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(54) **COUPLING MEMBER FOR A SHUTTER AND SIMILAR CLOSURES WHICH CAN BE WOUND ON A RELATED WINDING ROLLER**

(57) A coupling member for a shutter and similar windable closures with respect to a related winding roller comprises a main body with a coupling end, which is suitable for retaining an end of a windable closure. At an opposing end of the coupling member, there is provided a coupling appendix with a rectangular opening which is provided in the winding roller. The coupling appendix comprises a coupling head which projects from a stem which is thinner than the coupling head which defines two opposing teeth, which are generally wider than the width of the rectangular coupling opening in the winding roller and narrower than the height of the rectangular opening

in the winding roller.

In order to couple the shutter to a winding roller, it is simply necessary to twist the main body of the coupling member in order to rotate the coupling head, substantially through 90° in one direction, which can thereby be inserted into the rectangular opening in the winding roller. By releasing the main body, it returns resiliently into the initial configuration by making the coupling head rotate substantially through 90° in the opposite direction so that it remains coupled inside the rectangular opening in the winding roller.

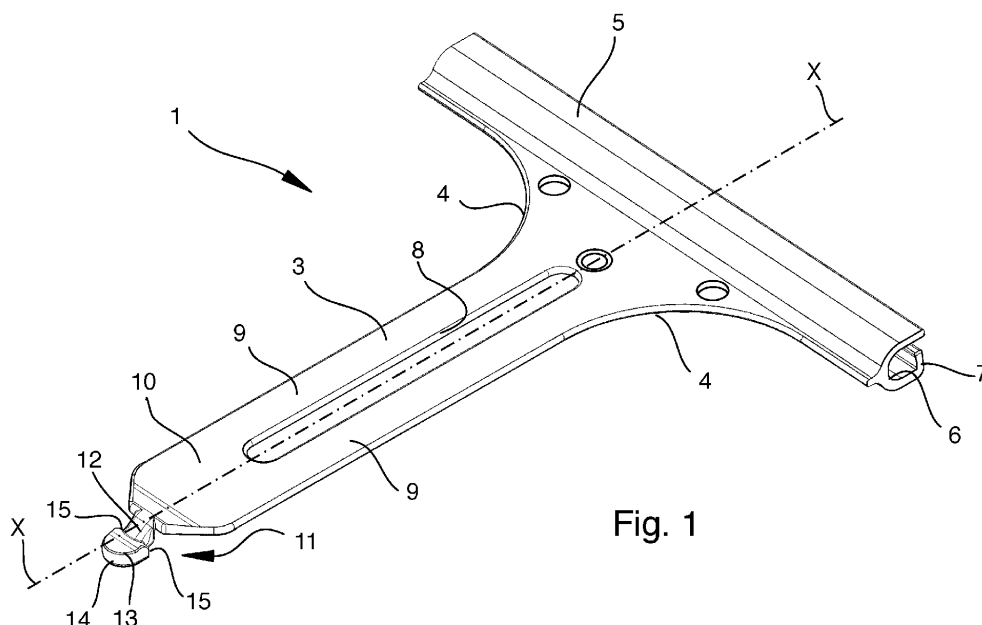


**Fig. 1**

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## Description

### Field of the invention

**[0001]** The present invention relates to the sector of windable closures, such as, for example, roller shutters, which are commonly also known as shutters, rolling gates, sun shades and similar closures.

**[0002]** The invention has been developed with particular regard for a coupling member for the actual windable closure structure with respect to the related winding roller.

### Technological background

**[0003]** Windable closures are commonly used to close doors and windows of buildings, shop windows, openings of garages and other openings of buildings. The windable closures which serve to close doors and windows in residential buildings are called roller shutters or more commonly shutters. The closures of shop fronts and garages are instead called rolling gates or less correctly shutters. They form part of windable closures, including windable shades, such as sun shades, and other similar closures. In the English language, mention is made of roller shutters, security shutters, coiling doors, roller doors, sectional doors, etc. Below, unless expressly indicated otherwise or where it is not evident from the context, all these terms above are intended to be understood to be synonyms and to indicate the same type of windable closures to which the present invention may be applied.

