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

(11) **EP 2 397 412 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.12.2011 Bulletin 2011/51

(51) Int Cl.:
B65B 13/04 *(2006.01)* ***B65B 13/18*** *(2006.01)*

(21) Application number: **11382155.7**

(22) Date of filing: **17.05.2011**

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

(30) Priority: **04.06.2010 ES 201030860**

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(54) **Strapping head and strapping machine**

(57) The invention relates to a strapping head and a strapping machine with said head. The strapping head comprises a first tamper, a second tamper and a third tamper involved in the strap casting, recovery, tightening, welding and cutting operations, each of the tampers being provided with a respective work surface oriented towards one of the faces of the object to be strapped, each of the tampers being susceptible to being shifted in a direction perpendicular to their work surfaces, essentially parallel to one another, between a forward movement end position and a backward movement end position with respect to the object to be strapped and the strap that will wrap it, by means of respective electro-pneumatic drives. The mentioned electro-pneumatic drives of each tamper are pneumatic cylinders, preferably having an elliptical section.

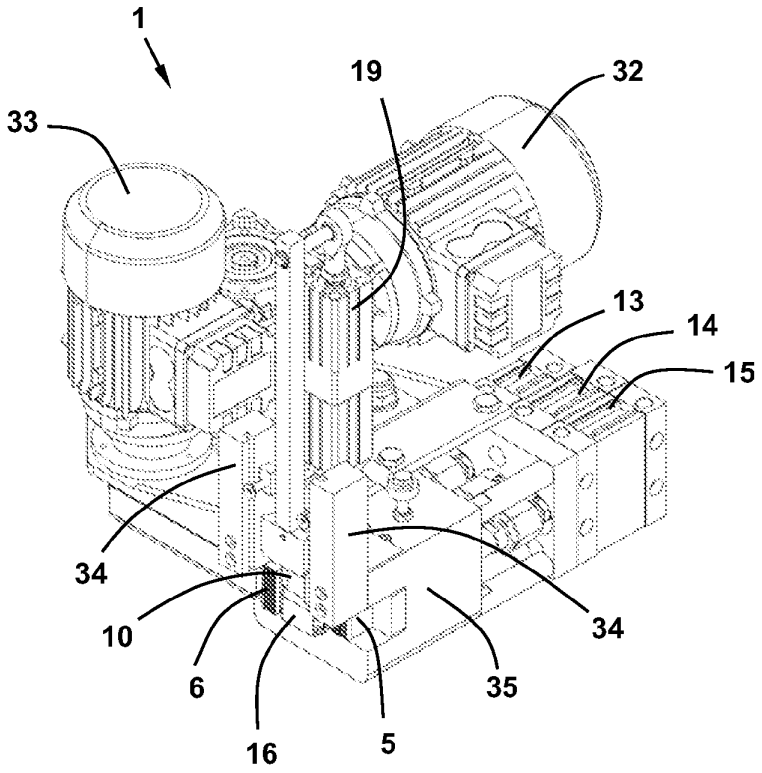

Fig. 2

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Description

Technical Field of the Invention

[0001] The present invention relates to a strapping head that applicable to strapping machines comprising a rack and a guide frame to guide the vertically shiftable strap and inside of which an object, parcel or load is placed around which must be applied at least one strap from a continuous strap feed reel. The strapping head comprises continuous strap casting means so that such strap runs along the guide frame around the object to be strapped, means for recovering and tightening the continuous strap around the object, welding means for welding a first free end of the continuous strap to a portion of the same strap forming a closed contour around the object to be wrapped with the strap, and cutting means for releasing the sector of the strap forming the closed contour from the rest of the continuous strap.

[0002] According to another aspect, a strapping machine comprising the strapping head of the invention is also disclosed.

Background of the Invention

[0003] In handling tasks and logistics of industrial sectors, such as the sector of red and white ceramics, bottling, chemicals, etc., it is common to store and transport merchandise packaged in cases, packages or parcels stacked on pallets. Pallets are designed such that they can be moved by transport trucks known as forklifts, and they allow accumulating a considerable load stacked thereon at considerable heights, usually exceeding the horizontal dimensions of the pallet itself.

[0004] While stowing the loaded pallets in warehouses or in vehicles or during their transport, the parcels can fall due to movement, reducing or deteriorating the quality of the stored or transported merchandise, in addition to the subsequent logistic damage. To avoid this, straps surrounding each of the levels are usually applied, and as a result of the binding or hoping effect, they provide greater structural integrity to the cases of each level.

[0005] The strapping operation consists of applying a metal or plastic strip, for example a polypropylene strip, to the object to be packaged which is usually placed on a pallet or similar structure. Said strap is applied by means of a strapping machine in which, from a continuous strap feed reel, a free end of the strap is cast to run along the inside of a guide frame surrounding the object to be strapped. The guide frame is assembled in a rack of the strapping machine through a vertically shiftable carriage which allows horizontally strapping the object with several straps separated from one another. Once the free end of the strap has run along the guide frame, going completely around the object to be strapped, the strap is tightened around said object, it is closed on itself by heating the end portions of the strap to attach them by welding and the continuous strap is finally cut in order to apply the next strap.

[0006] In order to carry out the mentioned operations making up the strapping, strapping machines are provided with a strapping head comprising continuous strap casting means so that such strap runs along the guide frame around the object to be strapped, means for recovering and tightening the continuous strap around the object, welding means for welding a first free end of the continuous strap to a portion of the same strap forming a closed contour around the object to be wrapped with the strap, and cutting means for releasing the sector of the strap forming the closed contour from the rest of the continuous strap.

[0007] Known strapping machines are based on a mechanical camshafts system to synchronize the strap welding and cutting operations, which is expensive to produce and complicated to regulate, in addition to occupying a considerable space.

[0008] It is therefore shown that there is a need for a strapping head which allows automating the entire strapping process without using a camshaft system, positioning sensors and trackers, and which allows saving space.

Disclosure of the Invention

[0009] For the purpose of providing a solution to the problems considered, a strapping head is disclosed that can be applied to strapping machines of the type comprising a rack and a guide frame to guide the vertically shiftable strap and inside of which an object is placed around which at least one strap must be applied from a continuous strap feed reel. The strapping head comprises continuous strap casting means so that such strap runs along the guide frame around the object to be strapped, means for recovering and tightening the continuous strap around the object, welding means for welding a first free end of the continuous strap to a portion of the same strap forming a closed contour around the object to be wrapped with the strap, and cutting means for releasing the sector of the strap forming the closed contour from the rest of the continuous strap.

[0010] The strapping head is essentially characterized in that it comprises a first tamper, a second tamper and a third tamper involved in the strap casting, recovery, tightening, welding and cutting operations, each of the tampers being provided with a respective work surface oriented towards one of the faces of the object to be strapped, each of the tampers being susceptible to being shifted in a direction perpendicular to their work surfaces, essentially parallel to one another, between a forward movement end position and a backward movement end position with respect to the object to be strapped and the strap that will wrap it, by means of respective electro-pneumatic drives. The strapping process is automated and the different operations are synchronized by means of the electro-pneumatic drives of the tampers in a precise and effective manner.

