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(71) Applicant: **MONT BLANC INDUSTRI AB** [SE/SE];
Toarpsdal, S-516 90 Dalsjöfors (SE).(72) Inventors: **EKMAN, Daniel**; Torggatan 2, 4tr, S-503 30
Borås (SE). **DALQUIST, Daniel**; Laxstigen 7, S-513 91
Fristad (SE). **JOHANSSON, Mattias**; Getared 102, S-523
98 Hökerum (SE).(74) Agent: **HYNELL PATENTTJÄNST AB**; Box 138, S-
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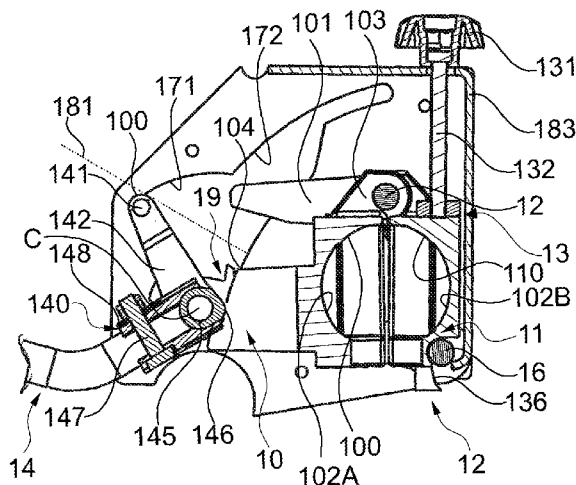


Fig. 3

(57) Abstract: The present invention relates to a coupling device on a coupling ball or any similar attachment element, which coupling device comprises a front clamp half (10) and a rear clamp half (11) with clamping surfaces (100, 110) arranged to be possible to attach to a coupling ball (D) or any similar attachment element, a housing (18) comprising two side walls (17), at and between which a first (12) element and a second (16) element are arranged, being force transmitting and force absorbing elements, of which at least one of said force transmitting elements (12) is an axis/shaft (A), about which at least one of said clamp halves (10, 11) is pivotably suspended, a handle (14) connected to an attachment mechanism (14, 15, 19), for the attachment and the release, respectively, of the coupling device, which attachment mechanism (14, 15, 19) comprises an axis/shaft (C) being pivotable in relation to the housing, and an adjustment means (13) arranged to enable adjustment of the attachment force from the clamp halves (10, 11), wherein said attachment mechanism (14, 15, 19) comprises an eccentric body (145) with an attachment surface (146) arranged to be attached against a clamp surface (104) of one of said clamp halves (10, 11).

BIKE HOLDER FOR ATTACHMENT TO COUPLING BALL OF VEHICLE

TECHNICAL FIELD

5 The present invention relates to a coupling device for the attachment to a coupling ball or any similar connection element, comprising a front clamp half and a rear clamp half with clamping surfaces arranged to be connected to a coupling ball or any similar connection element, a housing comprising two side walls, at and between which a first and a second force transferring and force absorbing element is arranged, of which at
10 least said force transferring element includes an axis/shaft round which at least one of said clamp halves is pivotably suspended, a handle coupled to a connection mechanism, for the connection and release, respectively, of the coupling device, which connection mechanism comprises an axis/shaft, which is pivotable in relation to the housing, and an adjustment means arranged to enable adjustment of the connection force by the clamp
15 halves.

PRIOR ART

Many different kinds of load carriers which may be coupled to vehicles, e.g. to a coupling ball, are previously known, for instance a bike holder. Known bike holders,
20 above all if there is a plurality of bikes which are to be carried, have proved to be defective in certain respects. Such a defect is that certain bike holders have to be dismounted from the coupling ball, or that bikes have to be removed from the bike holder, before the boot of the vehicle can be opened. Another known defect is that it may be problematic to achieve enough clamping force safety to keep the bike holder on
25 the coupling ball in the desired position and also that it may be difficult to mount the bike holder on the coupling ball in a safe manner. Further, some known bike holders fail, as they suffer from difficulties concerning the respective unloading of bikes from the bike holder.

30 Through EP 1 538 027 a load carrier for bikes is previously known, which is provided with a clamping mechanism for detachable coupling to a coupling ball of a vehicle, which clamping mechanism suffers from various disadvantages, i.a. as it comprises a toggle joint mechanism which is space consuming and which implies difficulties as to resistance. An additional disadvantage is that the clamping mechanism at the connection
35 to a coupling ball have to be locked with a locking pin in the connected position in order not to be released by the reaction forces, which implies a certain security risk.

Another type of bike holders is known through SE 532993, with a clamping mechanism intended to be clamped on a coupling ball. The clamping mechanism includes a housing and a pivotable clamping means, with a toggle joint linked to the housing. The coupling ball may be clamped between a spherical stationary clamp half arranged in the housing and a movable clamp half included in the pivotable clamping means, which may be pivoted between an open and a connecting position by means of a handle. A pressure plate is arranged between the housing and the pivotable clamping means. A similar bike holder is also known through US 5,344,174, where one benefits from one clamp half being stationary arranged at the housing. The devices have constructions implying certain drawbacks as to resistance and require comparatively much maintenance. Further, the adjustment of the clamping force is troublesome.

DE 202005004043 describes another load carrier intended to be connected to the rear part of a vehicle, a stationary frame element carries a movable support means with a load carrier. Further, there is a sliding and tilting arrangement for keeping the frame element and the support means together. A locking element enables locking of the support means in a first end position. After unlocking, the support means may be displaced to a second end position, in which a tilting of the support means is possible.

A coupling device is previously known through DE 202006012 for the connection to a coupling ball with two pivoting clamp halves, but with a construction implying disadvantages as to resistance.

DISCLOSURE OF THE INVENTION

According to a first aspect of the invention an essential advantage is achieved as a clamping mechanism is created enabling a very secure holding and which thanks to its design implies minimized, or almost eliminated, wear of the essential parts of the clamping mechanism. In addition, the invention comprises aspects which implies that a simple handling may be achieved.

Additional advantages will be apparent below.

BRIEF DESCRIPTION OF DRAWINGS

The invention will below be described more in detail with reference to the enclosed drawings, of which:

Fig. 1 shows a perspective view of a preferred embodiment of a bike holder according to the invention;

- Fig. 1A shows a perspective view of a preferred embodiment of details concerning the connection in a bike holder according to the invention;
- Fig. 2 shows a side view of a clamping mechanism according to a preferred embodiment of the invention;
- 5 Fig. 3 shows a cross-section of a clamping mechanism according to Fig.2;
- Fig. 4 shows a perspective view, obliquely from above, of a clamping mechanism in its locked position according to a somewhat modified embodiment according to the invention, wherein the front side wall has been removed from the view;
- Fig. 5 shows the same perspective view as Fig. 4, with the mechanism in a half-open position;
- 10 Fig. 6 shows the same perspective view as Fig. 4, with the mechanism in an entirely open position;
- Fig. 7 shows a cross-sectional view of a clamping mechanism in the position shown in Fig. 6;
- 15 Fig. 8 shows a clamping mechanism according to the invention in cross-section in a mounted state, locked on a coupling ball;
- Fig. 9 shows the corresponding view as Fig. 8 but with a cross-section which is displaced in relation to Fig. 8;
- Fig. 10 shows the same cross-section as Fig. 9 but with the mechanism in a half-open position;
- 20 Fig. 11 shows a tie arm, seen in a perspective view, according to a preferred embodiment of the invention;
- Fig. 12 shows a cross-section through the tie arm shown in Fig. 11;
- Fig. 13 shows pertinent details of a preferred embodiment of a tie arm according to the invention; and
- 25 Figs. 14 and 15 show that the product may have a compact design.

DETAILED DESCRIPTION

- Fig. 1 shows a preferred embodiment of a bike holder 1 according to the invention, which is intended to be mounted on a vehicle on its coupling ball (not shown). The bike holder 1 comprises a stationary frame part 3 as well as a movable frame part 2. The stationary frame portion 3 comprises a bottom portion 30 extending essentially in the horizontal direction. The movable frame part 2 is movably tied to the stationary frame part 3, in such a way that it may be safely locked in an inner position, and that it may be released and drawn out along the stationary frame part 3 in order to be pivoted/tilted in that position. On top of the movable frame part 2, tie means 20 with straps 203 are arranged in a manner known per se in order to be able to tie bikes to the bike holder 1.
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The tie means are displaceably arranged in relation to the frame 2, 3 by a fastening element 201 arranged on the movable frame part 3, which means have an outwardly resilient pin (not shown) for interaction with holes 202 in the tie means 20. An upper tie arrangement 5 extending upwards is arranged at the inner end of the stationary frame part 3, which tie arrangement comprises an upper frame part 4 in the form of an up-side-down U-shaped tube 40, which is pivotably arranged at a bracket 49. At the top, this tube 40 forms a horizontal tube portion 40A, to which a number of fastening arms 50A, 50B, 50C are arranged by clamp connections 52. The design of the central fastening arm 50B will be described more in detail below.

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A securing tube 31 extends between two parallel beam elements 30 included in the stationary frame part 3. A housing 18 is provided on the securing tube 31, inside which housing a clamping mechanism is arranged for the fastening of the bike holder 1 on a coupling ball. A handle 14 is arranged for the activation of the clamping mechanism.

15 Inside the housing 18 there are side portions 17, which constitute interacting means with the clamping mechanism, which will be described more in detail below. The housing 18 is provided with a pivotable lid 180, which is lockably securable by a lock 182.

According to a preferred embodiment, a portion of the housing 18 also comprises an upper and rear wall 183 of a resistant material (e.g. steel), which connects the side portions 17 in order to give increased strength.

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Tilting of the movable frame part 2 in relation to the stationary frame part 3 is advantageous as the tilting creates space for reaching the rear portion of the vehicle, e.g. to open a boot. According to the preferred embodiment of the invention a progressive tilting is enabled the farther away on the stationary frame part 3 the movable frame part 2 is moved. This is a great advantage as there may be varying needs to create space depending on the situation and the type of vehicle. Thanks to the preferred embodiment one may in many situations create enough tilting even at a comparatively small displacement of the moveable frame part 2 on top of the stationary frame part 3.

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Fig. 1A shows a preferred mechanism enabling this, which mechanism comprises an end attachment 210 at the inner end of the movable frame part 2, on which a downwards protruding wing 211 is arranged, which at its bottom edge has transversely extending flange portions 212. Said wing is arranged to be displaced in the longitudinal direction along a slit 302 in the stationary frame part 3. The flanges have a width exceeding the width of the slit 302, so that the wing cannot be removed from the stationary frame part 3. In the outer end of the slit there is an opening 303 which is larger than the width of

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the flanges in order to enable montage of the movable frame part 2 with the wing 211 inside the slit. Also the movable frame part 2 is provided with a similar slit 230 with an opening, but at the bottom side thereof, for the insertion of a similar wing 306A, extending upwards from an end element 306, which is fixed to the outer end of the stationary frame part 3. This frame portion 3 also have a downwards extending portion 306B, partly with the aim to be able to protect the movable wings and the rear central portion against blows/impacts from below during travel. After the mounting of the wing 211 inside the slit 302, the possibility to displace the movable frame part 2 is limited by a stop means 308, e.g. a screw/bolt, which is arranged right through the movable frame part 2 and which at contact with the wing 306A at the end element 306 prevents the flanges 212 to reach as far as to the back at the opening 303 during use. According to a preferred embodiment, at least one (more preferred two) end attachment 210/end element 306 is provided with a wing (preferably integrated, suitably by being moulded of plastics) both to control the sliding movement of the movable frame part 2 and preferably also to be a movement stopper. These aspects may either separately or in combination be protected by own applications.

According to a preferred embodiment, a spring loaded heel 220 may also be arranged inside the end attachment 210, i.e. at the end of at least one of the movable frame parts 2, which heels is resiliently influenced to protrude downwards out of the end attachment 210. A hole 304 adapted to the pin is also arranged in the stationary frame part 3, which is positioned to correspond to an inner locking position of the movable frame part 2 to the stationary frame 3. Further, downwardly protruding essentially L-shaped locking means (not shown) are arranged at the sides of the end attachment 210, which locking means in the locking position run in below a transversely protruding locking pin 305 at the end of the stationary frame part in order to secure the movable part in the vertical direction to the stationary frame part 3. A pivotable arm 307 (preferably in the form of both a handle and a pedal, as is shown, or only as one of them) is arranged on the inner side of the outer portion 332 of the movable frame 2 to be able to release the blocking mechanism with the locking heel 220 including a wire (not shown) running inside the movable frame 2 to make it possible to lift the locking heel 220. Thus, this arm 307 is pivoted when a release is desired. In the figures it is shown that an advantageous location of the handle portion of the pivotable arm 307 is such that it pivots about an axis/shaft transverse the longitudinal direction of the vehicle and with a lever portion protruding upwards in relation to the pivot axis/shaft, whereby the synergetic effect is achieved that at the same time as the arm is influenced to release the locking heel 220 the user will apply an outwardly directed force, i.e. a force in the same direction as the

movable frame part 2 is to be influenced in order to be moved outwards. As soon as the frame 2 is moved a distance so that the L-shaped locking means no longer are below the locking pin 305, the frame 2 can start to be tilted. This aspect may be protected by own applications.

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Fig. 2 shows a side view of a clamping mechanism according to a preferred embodiment of the invention. In the side view, one side wall 17 is shown, through which two bolts 12, 16 protrude, which bolts 12, 16 extends right through the housing 18 to a corresponding second side wall 17 and which bolts 12, 16 form force transferring and force absorbing elements (which, as the man skilled in the art realizes, may comprise of other types of elements, e.g. pin shafts, which can serve the same purpose), which will be described more in detail below. In addition, a third bolt 15 is shown, extending right through the housing 18, but the fulcrum C of which is movably arranged in relation to the housing 18. Swinging arms 19 are pivotably arranged about the lower bolt 16, which swinging arms 19 at their front ends support the third bolt 15. In the housing wall 17 there is an opening 170 with limit surfaces 171, 172, 173 forming curved surfaces. One of these curved surfaces 173 corresponds to the turning radius of the swinging arm 19 adapted to the movable bolt 15. The two other curved surfaces 171, 172 are adapted to interact with a guide pin 141 for activation and inactivation of the clamping mechanism in accordance with what will be described more in detail below. The guide pin 141 is fixedly connected to a end portion 140 arranged at the handle 14. A recess 179 is arranged in the side walls 17 for the positioning of the housing 18 to the securing tube 131.

Fig. 3 shows a cross-section of a clamping mechanism according to Fig. 2. The device is shown in its finally clamped position where also the bike holder 1 is secured to a ball of a coupling ball (not shown) by the rear half 11 and the front half 10, respectively, of the clamping mechanism with their respective spherical clamping surfaces 100, 110 having been provided with enough pressing force to carry the bike holder 1 with its load. Preferably the clamping surfaces 100, 110 are only arranged to the portions inside the respective half-sphere by giving the surface portions 102A, 102B around the inner centre of the half-spheres a somewhat larger radius so that these surfaces 102A, 102B become clearance surfaces, which improve the interaction and allows lower tolerance requirements. Then, the handle 14 has been pressed down into its lowermost position, as may be seen from Figs. 2 and 3. The end portion 140 is clamped at the handle end by a joint 147, suitably a screw joint. The end portion 140 comprises two upwardly directed levers 142, which at their uppermost ends have been provided with guide pins 141

extending in the transversal direction from the lever 142 into the opening 170. The guide pins 141 will in connection with the activation of the handle 14 follow the upper curves 171, 172 in the side walls 17. Between the two levers 142 there is an eccentric body 145, which partly connects the levers 142, so that the end portion 140 forms an integrated unit, partly supports an eccentric surface 146. The eccentric surface 146 interacts with an abutment surface 104, which is arranged at the front surface of the front clamp half 10. The front clamp half 10 is pivotably suspended about the upper stationary bolt axis/shaft 12 by means of lugs 103 which are arranged at the top of the upper clamp half 10. Also the rear clamp half 11 is pivotably arranged about the upper bolt 12 by means of lugs 113 arranged at the top of the clamp half 11.

The rear clamp half 11 is adjustably pivotably arranged about the bolt axis/shaft 12 by means of an adjustment means 13, suitably in the form of an adjustment yoke. Said adjustment yoke 13 abuts with its lower portion, with a cam surface 136, against the lower, stationary, rear bolt axis/shaft 16. The opposite side 137, in relation to the cam surface 136, abuts against a lower surface 119 of the rear clamp half 11. Through a vertical movement of the cam surface 136, its front side 137 will move in the transverse direction in relation to the bolt axis/shaft 16 and hence influence the front clamp half 11 inwards and outwards, respectively, i.e. the rear clamp half 11 is consequently forced to turn forwards and backwards, respectively, around the bolt axis/shaft 12. The adjustment itself is performed by means of an adjustment mechanism 132, suitably in the form of a screw which is threaded into the adjustment yoke 13. By influence by e.g. a steeringwheel 131, the adjustment screw 132 is threaded inwards into and outwards out of, respectively, the adjustment yoke 13, whereby the cam surface 136 is positioned in the desired manner. The steering wheel 131 may, of course, be exchanged for another suitable operation means, e.g. a hexagonal grip which is tightened with a hex key.

According to a preferred embodiment of a clamping mechanism according to the invention, the cam surface 146 of the eccentric body 145, in combination with the guide curve 171 for the pin 141, such that the movement takes place along the involute curve, whereby the eccentric surface 146 executes a rolling motion along the abutment surface 104. In the preferred case, the motion is thus to take place entirely without any gliding motion (or at least with only a small one) between the eccentric surface 146 and the abutment surface 104. Thanks to said embodiment, the wear of said two surfaces 146, 104 may in principle be entirely eliminated, which implies a plurality of advantages.

At the movement of the handle 14 from its locked position, as is shown in Fig. 3, the lid 180 must first be opened and unfold, which is achieved by releasing the lock 182 (see also Fig. 9). Thereafter, the handle may be turned upwards, wherein the pin 141 will be moved along the involute curve 171 and at the same time the cam surface 146 will roll against the abutment surface 104 in a downward direction. When the pin has reached the end of involute curve 171, the eccentric body 145 will be in a position where the eccentric surface 146 is no longer in clamping contact with the abutment surface 104, thanks to the fact that the thickness (radially) for the eccentric body 145 in this position is essentially smaller than in the position where the locking takes place. In this position, an upper surface 148 of the end portion 140 will be more in contact with lifting arms 101 which are fixed to the front clamp half 10. Then, when the lifting movement continues, the pin 141 will slide in along the upper curve 172 and after a certain movement also begin to pivot the front clamp half 10 about the bolt 12 by the lifting arms 101 being pressed upwards. When the pin 141 has reached the upper position in the opening 170, the clamp halves 10, 11 are completely open so that the bike holder 1 may be lifted away from the coupling ball (see also Fig. 7).

Fig. 4 shows a perspective view of a somewhat modified embodiment of a clamping mechanism according to the invention in a position where the clamping mechanism is locked, i.e. in the same position as is shown in Figs. 2 and 3. Contrary to the embodiment of Fig. 2 and 3, the movable bolt shaft 15 does not extend outside the side walls 17, implying that each opening 170 only need to accommodate the guide pin 141. In this view, the front wall 17 has been removed and the swinging arm 19 is shown in full. Here, it may be seen that the swinging arm 19 is provided with a recess 191, in which a stop means 147 of the end portions 140 is arranged. At the ends of the recess 191 there are edges defining a lower and an upper, respectively, end position for the end portion 140 in relation to the swinging arm 19. The lower edge of the recess 191 is positioned such that the pins 141 of the end portion 140 then are in the end position of the involute curve 171, while the upper end position corresponds to a position of the end portion 140 where the pins are at the transition between the involute curve 171 and the upper curve 172. It is shown that when the handle 14 has been turned to a position where the pins 141 are in an intermediate position between the two curves 171, 172, a continued influence upwards will imply that the movable bolt shaft 15 is moved together with the swinging arms 19 upwards in a radius corresponding to the upper curve 170. Further, it is apparent from Fig. 4 that at the end portion 140 a female means 149 is arranged intended for the lock knob 182.

Fig. 5 shows the corresponding perspective view as Fig. 4, where the handle 14 has been turned about the movable axis/shaft 15 and its fulcrum C, so that the pin 141 has been positioned in the transition between the two curves 171, 172. As can be seen from the figure, the stop means 147 of the end portion 140 has then reached its upper end
5 position along the recess 191 in the swinging arm 19.