[0011] According to another feature of the invention,

the respective electro-pneumatic drives of each tamper are pneumatic cylinders.

[0012] According to another feature of the invention, the respective electro-pneumatic drives of each tamper are pneumatic cylinders having an elliptical section. The pneumatic cylinders having an elliptical section, by means of which the complete strapping sequence is performed, maintain the stresses necessary to that end and at the same time allow them to be placed in a reduced space. The means for recovering, tightening, welding and cutting are preferably located in the upper area of the head which, together with the pneumatic cylinders having an elliptical section, allow saving space, making it possible to be able to place the first strap directly on the base pallet on which the load is located.

[0013] According to another feature of the invention, the work surface of the second tamper is located between the work surface of the first tamper and between the work surface of the third tamper. In other words, the second tamper is located in a central position between the other two tampers.

[0014] According to another feature of the invention, the first tamper is provided with a hole through which the first free end of the continuous strap passes when it is cast to wrap around the object to be strapped.

[0015] According to another feature of the invention, the strapping head comprises a housing flat bar, provided with two opposing faces, an inner face and an outer face oriented towards one of the faces of the object to be strapped, said faces of the housing flat bar being essentially parallel to the work surface of the second tamper, the housing flat bar being vertically shiftable from an upper end position to a lower end position in which the housing flat bar is arranged in front of and at the same height as the work surface of the second tamper, leaving a minimum separating gap equal to the thickness of the strap, and the outer face of the housing flat bar being provided with a stop to stop the forward movement of the first free end of the strap when it has already gone around the object to be strapped.

[0016] According to another feature of the invention, the strapping head also comprises an outer front flat bar vertically slidable from an upper end position to a lower end position in which the outer front flat bar is arranged in front of and at the same height as the work surfaces of the tampers, leaving a minimum separating gap equal to the thickness of the strap between the inner face of the outer front flat bar and the mentioned work surfaces.

[0017] According to another feature of the invention, the strapping head comprises a prismatic-shaped heating resistor, comprising an outer face and an inner face which is coplanar with the inner face of the housing flat bar, the mentioned heating resistor being arranged vertically adjacent below the housing flat bar together with which it is susceptible of being shifted vertically and integrally, the heating resistor being intended to heat the segments of the strap arranged between the work surface of the second tamper and the inner face of the resistor, and between the outer face of the resistor and the inner face of the outer front flat bar.

[0018] According to another feature of the invention, the work surface of the second tamper is provided with cutting means for cutting the strap.

[0019] According to another feature of the invention, the work surface of the first tamper is provided with a grooving which contributes to keeping a portion of strap secured to the strapping head during the strap recovery and tightening operations when the first tamper adopts its forward movement end position by pressing the portion of strap against the inner face of the outer front flat bar when the latter is in its lower end position.

[0020] According to another feature of the invention, the work surface of the third tamper is provided with a grooving which contributes to keeping a portion of strap secured to the strapping head after the strap heating operation when the third tamper adopts its forward movement end position by pressing the portion of strap against the inner face of the outer front flat bar when the latter is in its lower end position.

[0021] According to another aspect of the invention, a strapping machine is disclosed, of the type comprising a rack and a guide frame to guide the vertically shiftable strap and inside of which an object is placed around which at least one strap must be applied from a continuous strap feed reel. Said strapping machine is essentially characterized in that it comprises a strapping head such as the one described above. As a result of its head, the strapping process in said strapping machine is automated and easy to regulate.

[0022] According to another feature of the strapping machine object of the invention, the guide frame of the strap defines a guide rail having an essentially circular path for the strap which is cast from the continuous strap feed reel by casting means to run along the guide rail. Since the guide rail has a circular path, the running of the polypropylene strap around the object to be strapped is greatly aided, the strap being slid smoothly because the direction does not have to be changed abruptly, as occurs in existing strapping machines with a rectangular guide frame.

[0023] According to another feature of the strapping machine object of the invention, the guide rail comprises an element having a C-shaped cross-section, the side opening of which is partially closed by guard means to prevent the strap running along the guide rail from coming out of the element having a C-shaped cross-section during the strap casting operation before the strap is tightened around the object to be strapped.

[0024] According to another feature of the invention, the guard means are formed by strips of bristles or lamellae arranged like curtains that are strong enough to retain the strap inside the guide rail during the strap casting operation, but which are flexible enough to allow the strap to progressively leave the inside of said rail during the strap tightening operation.

[0025] According to another feature of the invention,

the strapping machine comprises folding means for dismantling the guide frame of the strap on the rack to thus facilitate its transport when the strapping machine is in a non-operating rest mode or must be stored, occupying a minimum space.

Brief Description of the Drawings

[0026] The attached drawings illustrate by way of non-limiting example a preferred embodiment of the strapping head and of the strapping machine objects of the invention. In said drawings:

Figures 1 and 2 are two perspective views of the strapping head object of the invention;
Figure 3 is a perspective view of the strapping machine object of the invention, comprising the strapping head of Figure 1, with the guide frame in the operative or unfolded position;
Figures 4 and 5 are respective elevational views of the strapping machine of Figure 3 with the guide frame in the folded position;
Figure 6 is an exploded perspective view of the strapping head of Figure 1;
Figure 7 is a schematic view of the guide rail with the guard means of the guide frame of the strapping machine of Figure 3; and
Figures 8 to 15 show the components of the strapping head of Figure 1 in different steps of the strapping operation.

Detailed Description of the Drawings

[0027] Figure 3, 4 and 5 show a strapping machine 20 designed to apply several horizontal straps 2 around a parcel, load or object 30, schematically depicted with dotted lines. The strapping machine 20 comprises a rack 21 on which are arranged a continuous strap feed reel or spool 23 for feeding a continuous polypropylene strap 2, a strapping head 1, and a guide frame 22 for guiding the run of the strap 2 around the object 30 to be strapped, said frame 22 being vertically shiftable along the rack 21 in order to gradually apply several straps 2 at a different height with respect to the base of the object 30.

[0028] In order to place a sector of the strap 2 having a closed contour around the perimeter of the object 30, a first free end 2a of the continuous strap 2 wound on the reel 23 is cast by casting means arranged in the strapping head 1 to the inside of the guide rail 24 of the guide frame 22. The guide rail 24, manufactured in polyethylene, defines an essentially circular path, which greatly facilitates the strap 2 running smoothly along the circular path around the object 30. As can be seen in Figure 7, the guide rail 24 is basically formed by an element 25 having a C-shaped cross-section such that the strap 2 runs along the groove defined by said element 25. To prevent the strap 2 from leaving the guide frame 22 before having gone completely around the object 30 to be strapped, the guide rail 24 has been provided with guard means for the strap 2, formed by strips 26 of bristles or lamellae arranged like a brush or curtains covering the opening of the element 25. The strips 26 are strong enough to retain the strap 2 inside the guide rail 24 during the strap 2 casting operation, i.e., while the strap 2 runs along the path marked by the guide frame 22, but they are flexible enough to allow the strap 2 to leave the inside of the guide rail 24 when the strapping head 1 tightens the strap 2, at the end of which the strap 2 is arranged in contact with and pressing the faces of the object 30. As can be seen in Figure 7, there is a small separating gap between the two strips 26 arranged at the ends of the element 25. When the means for tightening the strapping head 1 pull on the strap 2 to tighten it around the object 30, the strap 2 located in the groove of the guide rail 24 will leave the groove pushing the strips 26, making them open.