Fig. 6 shows the same perspective view as Figs. 4 and 5, where the handle 14 has been turned up to its upper position, wherein the lifting arm 101 has interacted with an upper surface 148 of the end portion 140, so that the front clamp half 10 has pivoted to its
10 upper position about the bolt axis/shaft 12. The pins 141 are then in an upper end position in the upper groove 172.

Fig. 7 shows a central cross-section through a clamping mechanism according to the invention, wherein it can be seen that the front clamp half 10 by means of the lifting
15 arms 110 is pivoted to an open position when the handle 14 is in its upper position.

Fig. 8 shows a cross-section through the clamping mechanism in a plane where the cam surface 146 is in contact with the clamping surface 104. As may be seen here, the clamping surface 104 is advantageously arranged in a separate element 108, like the
20 eccentric body 145, which are suitably made of such a material that any real deformation or wear of the eccentric surface 146 or the clamping surface 104 does not occur. Suitably, the material of the eccentric body 145 and the clamping element 108 comprises a hard-wearing steel, while the surrounding material may comprise of a less durable material, e.g. aluminium. Further, it is shown that the front clamp half 10 is
25 suitably provided with lightening holes 107.

Fig. 9 shows a cross-section in a cut running centrally through the clamping mechanism with a coupling ball D arranged therein. This figure shows also clearly an advantageous geometry which is achieved with a construction according to the invention, namely a kind of self-locking interaction between the pertinent parts at the placement of the
30 handle 14 in its lower position. The reaction force R from the interaction between the eccentric surface 146 and the clamping surface 104 will then be directed such that it gives a downwards turning moment M on the handle 14. In other words, first said moment M has to be overcome by drawing the handle in a certain angle α upwards, before the handle may be removed from the locking, clamping position. Further, it is
35 shown, that the clamping mechanism as such is self-supporting about the coupling ball D, as the three interacting force-absorbing bolts 12, 15, 16 and pertinent suspension details 17, 19, 103, 113 form a closed unit balancing the pressing forces between them.

Fig. 10 shows a view in cross-section with the handle in a position where the self-locking effect by the reaction force between the eccentric surface 146 and the clamping surface 104 has ceased by the handle being rotated in a certain angle α (suitably 30-60°, here about 45°) upwards.

Figs. 14 and 15 shows that the bike holder 1 according to the invention can be given a very compact construction. The bike holder 1 is arranged in such a way that it may be folded to form a very compact unit, which becomes essentially easier to store and transport than in its erected position. Partly, the upper frame portion 4 may be folded inwards and downwards, partly the rear portion 33 of the frame part 3 may be made more compact by folding the outer portions 130, 131 together, and partly the securing means 20 may be displaced inwards. Fig. 14 shows the bike holder 1 in its erected position, while Fig. 15 shows the bike holder in its folded position.

When folding the bike holder 1, one begins e.g. first to fold the wings 330, 331 towards the centre portion 332 by unscrewing a securing screw (not shown) which locks the wings in the erected position. Said wings may easily be locked in an outer position and an inner position, respectively, preferably with a easily operated screw joint. One may also start to make the bike holder 1 more compact by displacing the tie means 20 inwards towards the centre of the bike holder. The tie means 20, which also carry straps 203, are arranged somewhat curved. At the bottom of each tie means there is a profile element (not shown). Suitably, said tie means 20 are made of aluminium, preferably manufactured through extrusion. The profile element (not shown) at the bottom of the tie means is inserted into engagement with two fastening elements 201, which are arranged on both sides of the movable frame parts 20. In their preferred shape, said fastening elements 201 are entirely identical, whereby several advantages may be gained. In each such fastening element 201 there is thus corresponding grooves formed, which receives the profile element in the tie means 20, which has the form of a curved rail. Suitably, the fastening elements 201 are made of a polymeric material, wherein a comparatively low friction is obtained, which results in that the tie means 20 may easily be displaced in relation to the fastening elements 201. To be able to lock the tie means 20 in the desired positions at the fastening elements 201, holes 202 are provided in the tie means 20 and a resilient pin means (not shown) is mounted in each fastening element 201. Thus, in an unloaded state, the spring-influenced pin protrudes from the fastening elements 201 at each tie means 20. By providing the tie means 20 with at least two holes (may be more), the tie means 20 may be locked in different positions at the

fastening element 201. Thus, the "resilient" pin is influenced such that it loses its engagement with the hole 202 in the tie means 20, when a compact state of the bike holder 1 is desired, and the tie means 20 is displaced from its outer position inwards towards the centre of the bike holder 1, as is shown in Fig. 15. Thereafter, the upper
5 frame part 4 may be folded forwards by releasing the clamping joint (not shown) at the bracket 49 which is attached to the end attachment 210 and which carries a pivot axis/shaft for the upper frame part 4. When the clamping joint is released, the frame part 4 may be lifted a limited distance upwards, so that the lower edge of the frame part lands above a lower portion 49A of the bracket 49 and thereafter be lowered.

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Fig. 11 shows a tie arm 50 according to a preferred embodiment of the invention. The tie arm 50 comprises a plurality of parts which may be moved between them. A clamping joint 52 is arranged at one end of the arm 50 for fastening the arm 50 to a frame part 4 (see Fig. 1). Preferably the clamping joint 52 comprises a locking arm 52A
15 with an eccentric mechanism (previously known per se), so that a quick and simple locking may be achieved at a tube 40 included in the frame part 4. The tie arm 50 comprises an inner arm portion 53 and an outer arm portion 54. Between these arm portions there is a toggle joint mechanism 55, which enables locking of said two arm portions 53, 54 in different angle positions in relation to each other. At the outer end of
20 the arm 50 there are clamping jaws 56, intended to be clamped around a bike (not shown). To admit good flexibility, the inner arm portion 53 is rotatably arranged in relation to said clamping joint 52 and the outer arm portion 54 rotatably arranged in relation to the portion with clamping jaws 56.

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A lockable knob 57 is arranged at the outermost end of the arm 50. The knob 57 is threaded in relation to a bar 58 extending inside the outer arm portion 54. The bar 58 connects the arm parts 53, 54 by means of a shaft 58A running in the transverse direction through the toggle joint 55. The toggle joint comprises two parts 550, 551, which are connected with the shaft 58A in such a way that they are displaceable in the longitudinal direction in relation to each other, when the knob 57 has been unscrewed
30 along the bar 58. The inner part 550 of the toggle joint is connected to the bolt shaft 58A via a lug 552, which is provided with a slit-shaped groove 553. The slit-shaped groove 553 enables displacement of the inner part 550 in relation to the outer part 551, when the bar is pushed out from the outer arm part 54, i.e. in connection with the knob
35 57 having been unscrewed. Through opposite influence by the knob 57 the parts 550, 551 will instead be pressed towards each other. By means of teeth 554, 555, different positioning of the toggle joint mechanism may be obtained, i.e. different angle positions

between the inner 53 and the outer 54 arm parts. By screwing the knob 57 along the thread on the bar 58, not only a locking of the toggle joint mechanism 55 in the desired angle position is obtained but also fastening of the clamping jaws 56. The clamping jaws 56 are pivoted about a transverse axis 560 and are spring-influenced outwards with a comparatively small spring force, so that it "automatically" aims towards an open position (facilitates the fastening of a bike) and so that it is easy to press them together in connection with a disengagement in the toggle joint 55. Thanks to this construction, the tie arm 50 may thus be bent and positioned in a very flexible way, without any need to shift the bikes but simply only by altering the arm 50.

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The invention is not limited to what is described above but may be varied within the scope of the appending claims. The man skilled in the art realizes for instance that many of the support means and guide means described above may be arranged to be both only one or two or more, depending on the construction aspects at different applications.

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Further, the man skilled in the art realizes that many of the shown functions according to the invention may be fulfilled by an inverted principle, such for instance that instead of having pins to guide the motion of the locking arm 14, one can instead invert this and arrange pins at the side walls 17 to guide the corresponding grooves in the locking arms.

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Further, the man skilled in the art realizes that the angle motions which have proved to be possible with a tie arm according to Fig. 11 may be varied depending on need, i.a.

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implying that the arm may be constructed to pivot a larger angle region but let the lockable angle region be the same, or, on the contrary, to reduce the total pivotable region, etc. In this connection it should be mentioned that the total pivotable region serve an important purpose in many cases when the tie arm in a flexible manner is to be moved through several bike frames, i.e. a movement which may require a comparatively large freedom of movement, while the locking itself often requires an essentially small angle region to be able to achieve a safe locking of the bikes. The lockable region is determined by the two opposite parts of the pivotable joint which is arranged with tooth elements, which thus offers the possibility to fasten the two arm parts in angles in

30

relation to each other.

CLAIMS

1. A coupling device for the connection to a coupling ball or any similar connection element, comprising a front clamp half (10) and a rear clamp half (11) with clamping surfaces (100, 110) arranged to be able to be connected to a coupling ball (D) or any similar connection element, a housing (18) comprising two side walls (17), at and between which a first (12) element and a second (16) element which constitute force transmitting and force absorbing elements are arranged, of which at least one of said force transmitting elements (12) is an axis/shaft (A), about which at least one of said clamp halves (10, 11) is pivotably suspended, a handle (14) connected to an attachment mechanism (14, 15, 19) for the attachment and the release, respectively, of the coupling device, which attachment mechanism (14, 15, 19) comprises an axis/shaft (C) which is pivotable in relation to the housing, and an adjustment means (13) arranged to enable adjustment of the attachment force by the clamp halves (10, 11), wherein said pivotable axis/shaft (C) is arranged parallel to said first axis/shaft (A) through at least one swinging arm (19) with a stationary centre of rotation (B) arranged through said second force transmitting and force absorbing element (16), c h a r a c t e r i z e d in that both clamp halves (10, 11) are pivotably arranged in relation to said housing (18), preferably coaxially about said first axis/shaft (A), and that said attachment mechanism (14, 15, 19) is arranged, together with said force transmitting and force absorbing elements (12, 15, 16), to form a unit, which in itself is uniting and force absorbing, at the attachment of the coupling unit.
- 2.
2. A coupling device according to claim 1, c h a r a c t e r i z e d in that at least one of said side walls (17) has an opening (170) with limit surfaces (171, 172) forming curved guide tracks (D, E), that said attachment mechanism (14, 15, 19) comprises an end portion (140) fastened to the handle, which end portion has a guide pin (141) arranged to guide the attachment motion in interaction with said guide tracks (D, E).
3. A coupling device according to claim 1 or 2, c h a r a c t e r i z e d in that the interaction between the eccentric surface (146) and the clamping surface (104) is arranged in such a way that the reaction force (R) therefrom will be directed so that it gives a downwards turning moment (M) on the handle (14) in a closed position.

4. A coupling device according to claim 1, 2 or 3, c h a r a c t e r i z e d in that said attachment mechanism also comprises suspension details arranged at the housing (18), at least one swinging arm (19) and fastening means (103, 113) arranged at at least one clamp half.
5. A method for the attachment of the coupling device on a coupling ball or any similar attachment element, which coupling device comprises a front clamp half (10) and a rear clamp half (11) with clamping surfaces (100, 110) to be attached to a coupling ball (D) or any similar attachment element, a housing (18) comprising two side walls (17), at and between which a first (12) element and a second (16) element are arranged, being force transmitting and force absorbing elements, of which at least one of said force transmitting elements (12) is an axis/shaft (A), about which at least one of said clamp halves (10, 11) is pivotably suspended, a handle (14) connected to an attachment mechanism (14, 15, 19), for the attachment and the release, respectively, of the coupling device, which attachment mechanism (14, 15, 19) comprises an axis/shaft (C) being pivotable in relation to the housing, and an adjustment means (13) arranged to enable adjustment of the attachment force from the clamp halves (10, 11), wherein said attachment mechanism (14, 15, 19) is provided with an eccentric body (145) comprising an attachment surface (146) arranged to transmit an attachment force to the clamp surface (104) at one of said clamp halves (10, 11), c h a r a c t e r i z e d in that an essentially involute attachment motion is used between said surfaces (104, 146).
6. A method according to claim 3, c h a r a c t e r i z e d in that a direct contact is used between said surfaces (104, 146) at the application of the attachment force.
7. A method according to claim 3 or 4, c h a r a c t e r i z e d in that at least one of said side walls (17) has an opening (170) with limit surfaces (171, 172) forming curved guide tracks (D, E), that said attachment mechanism (14, 15, 19) is provided with an end portion (140) fastened to the handle, which end portion has a guide pin (141) arranged to guide the attachment motion in interaction with said guide tracks (D, E).
8. A tie arm for load carriers, comprising an inner clamp joint (52) arranged for the attachment of the tie arm (50) to a frame part (4), an arm part (53, 54) and

clamping jaws (56) arranged at the outer end of the arm part, characterized in that the arm part (53, 54) comprises a toggle joint mechanism (55) connecting an inner arm part (53) and an outer arm part (54).

- 5 9. A tie arm according to claim 6, characterized in that said inner arm part (53) is rotatably arranged in relation to said clamp joint (52) and that said outer clamping jaws (56) are rotatably arranged in relation to said arm part (54).
- 10 10. A tie arm according to claim 6 or 7, characterized in that said toggle joint mechanism (55) comprises two parts (550, 551), which are connected with each other in such a way that they are axially displaceable in relation to each other and are provided with interacting means (554, 555) arranged to enable locking of said arm parts (53, 54) in different angle positions in relation to each other.
- 15 11. A tie arm according to claim 8, characterized in that the same mechanism (57, 58) is used to lock said toggle joint (55) and said clamping jaws (56).
- 20 12. A method for the attachment to load carriers, comprising a tie arm for load carriers, which is provided with an inner clamp joint (52) arranged for the attachment of the tie arm (50) to a frame part (4), an arm part (53, 54) and clamping jaws (56) arranged at the outer end of the arm part, characterized in that the arm part (53, 54) is provided with a toggle joint mechanism (55) connecting an inner arm part (53) and an outer arm part (54).
- 25 13. A method according to claim 10, characterized in that said inner arm part (53) is arranged to be rotatable in relation to said clamp joint (52) and that said outer clamping jaws (56) are arranged to be rotatable in relation to said arm part (54).
- 30 14. A method according to claim 10 or 11, characterized in that said toggle joint mechanism (55) is arranged to comprise two parts (550, 551), which are connected to each other in such a way that they are axially displaceable in relation to each other and are provided with interacting means (554, 555) arranged to enable locking of said arm parts (53, 54) in different angle positions
- 35 in relation to each other.

15. A method according to claim 12, characterized in that the same mechanism (57, 58) is used to lock said toggle joint (55) and said clamping jaws (56).

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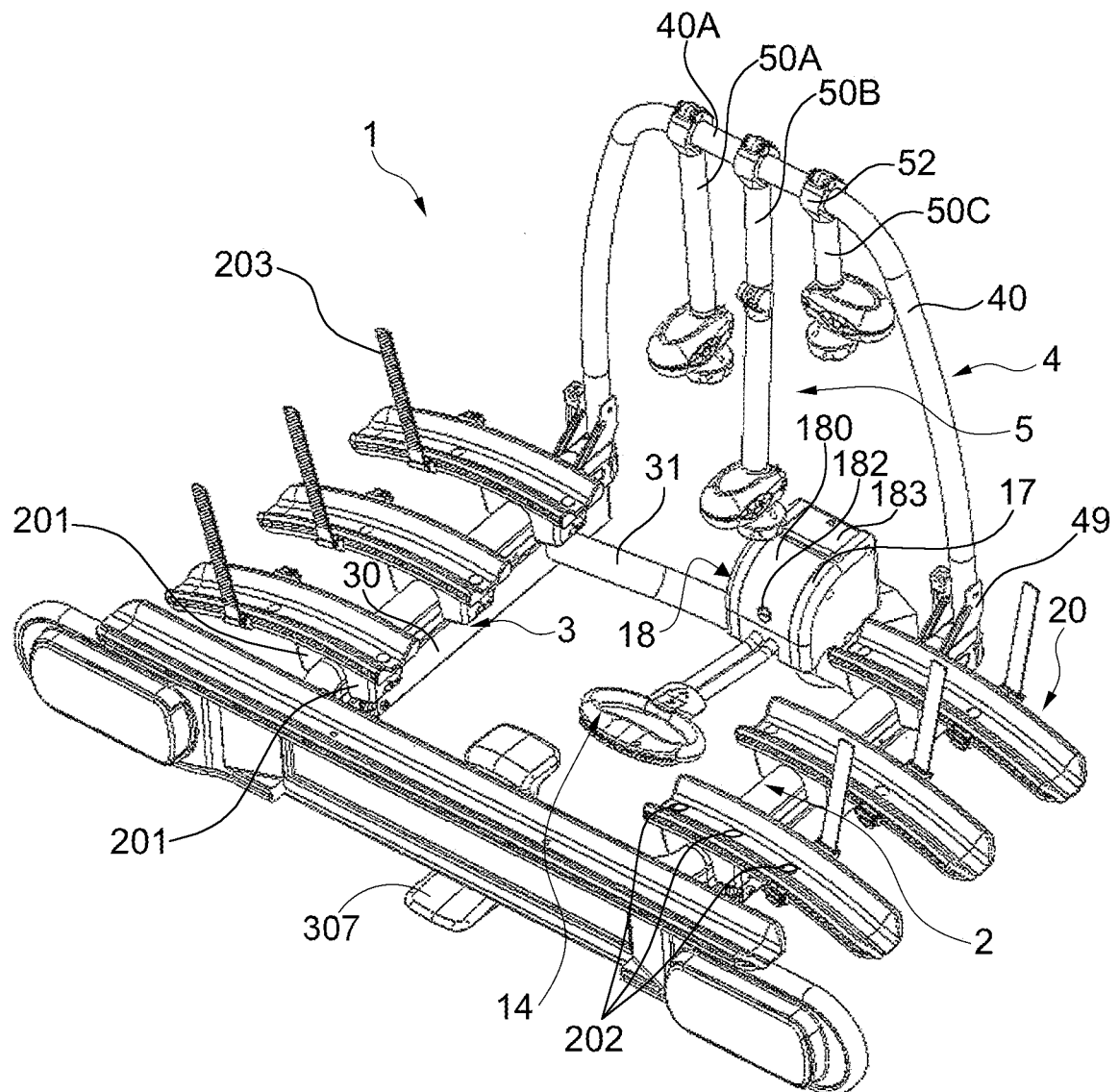


Fig. 1

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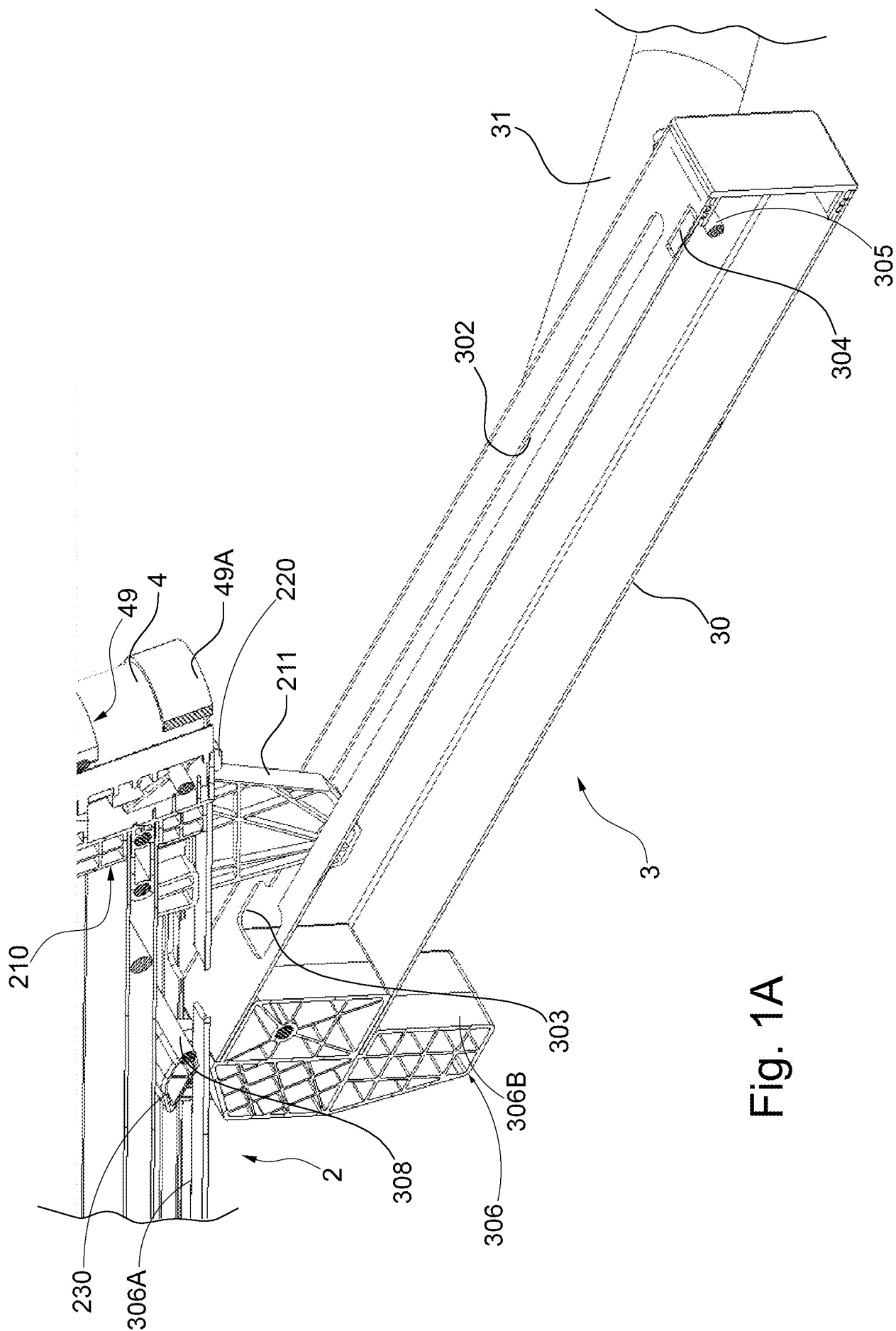