[0029] It should also be mentioned that the strapping machine 20 comprises hinge-like folding means intended for dismantling the guide frame 22 on the rack 21 so that the strapping machine 20 occupies minimal storage space or is easy to transport when it is in a rest or non-operating mode. The strapping machine 20 in the folded position is observed in Figures 4 and 5, where the guide frame 22 has been dismantled upwardly.

[0030] The strapping head 1 of the strapping machine 20 described above is responsible for performing the steps of the strapping operation, comprising: casting the strap 2 so that it runs along the guide rail 24 of the guide frame 22, recovering and tightening the continuous strap 2 around the object 30, attaching by welding the first free end of the continuous strap 2 to a portion of the same strap 2, thus forming a closed contour around and against the object 30, and cutting the excess strap 2 to separate and release the strap 2 surrounding the object 30 from the rest of the continuous strap 2 and to thus be able to apply the next strap 2. To that end, the strapping head 1, shown in Figures 1, 2 and 6, comprises casting means including a casting roller 28 connected to a casting motor 33, means for recovering and tightening the strap 2, including a tightening roller 29 connected to a tightening motor 32, welding means formed by a heating resistor 16 and cutting means.

[0031] It should be mentioned that a first tamper 3, a second tamper 4 and a third tamper 5, which act separately and jointly for performing the different strapping steps, as will be explained below, are also involved in the strapping operation. Each of the three tampers 3, 4 and 5 is provided with a respective work surface 6, 7 and 8 which at one time or another contact a segment of the strap 2 according to the strapping step, said work surfaces 6, 7 and 8 being oriented towards one of the faces 31 of the object 30 to be strapped, the face closest to the strapping head 1, as can be seen in Figure 3. The work surfaces 6, 7 and 8 of the tampers 3, 4 and 5, respectively, are essentially parallel to one another.

[0032] According to the strapping step being per-

formed, the three tampers 3, 4 and 5 will be shifted individually or at the same time as another tamper, in a direction perpendicular to their respective work surfaces 6, 7 and 8, each being able to adopt a forward movement end position towards the object 30 to be strapped and a backward movement end position with respect to same. To enable the shifting of the tampers 3, 4 and 5 and the synchronization of their movements during the different strapping steps, the tampers 3, 4 and 5 are actuated by means of respective electro-pneumatic drives 13, 14 and 15. The electro-pneumatic drives 13, 14 and 15 can be formed by pneumatic cylinders having a circular section, although pneumatic cylinders having an elliptical section are advantageously preferred because of the space savings they represent, which favors the compactness of the strapping head 1.

[0033] The working of the different components of the strapping head 1 involved in the different steps of the strapping operation will be described below with the aid of Figures 8 to 15.

[0034] Figure 8 corresponds to a rest or non-operative situation of the strapping head 1. As can be seen, the three tampers 3, 4 and 5 are in the backward movement end position, it can be seen that the rear part of the third tamper 5 is supported against the wall of the bottom of the housing of the block 35 in which the three tampers 3, 4 and 5 are housed.

[0035] It can also be seen that the strapping head 1 comprises a housing flat bar 10 provided with an inner face (not visible in the drawing) and an outer face oriented towards one of the faces 31 of the object 30 to be strapped. The inner and outer faces of the housing flat bar 10 are essentially parallel to the work surface 7 of the second tamper 4. The housing flat bar 10 can be shifted vertically from an upper end position to a lower end position, depicted in Figure 8, in which the housing flat bar 10 is arranged in front of and at the same height as the work surface 7 of the second tamper 4, hence said work surface 7 is barely visible in Figure 8. Between the inner face of the housing flat bar 10 and the work surface 7 of the second tamper 4 there is a tight separating gap, at least equal to the thickness of the strap 2, in order to allow the strap 2 to pass between these two components.

[0036] It can also be seen in Figure 8 that the strapping head 1 comprises a prismatic-shaped heating resistor 16, comprising an outer face and an inner face, the latter being essentially coplanar with the inner face of the housing flat bar 10. The heating resistor 16 is arranged vertically adjacent below the housing flat bar 10 with which it is simultaneously shifted in the same direction.

[0037] To get an idea of the run of the strap 2 during the strapping step, three segments of a strap 2 have been distinguished in Figure 6 and in Figures 8 to 14, segment 2a being the strap 2 going from the reel 23 to its introduction through a hole 9 made in the first tamper 3, from which the strap 2 starts to go around the object 30, segment 2b indicates the strap 2 when it starts to go around the first half of the object 30 and segment 2c is the strap 2 which finishes going around the second half of the object 30 to its overlapping with segment 2b (see Figure 13).

[0038] In Figure 9, segment 2a of the strap 2 (also see Figure 6) from the reel 23 passes through the hole 9 made in the side of the first tamper 3. From this point, the strap 2 passes in front of the work surfaces 7 and 8 of the second tamper 4 and of the third tamper 5, respectively, and is guided through the inside of the guide rail 24 of the guide frame 22. The curtain-like strips 26 will keep strap 2 inside the guide rail 24 until the tightening begins.

[0039] It should be explained that Figure 9 does not show the housing flat bar 10 so that it can be seen that segment 2b of the strap 2 passes in front of the work surfaces 7 and 8 of the second tamper 4 and of the third tamper 5, though in reality, in this strapping step, the housing flat bar 10 would be in the position shown in Figure 8, i.e., in its lower end position, whereby the sector of strap 2b passes in the gap between the work surfaces 7 and 8 with the inner face of the housing flat bar 10.

[0040] In Figure 10, the free end of the strap 2 has already run along the entire guide frame 22 and its segment 2c passes in front of the first tamper 3 and the second tamper 4, contacting the outer face of the housing flat bar 10, the free end of the strap hitting against a stop 11 provided in the outer face of the housing flat bar 10. At this point, detection means, such as a photocell or a meter device for measuring the length of the strap 2, detect that the second loop or segment 2c has reached the housing flat bar 10 and send a signal to the electro-pneumatic drive 13 of the first tamper 3 so that the latter is shifted, adopting its forward movement end position, shown in Figure 11, and fixes the strap 2 against the inner face 12a of an outer front flat bar 12, not depicted in Figure 11 for the sake of clarity (to not cover the components behind it), but it is depicted in Figures 1 and 6. The outer front flat bar 12 is vertically slidable along the guides 34 from an upper end position to a lower end position in which the outer front flat bar 12 is arranged in front of and at the same height as the work surfaces 6, 7 and 8 of the tampers 3, 4 and 5, respectively. There is a separating gap at least equal to the thickness of the strap 2 between the inner face 12a of the outer front flat bar 12 and the mentioned work surfaces 6, 7 and 8. After fixing the strap 2, since it is pressed by the first tamper 3 against the inner face 12a of the outer front flat bar 12, the casting roller 28 which cast the strap 2 then rotates in the opposite direction and tightens the strap 2, or if the strapping head 1 has a tightening roller 29, the latter begins to rotate in order to tighten the strap.