Fig. 1A

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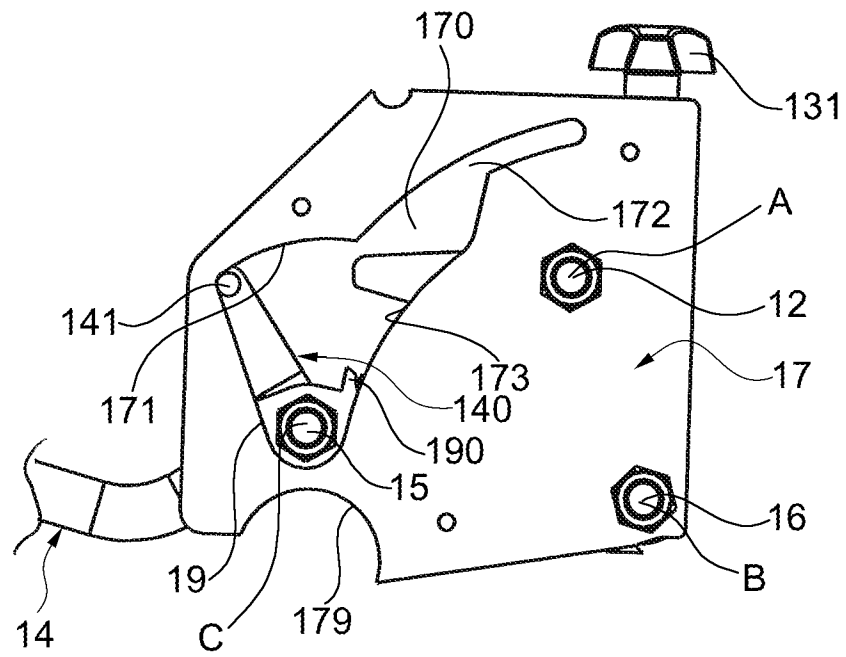


Fig. 2

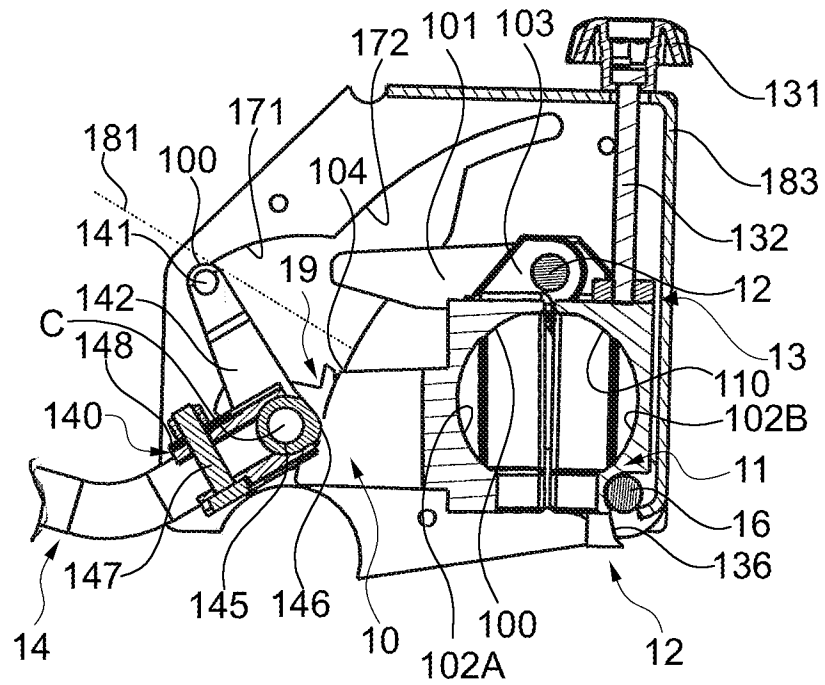


Fig. 3

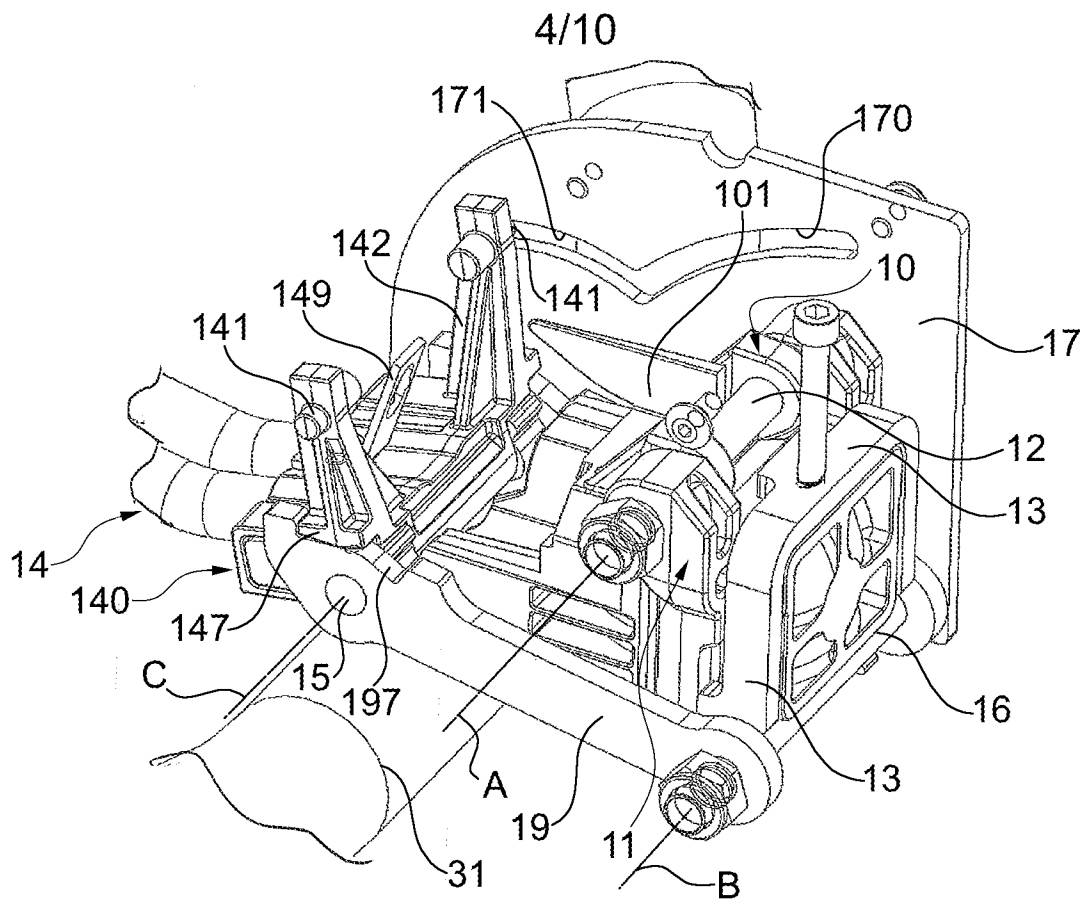


Fig. 4

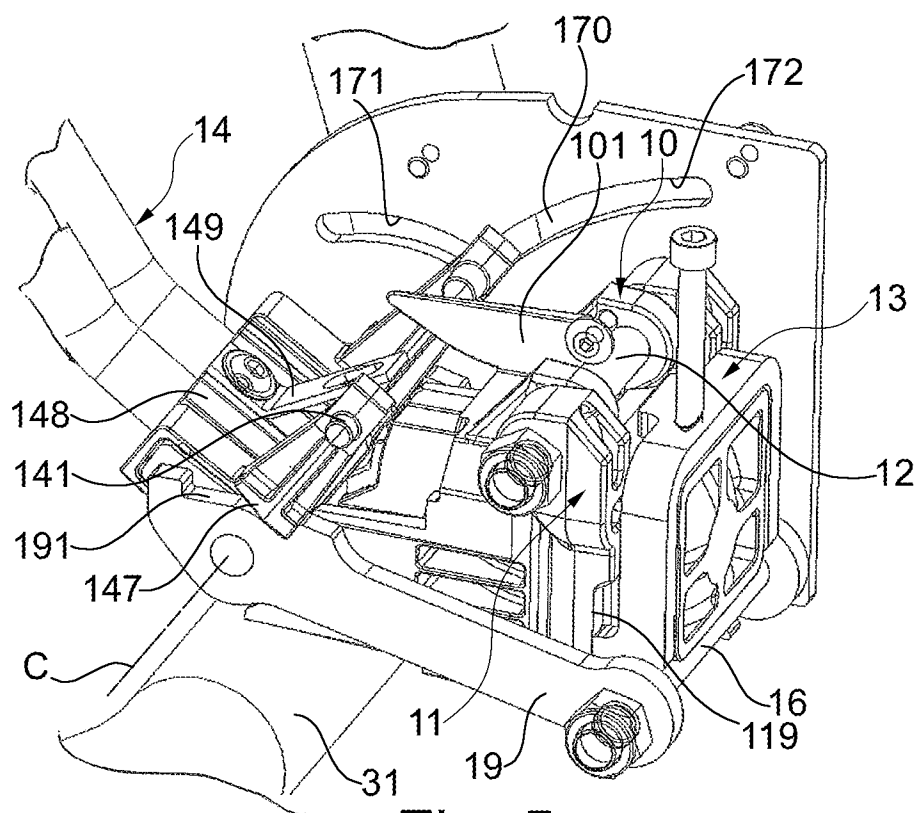


Fig. 5

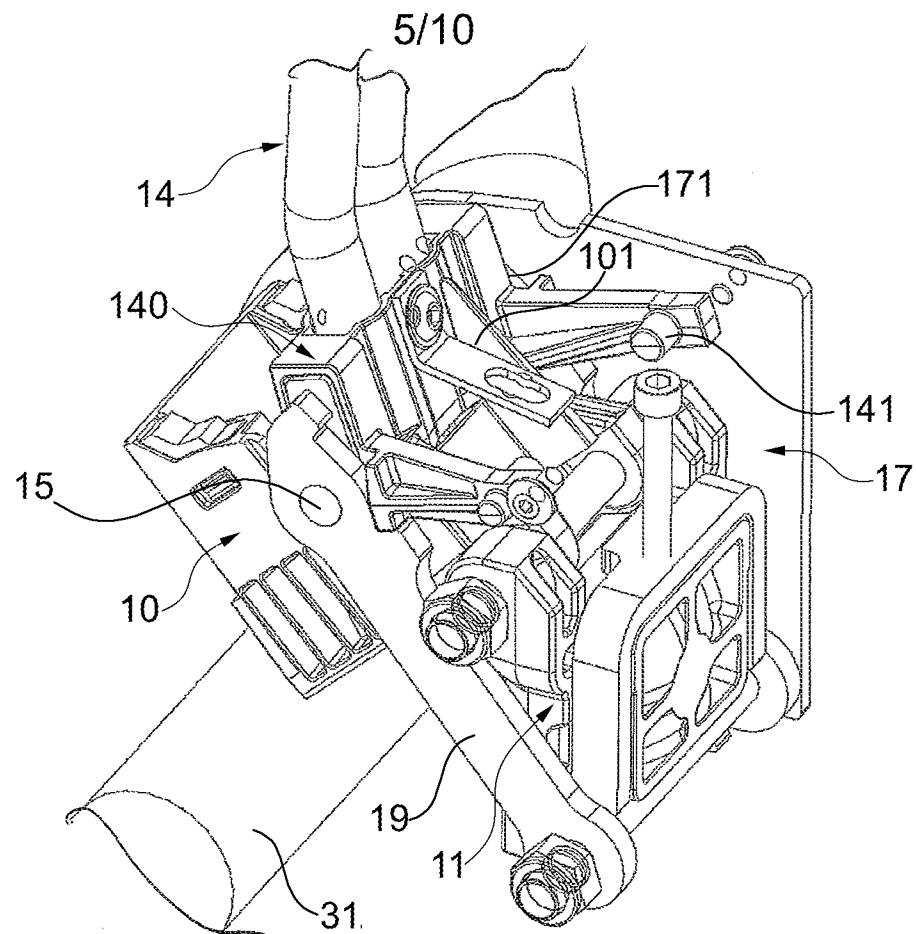


Fig. 6

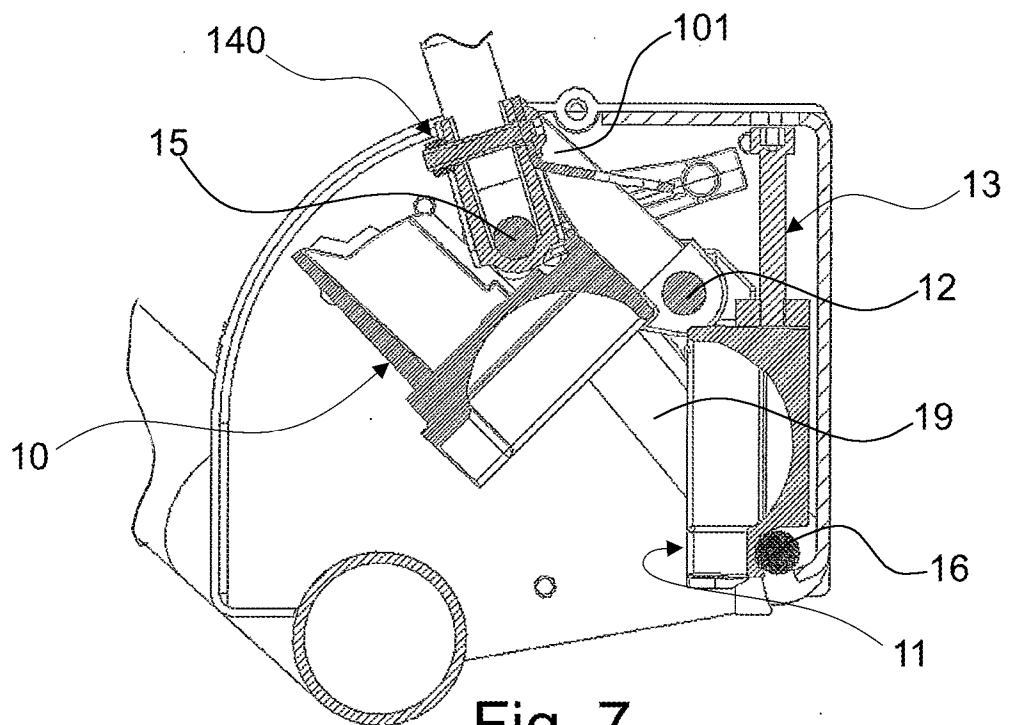


Fig. 7

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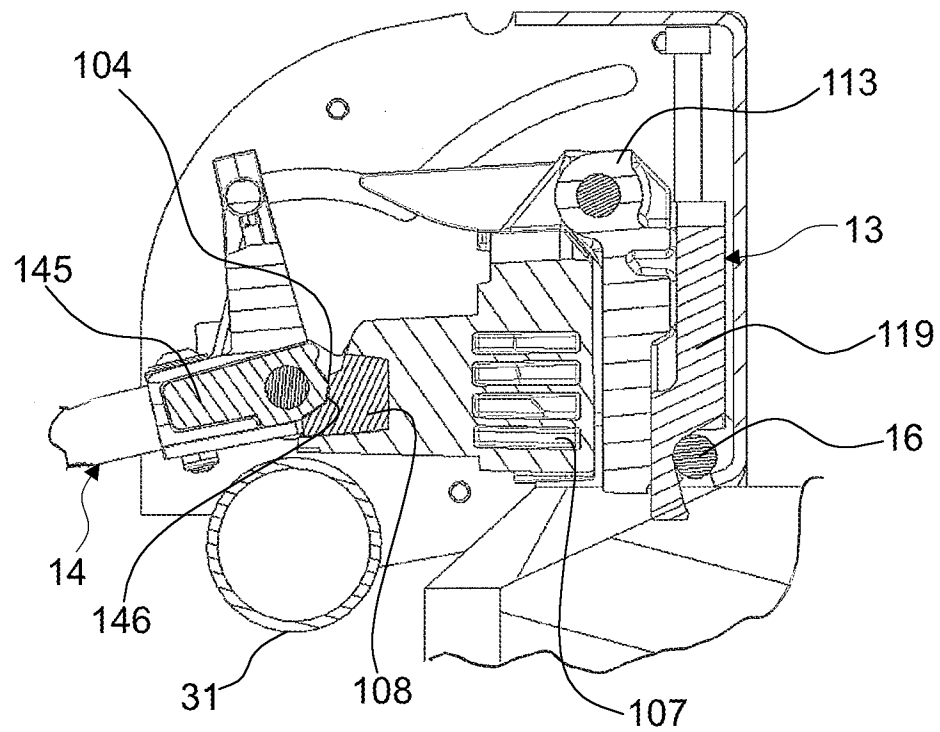