[0041] Figure 12 describes the following step, in which the heating resistor 16 is shifted vertically upwards, shifting the housing flat bar 10 and occupying the position it occupied. The first loop or segment 2b of the strap 2 is thus located in the part behind the heating resistor 16, i.e., between the inner face of the heating resistor 16 and the work surface 7 of the second tamper 4. The second loop or segment 2c of the strap 2 is located in the outer

part of the heating resistor 16, between its outer face and the inner face 12a of the outer front flat bar 12, not depicted in Figure 12 so as to allow seeing the position of the heating resistor 16. The second tamper 4 is then shifted as it is actuated by its electro-pneumatic drive 14 and adopts a forward movement position in which it presses a segment of the first and second loop of the strap 2 and also the heating resistor 16 against the inner face 12a of the outer front flat bar 12. The pressure exerted by the work surface 7 of the second tamper 4 lasts the time necessary for the segments of the strap 2 to heat up.

[0042] In Figure 13, the second tamper 4 has been removed so that the heating resistor 16 could be shifted upwards, leaving the segments of the first and second loop of the strap 2 hot.

[0043] Next, the third tamper 5 is shifted as it is actuated by an electro-pneumatic drive 15 and adopts a forward movement end position, shown in Figure 14, in which secures the first loop of the strap 2 by part of segment 2b. In fact, it can be observed that the third tamper 5 has been shifted from its initial rest position for backwards movement because there is a separation between the base of the third tamper 5 and the wall of the bottom of the housing of the block 35 in which the three tampers 3, 4 and 5 are housed.

[0044] Next, the second tamper 4 moves forward to collide with the outer front flat bar 12, thus pressing the two segments of strap 2 therebetween. Said segments thereby overlap, being welded together, and the strap 2 closed on itself is cut, separating it from the excess strap 2 from the reel 23. The second tamper 4 is provided with cutting means such that the forward movement of the second tamper 4 beyond the hole 9 made in the first tamper 3 cuts the strap 2.

[0045] Finally, the three tampers 3, 4 and 5 return to their backward movement end position and the outer front flat bar 12 is removed by sliding vertically upwards, allowing the exit of the strap 2 closed on itself wrapped around the object 30.

[0046] It should be pointed out that as a result of the electro-pneumatic drives 13, 14 and 15 of the first tamper 3, of the second tamper 4 and of the third tamper 5, respectively, which allow considerable improvement in the synchronization of the different steps, the operation of applying a horizontal strap 2 around the perimeter of an object 30 can be done in less than 14 seconds, according to tests conducted for strapping an object 30 of suitable dimensions to what would be the base of a standard pallet.

Claims

1. A strapping head (1) applicable to strapping machines (20) comprising a rack (21) and a guide frame (22) to guide the vertically shiftable strap and inside of which an object (30) is placed around which at least one strap (2) must be applied from a continuous strap feed reel (23), the strapping head comprising continuous strap casting means so that such strap runs along the guide frame around the object to be strapped, means for recovering and tightening the continuous strap around the object, welding means for welding a first free end of the continuous strap to a portion of the same strap forming a closed contour around the object to be wrapped with the strap, and cutting means for releasing the sector of the strap forming the closed contour from the rest of the continuous strap, **characterized in that** the strapping head comprises a first tamper (3), a second tamper (4) and a third tamper (5) involved in the strap casting, recovery, tightening, welding and cutting operations, each of the tampers being provided with a respective work surface (6, 7, 8) oriented towards one of the faces (31) of the object to be strapped, each of the tampers being susceptible to being shifted in a direction perpendicular to their work surfaces, essentially parallel to one another, between a forward movement end position and a backward movement end position with respect to the object to be strapped and the strap that will wrap it, by means of respective electro-pneumatic drives (13, 14, 15).

2. The strapping head (1) according to claim 1, **characterized in that** the respective electro-pneumatic drives (13, 14, 15) of each tamper (3, 4, 5) are pneumatic cylinders.

3. The strapping head (1) according to claim 2, **characterized in that** the respective electro-pneumatic drives (13, 14, 15) of each tamper (3, 4, 5) are pneumatic cylinders having an elliptical section.

4. The strapping head (1) according to any one of claims 1 to 3, **characterized in that** the work surface (7) of the second tamper (4) is located between the work surface (6) of the first tamper (3) and between the work surface (8) of the third tamper (5).

5. The strapping head (1) according to claim 4, **characterized in that** the first tamper (3) is provided with a hole (9) through which the first free end of the continuous strap (2) passes when it is cast to wrap around the object (30) to be strapped.

6. The strapping head (1) according to claim 4 or 5, **characterized in that** it comprises a housing flat bar (10), provided with two opposing faces, an inner face and an outer face oriented towards one of the faces (31) of the object to be strapped, said faces of the housing flat bar being essentially parallel to the work surface (7) of the second tamper (4), the housing flat bar being vertically shiftable from an upper end position to a lower end position in which the housing flat bar is arranged in front of and at the same height as the work surface of the second tamper, leaving a

minimum separating gap equal to the thickness of the strap (2), and the outer face of the housing flat bar being provided with a stop (11) to stop the forward movement of the first free end of the strap when it has already gone around the object (30) to be strapped.

7. The strapping head (1) according to claim 6, **characterized in that** it comprises an outer front flat bar (12) vertically slidable from an upper end position to a lower end position in which the outer front flat bar is arranged in front of and at the same height as the work surfaces (6, 7, 8) of the tampers (3, 4, 5), leaving a minimum separating gap equal to the thickness of the strap (2) between the inner face (12a) of the outer front flat bar and the mentioned work surfaces.

8. The strapping head (1) according to claim 7, **characterized in that** it comprises a prismatic-shaped heating resistor (16), comprising an outer face and an inner face that is essentially coplanar with the inner face of the housing flat bar (10), the mentioned heating resistor being arranged vertically adjacent below the housing flat bar (10) together with which it is susceptible of being shifted vertically and integrally, the heating resistor being intended to heat the segments of the strap (2) arranged between the work surface (7) of the second tamper (4) and the inner face of the resistor, and between the outer face of the resistor and the inner face (12a) of the outer front flat bar (12).

9. The strapping head (1) according to claim 8, **characterized in that** the work surface (7) of the second tamper (4) is provided with cutting means for cutting the strap (2).

10. The strapping head (1) according to claim 9, **characterized in that** the work surface (6) of the first tamper (3) is provided with a grooving which contributes to keeping a portion of strap (2) secured to the strapping head during the strap recovery and tightening operations when the first tamper adopts its forward movement end position by pressing the portion of strap against the inner face (12a) of the outer front flat bar (12) when the latter is in its lower end position.

11. The strapping head (1) according to claim 9 or 10, **characterized in that** the work surface (8) of the third tamper (5) is provided with a grooving which contributes to keeping a portion of strap (2) secured to the strapping head after the strap heating operation when the third tamper adopts its forward movement end position by pressing the portion of strap against the inner face (12a) of the outer front flat bar (12) when the latter is in its lower end position.