Fig. 8

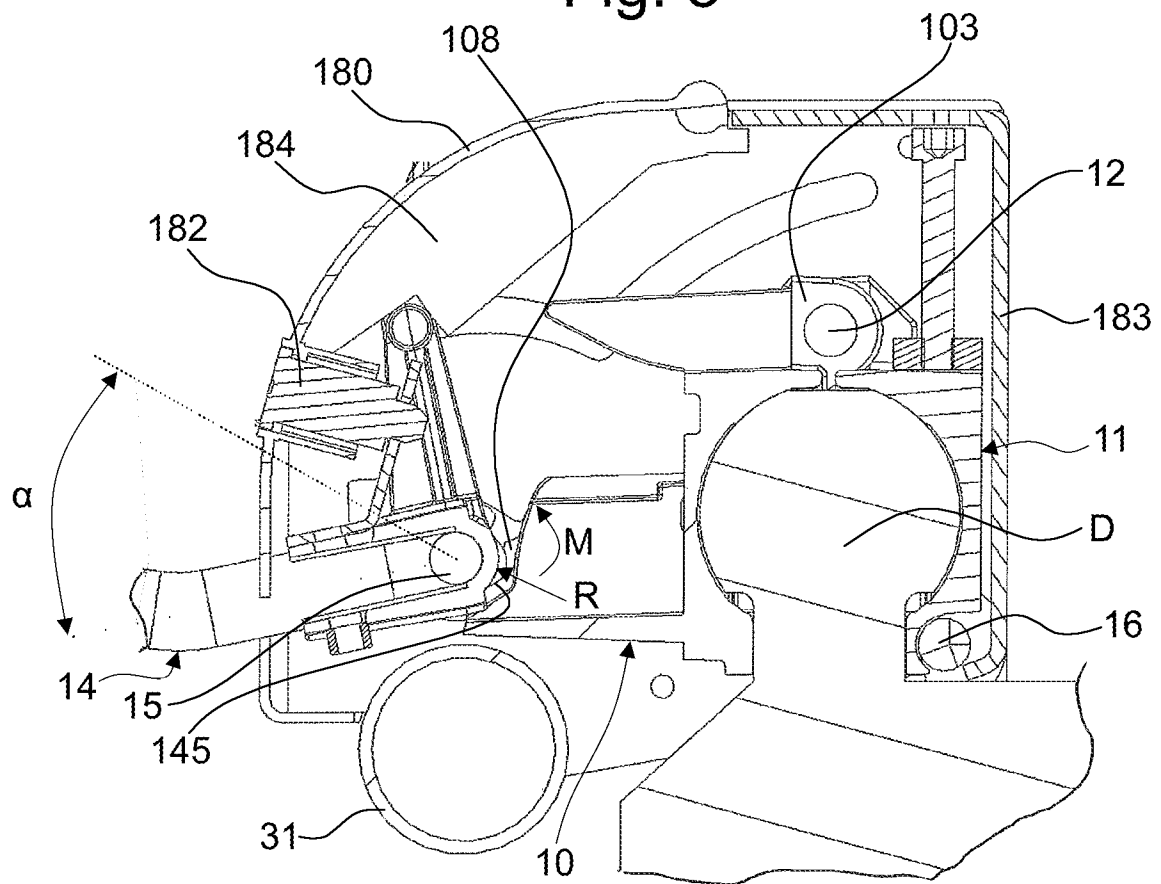


Fig. 9

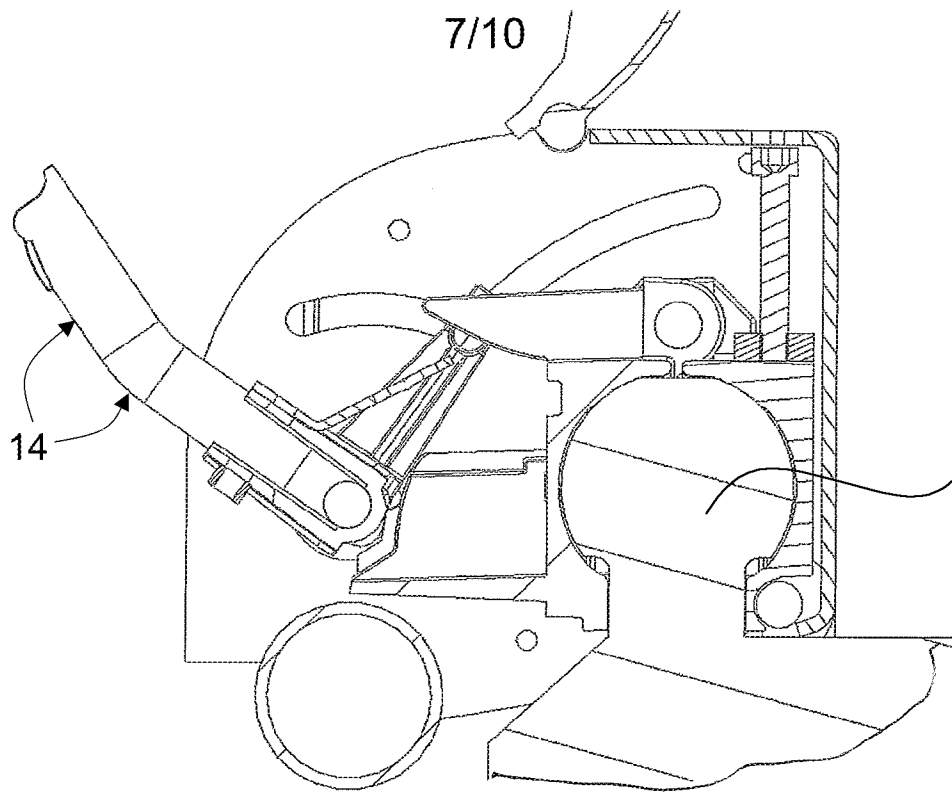


Fig. 10

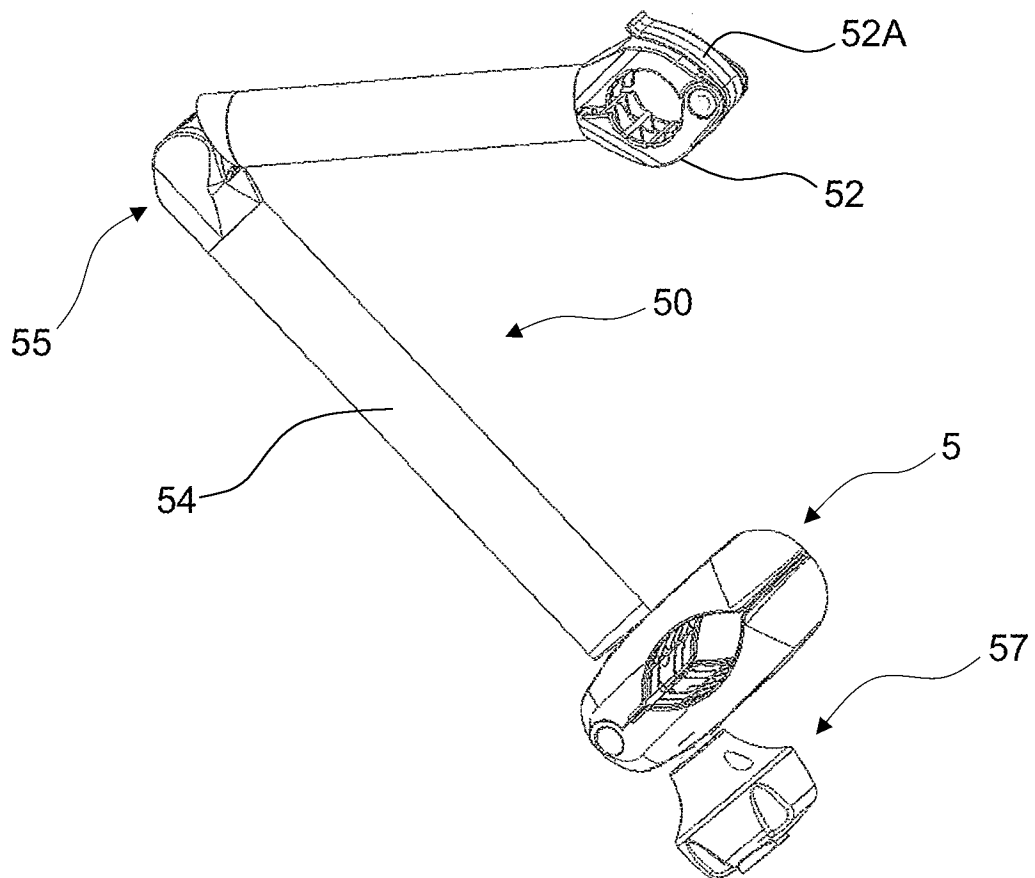


Fig. 11

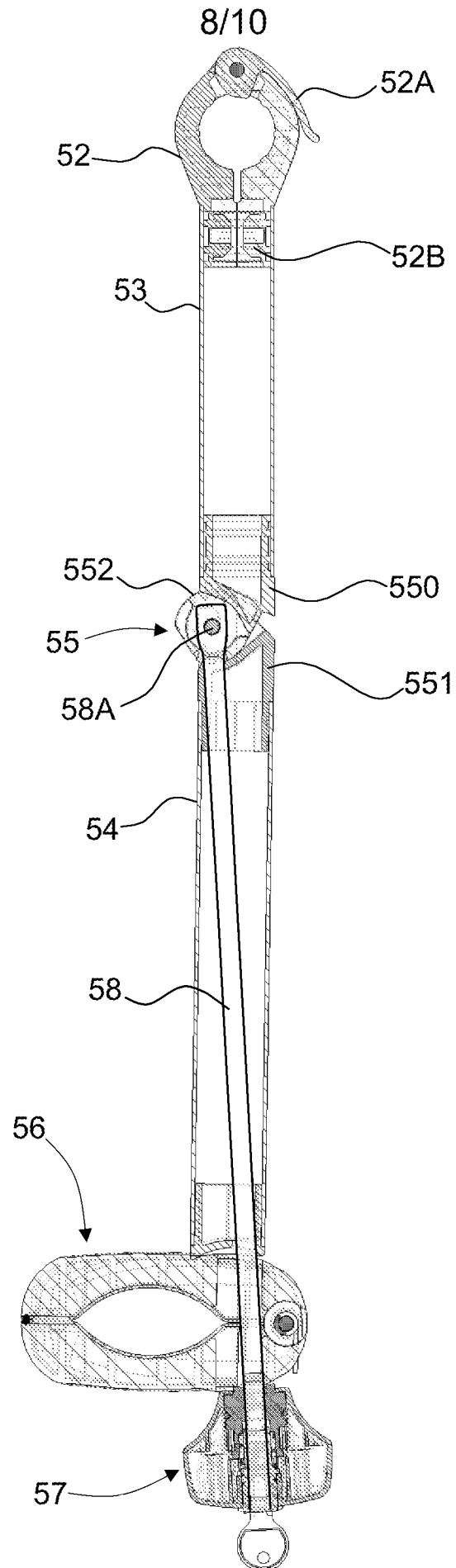


Fig. 12

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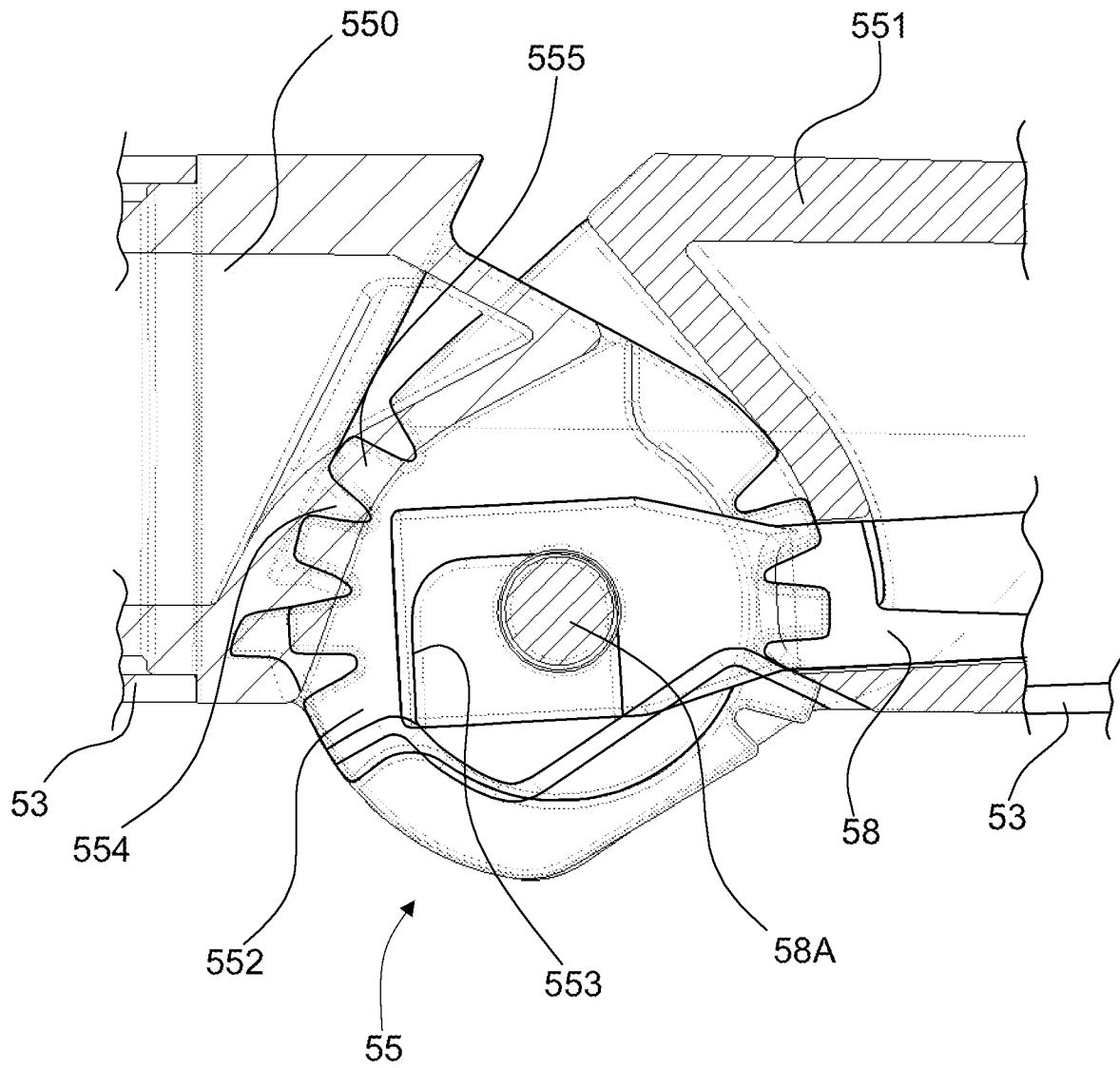


Fig. 13

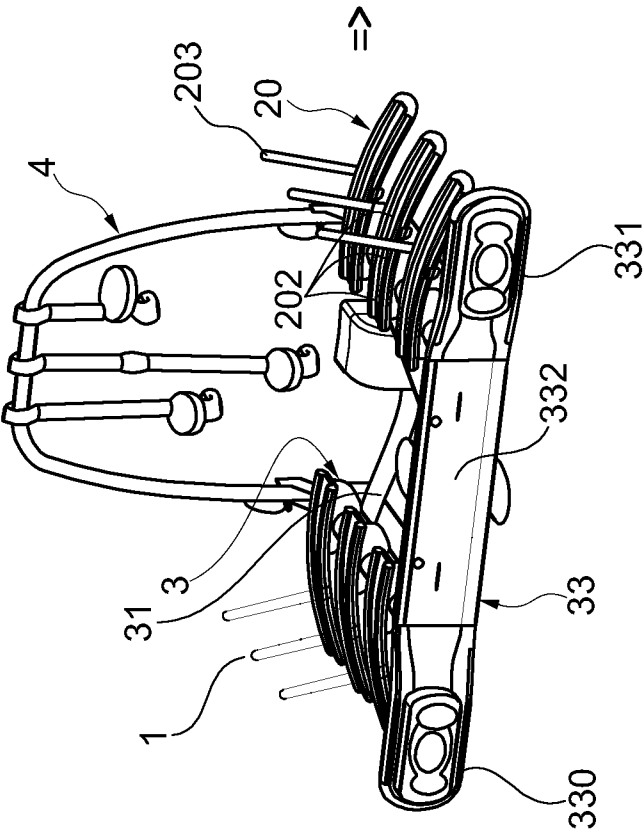


Fig. 14

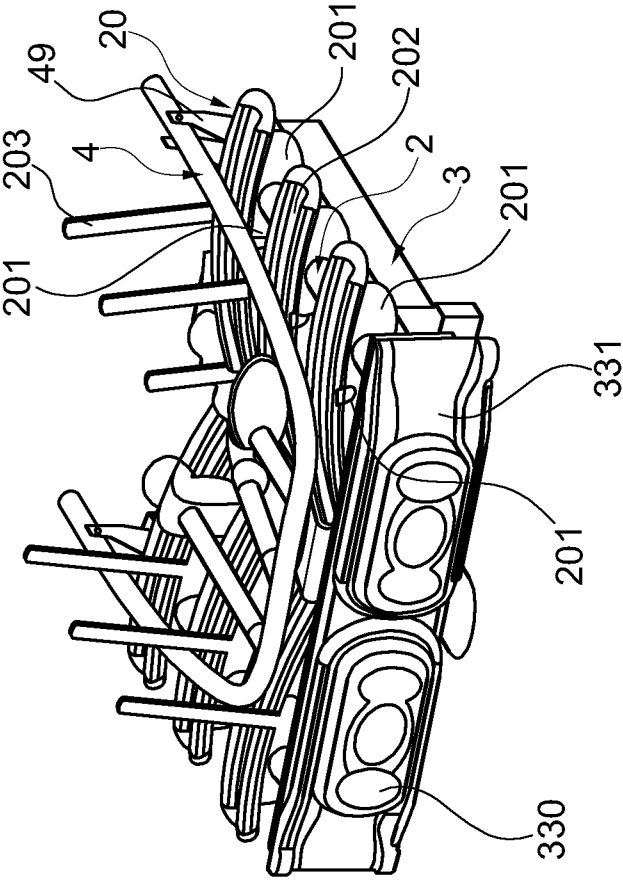


Fig. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2014/050778

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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)

IPC: B60D, B60R

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

SE, DK, FI, NO classes as above

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 5344174 A (SANDERS TEUN J H L), 6 September 1994 (1994-09-06); column 2, line 15 - column 3, line 33; figures 1-3	5-7
Y	--	1-4
Y	DE 202006012073 U1 (EUFAB GMBH), 28 September 2006 (2006-09-28); paragraphs [0017]-[0024]; figures 1-2	1-4
A	US 4239252 A (HUETSCH LARRY C ET AL), 16 December 1980 (1980-12-16); column 3, line 5 - line 21; figures 1-9	2, 4, 7



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

02-12-2014

Date of mailing of the international search report

05-12-2014

Name and mailing address of the ISA/SE

Patent- och registreringsverket
Box 5055
S-102 42 STOCKHOLM
Facsimile No. + 46 8 666 02 86

Authorized officer

Anette Hall

Telephone No. + 46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2014/050778

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0983880 A1 (SANDERS TEUN JOHAN HUGO LEENDE), 8 March 2000 (2000-03-08); paragraphs [0014]-[0016]; figures 1-3	3-5
Y	--	1-4
X	DE 10209866 C1 (WINTERHOFF GMBH), 6 November 2003 (2003-11-06); paragraph [0028]; figures 1-7	5-6
A	--	7
A	DE 202011051091 U (KING ROOF IND CO), 10 November 2011 (2011-11-10); abstract; figures 1-6	2, 4, 7
A	EP 1538027 A2 (SPINDER PRODUCTS BV), 8 June 2005 (2005-06-08); abstract; figures 2a-2d,6	2, 4, 7
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2014/050778

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:

The following separate inventions were identified:

1: Claims 1-7 directed to a coupling device for the connection to a coupling ball or any similar connection element. Also the subject-matter of claims 1 and 5 is unclear. Claim 1 seems to relate to the problem of enabling a secure holding of the clamping mechanism. In claim 1 the problem appears to be solved by arranging two clamp halves pivotally. Claim 5 seems to relate to the problem of enabling a secure holding of the clamping mechanism

.../...

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 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.: 1-7

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.

Continuation of: Box No. III

reducing wear. In claim 5 the problem appears to be solved by a locking device provided with an eccentric body designed such that the movement between them takes place during a rolling motion.

2: Claims 8-11 directed to a tie arm for load carriers and claims 12-15 directed to a method for the attachment to load carriers. However, the method claims only describe a device. Claims 8 and 12 relate to the problem of providing a tie arm that can be bent. This problem is solved by providing the arm with a toggle joint.

A partial search has been carried out, which relates to the invention 1 mentioned above.

The present application has been considered to contain two inventions which are not linked such that they form a single general inventive concept, as required by Rule 13 PCT for the following reasons:

As both the problems and solutions are technically different, no single general concept can be formulated based on the technical features of the inventions. Consequently, the requirements of Rule 13.1 PCT are not met.

It was investigated under Rule 13.2 if any further feature, either in the claims or derivable from the description, could be considered as a same or corresponding feature, and could be considered a special technical feature establishing a technical link between the three groups of inventions. No such features were identified.

Consequently, the two groups of inventions are not so linked as to form a single general inventive concept as required by Rule 13.1 PCT.

Continuation of: second sheet

International Patent Classification (IPC)

B60D 1/06 (2006.01)

B60R 9/06 (2006.01)

B60R 9/10 (2006.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE2014/050778

US	5344174 A	06/09/1994	AT	132814 T	15/01/1996
			DE	9113527 U1	06/02/1992
			DE	69116308 T2	15/05/1996
			DK	0483926 T3	28/05/1996
			ES	2082117 T3	16/03/1996
			GR	3019211 T3	30/06/1996
			NL	9002357 A	18/05/1992
			WO	9207727 A1	14/05/1992
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			DE	502007007043 D1	09/06/2011
			EP	1884410 A2	06/02/2008
US	4239252 A	16/12/1980	NONE		
EP	0983880 A1	08/03/2000	DE	69906647 D1	15/05/2003
			NL	1010010 C2	07/03/2000
DE	10209866 C1	06/11/2003	NL	1022861 C2	31/10/2003
DE	202011051091 U	10/11/2011	NONE		
EP	1538027 A2	08/06/2005	NL	1024559 C1	20/04/2005