12. A strapping machine (20) comprising a rack (21) and a guide frame (22) to guide the vertically shiftable strap and inside of which an object (30) is placed around which at least one strap (2) must be applied from a continuous strap feed reel (23), **characterized in that** it comprises a strapping head (1) according to that defined in any one of claims 1 to 11.

13. The strapping machine (20) according to claim 12, **characterized in that** the guide frame (22) of the strap (2) defines a guide rail (24) having an essentially circular path for the strap which is cast from the continuous strap feed reel (23) by casting means to run along the guide rail.

14. The strapping machine (20) according to claim 13, **characterized in that** the guide rail (24) comprises an element (25) having a C-shaped cross-section the side opening of which is partially closed by guard means to prevent the strap (2) running along the guide rail from coming out of the element having a C-shaped cross-section during the strap casting operation before tightening the strap around the object (30) to be strapped.

15. The strapping machine (20) according to claim 14, **characterized in that** the guard means are formed by strips (26) of bristles or lamellae arranged like curtains that are strong enough to retain the strap (2) inside the guide rail (24) during the strap casting operation, but which are flexible enough to allow the strap to progressively leave the inside of said guide rail during the strap tightening operation

16. The strapping machine (20) according to any one of claims 12 to 15, **characterized in that** it comprises folding means for dismantling the guide frame (22) for guiding the strap (2) on the rack (21) to facilitate its transport when the strapping machine is in a non-operating rest mode.

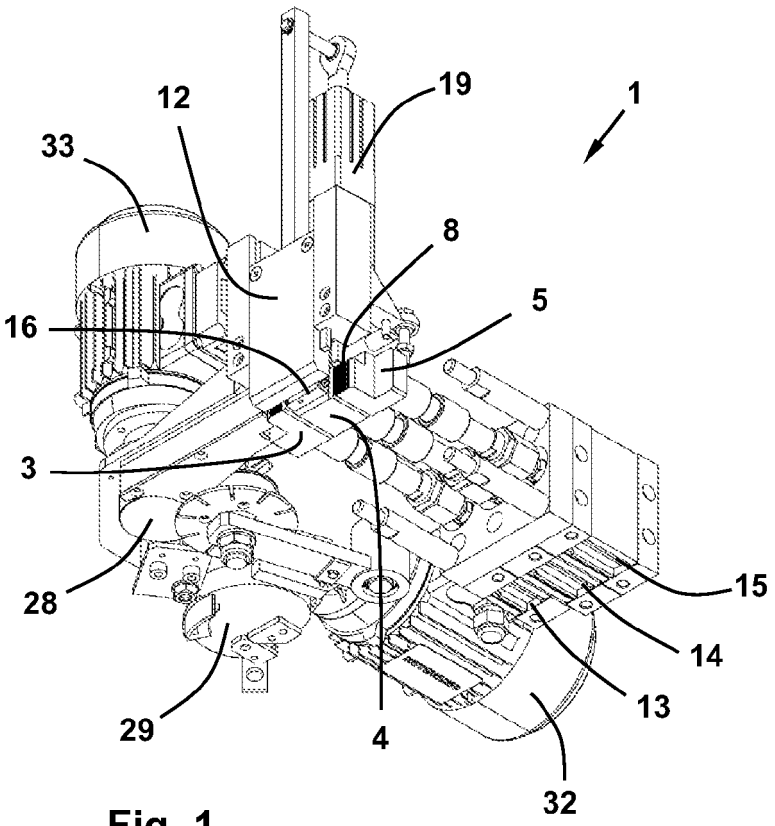
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Fig. 1

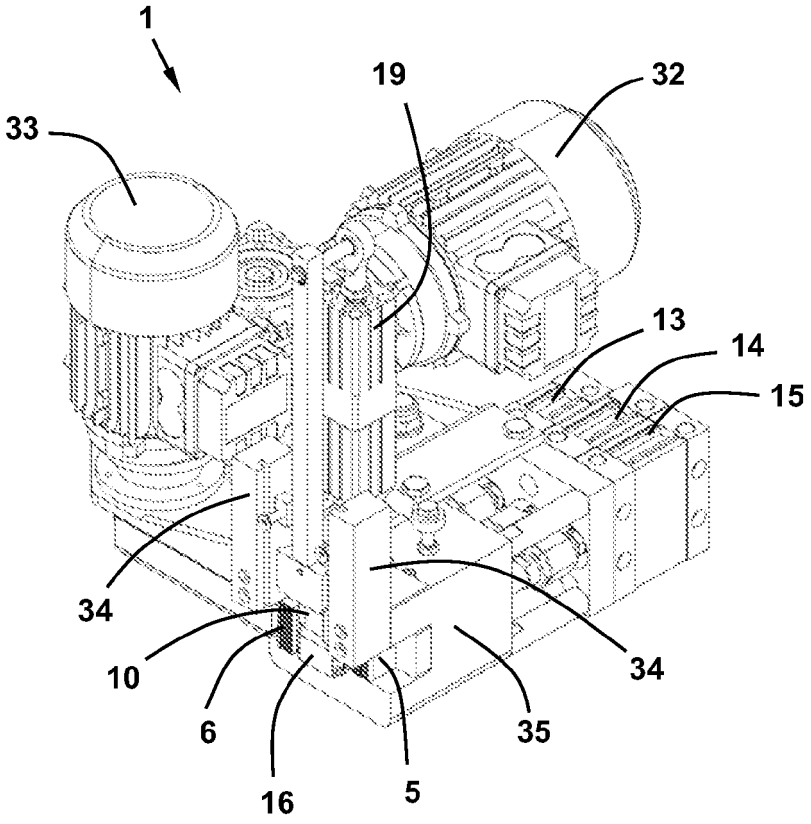
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Fig. 2

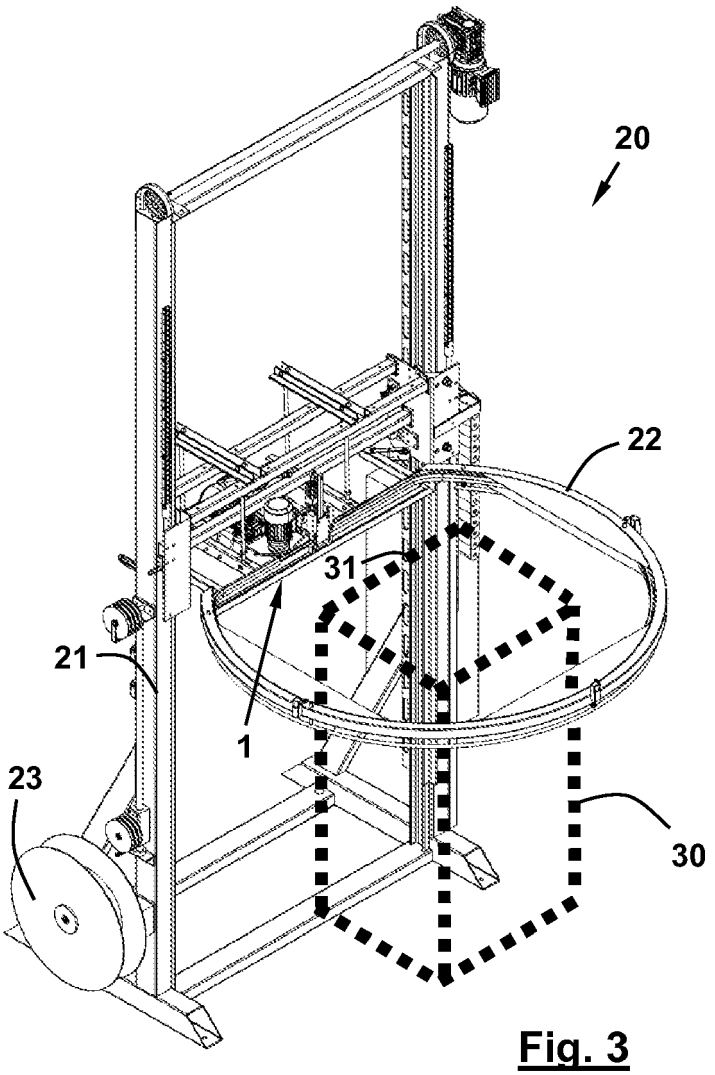


Fig. 3

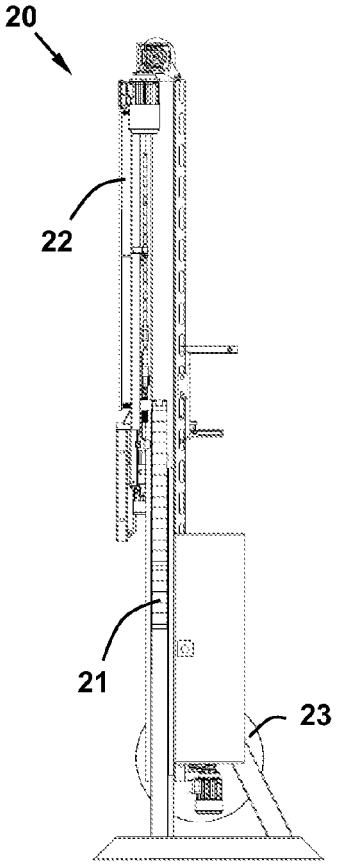


Fig. 4

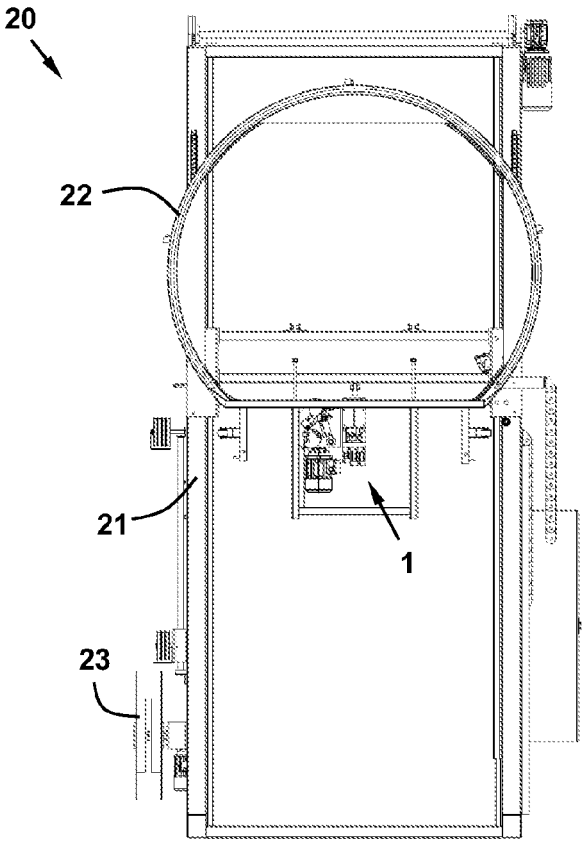


Fig. 5

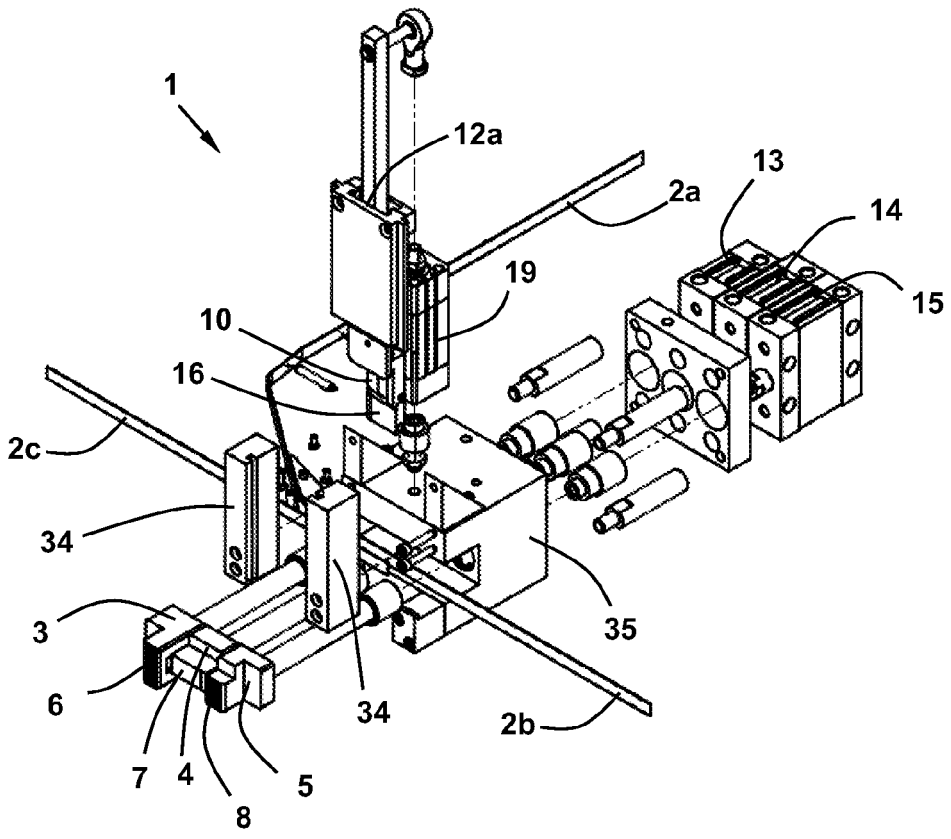


Fig. 6

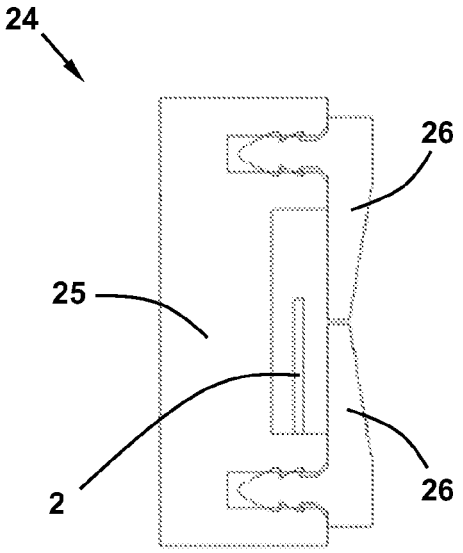
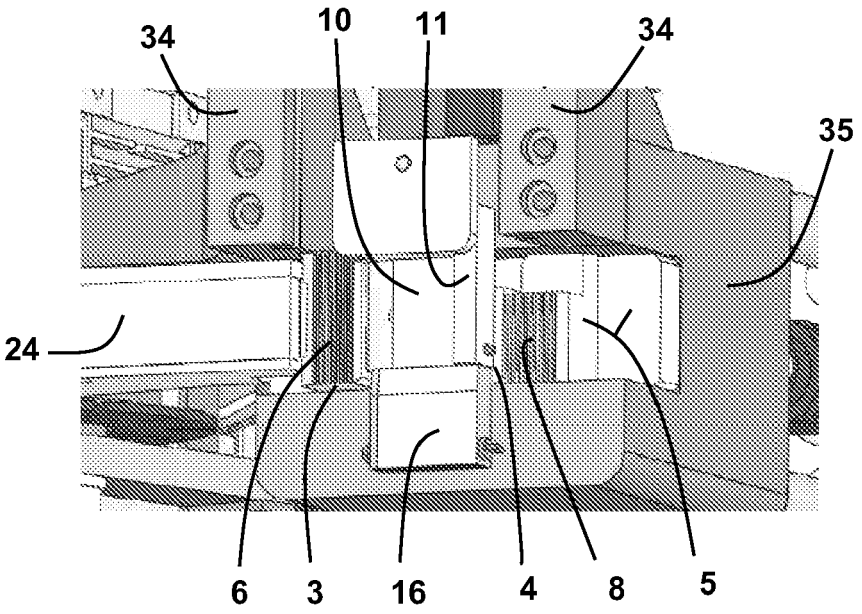


Fig. 7



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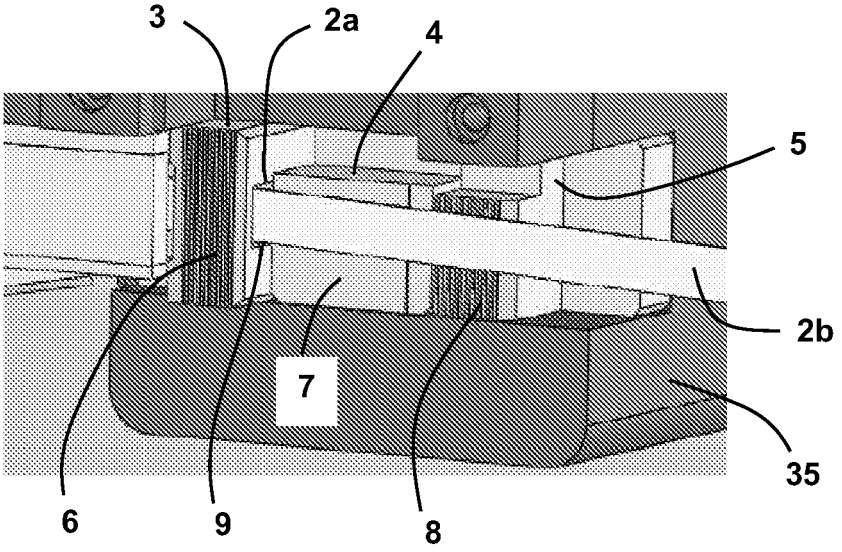

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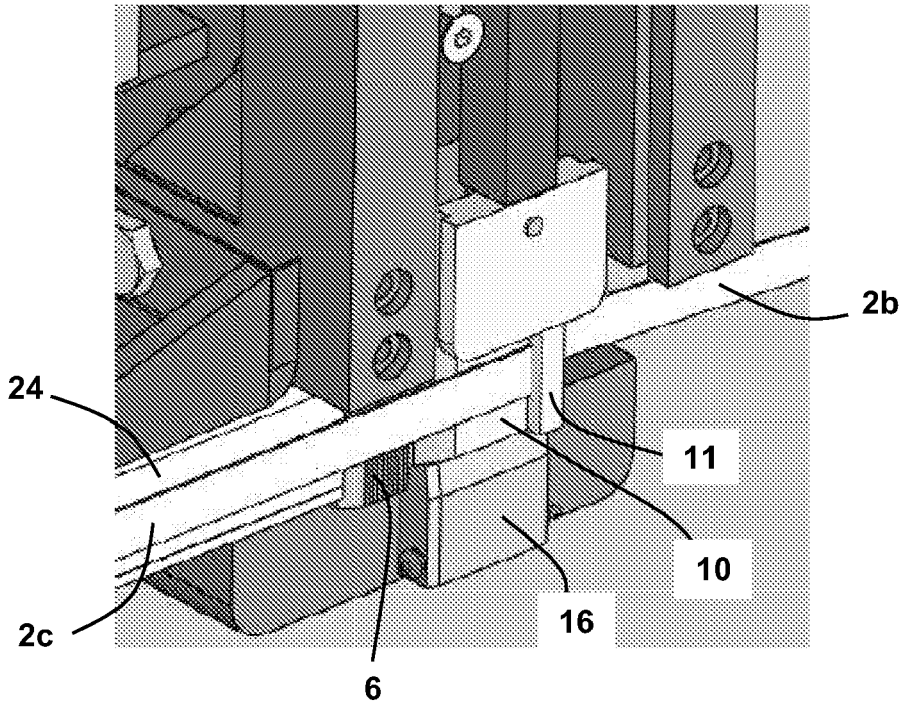

Fig. 10

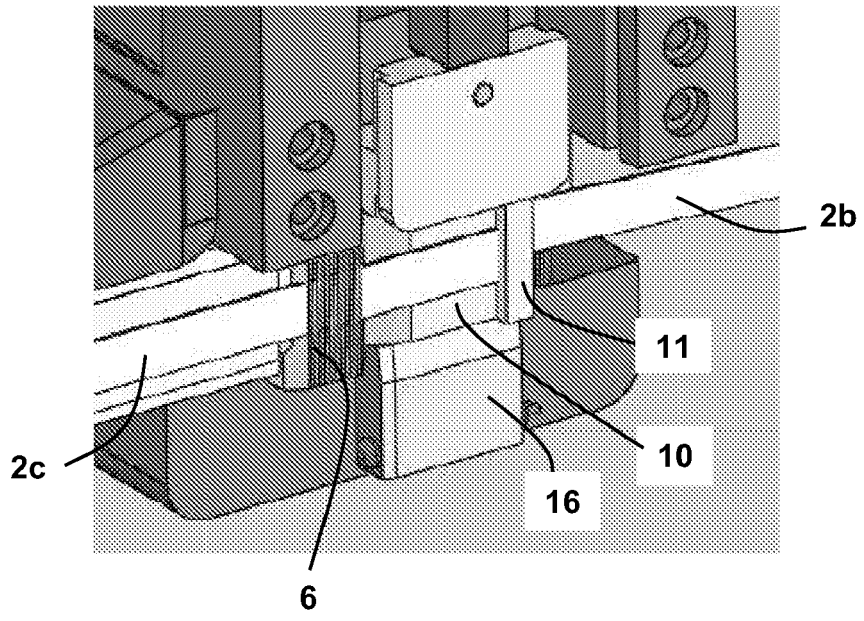

Fig. 11

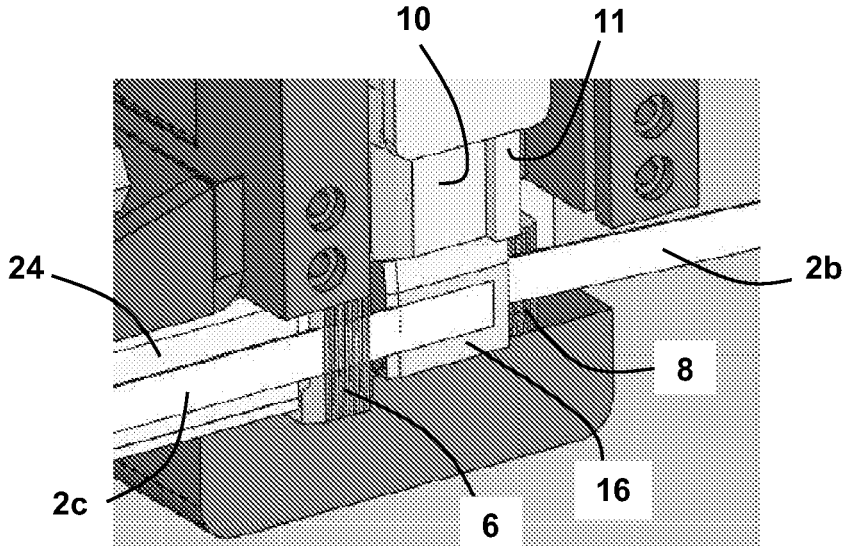

Fig. 12

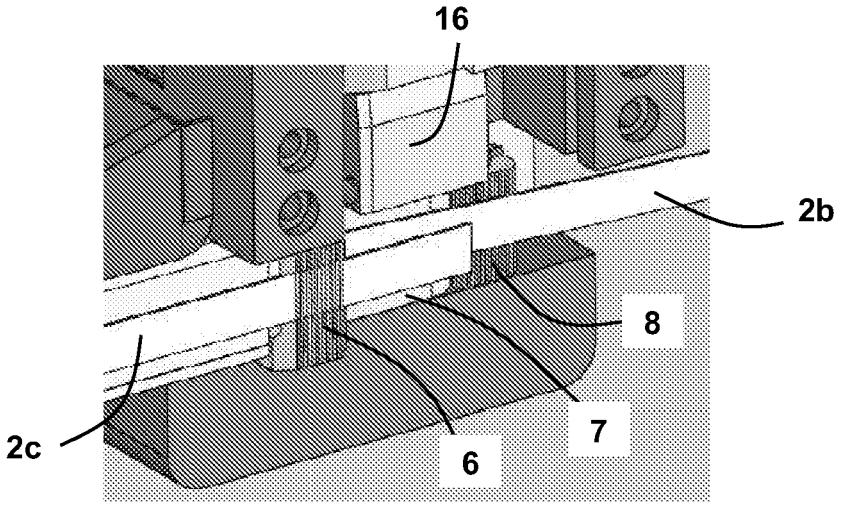

Fig. 13

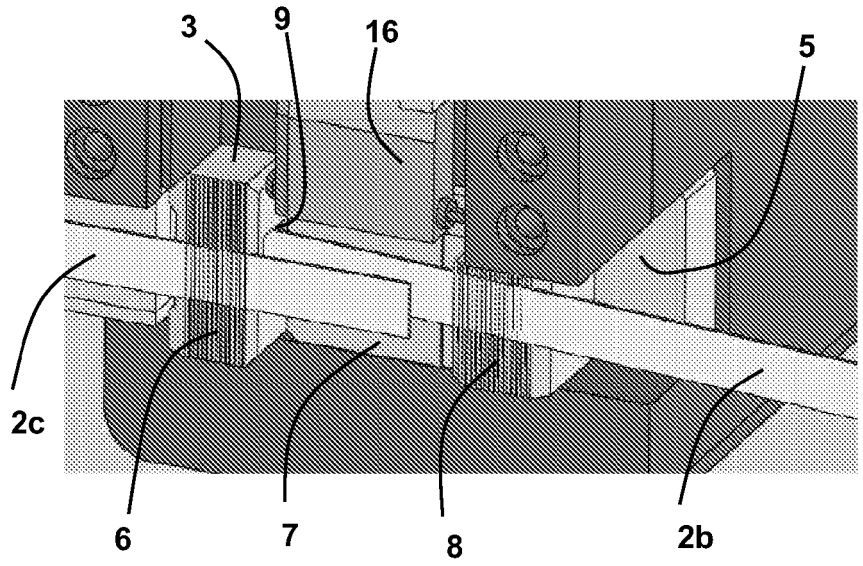

Fig. 14

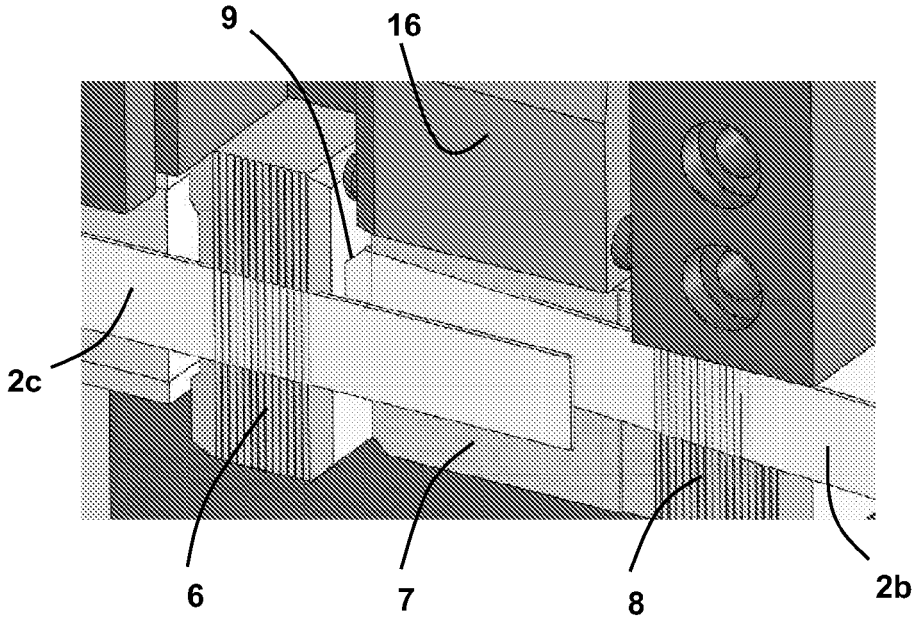

Fig. 15

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EUROPEAN SEARCH REPORT

Application Number
EP 11 38 2155

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 November 2011	Yazici, Baris

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