**[0004]** Windable closures have multiple applications and can be used, for example, as a means for controlling access to buildings, for example, in order to prevent intrusions or acts of vandalism. They can also be used as instruments for protection from atmospheric agents, such as rain, hail, wind, snow and are sometimes also used as protection from fires. Furthermore, windable closures can be used to adjust the brightness inside environments because it is possible to adjust the winding degree thereof and therefore to vary the opening extent of the relevant space, for example, the door or the window.

**[0005]** A windable closure generally comprises a windable structure on a movement shaft which is also referred to as a winding roller and which can be rotated about an axis which is usually horizontal and normally positioned above the space affected by the windable closure. The windable structure may be a flexible web, as in the case of windable shades, or may be formed by horizontal elements which are articulated to each other, as in the case of roller shutters or rolling gates. The horizontal elements are slats which are also known as laths and which are parallel with and articulated to each other and made from various materials, for example, wood, metal or plastics material. The winding roller can be caused to rotate by means of a motor or manually so as to allow the winding and unwinding of the windable closure. In order to manu-

ally actuate the winding roller, for example, there can be used a belt which is wrapped around a pulley which is mounted at one end of the winding roller and which is coaxial with the longitudinal axis thereof. Alternatively, it is possible to use a crank which is connected to a gear mechanism which controls the winding roller in terms of rotation. In the case of heavy windable closures, such as rolling gates, but also increasingly often for roller shutters in residential buildings, the winding roller is controlled by an electric motor with a manual or automatic control system.

**[0006]** The winding roller normally used in modern shutters is generally a metal tube, which virtually always has an octagonal cross-section and which carries on at least one of the octagonal faces thereof a group of openings, for example, holes, slots and grooves, in which the coupling members of the shutter can be fixed. The position, dimensions and spacing of these openings on the winding roller is generally such as to be compatible with the different coupling members of the different manufacturers of shutters. The thickness of the metal tube may vary so as to provide adequate resistance in accordance with the uses: winding rollers which are subjected to greater loads, for example, for very wide or very long shutters, have a thickness greater than the winding rollers for lower loads, which have a smaller thickness and are therefore more economical.

**[0007]** The coupling members connect the upper end of the windable structure of a windable closure to the actual winding roller. In particular, particularly in the case of modern shutters for residential buildings, the windable structure of which is formed by horizontal slats, the coupling members have, at one end thereof, a shaped profile which forms a groove in which a corresponding profile which is formed in the upper slat of the shutter is engaged. At the other end, opposite the engaging groove of the end slat, some types of modern coupling members are provided with a connection lock which is blocked in the openings provided for this purpose in the winding roller. A coupling member of this known type is described in IT 102022000006995 by the same Applicant.

**[0008]** A number of coupling members of the windable structure with respect to the winding roller are composed of mesh elements which are hinged with respect to each other along an axis parallel with the longitudinal axis of the winding roller. These coupling members are capable of being blocked when the shutter is completely unrolled, thereby ensuring a secure blocking function of the shutter which cannot be lifted from outside. Examples of coupling members for shutters of this type are described, in addition to the publication already cited IT 102022000006995 by the same Applicant, in EP 1728962 and EP 1726771. The type of coupling member described in these last two documents of the prior art comprise a connection lock which is coupled to the winding roller by means of a hook and grooves which are suitably provided in the winding roller. The hook can be inserted in one of the grooves in the winding roller by lowering two flexible metal rods

which are then blocked under two tabs which prevent them from being lifted.

**[0009]** The known coupling members of the type indicated above are complex to produce and are generally expensive. In the installations in which a high level of security is not required, it is known to connect the windable structures of the shutters to the respective winding rollers by means of connection members which are in the form of a flexible tongue made of steel. The flexible tongue has a preferably grooved end, in which there is engaged, as in the case of the connection members indicated above, the upper slat of the shutter. The other end of the flexible tongue has two opposing teeth which project at the sides of the tongue and which are constructed at the end of two corresponding resilient appendixes. The appendixes can be compressed with the fingers, acting counter to the resilience thereof so as to temporarily move the two teeth together, placing one on the other, in order to introduce them inside a horizontal groove which is provided in the winding roller. By releasing the appendixes, they return resiliently into a position in which the two teeth which are moved apart from each other engage against the internal surface of the winding roller, blocking at that location the flexible tongue which thereby connects the shutter to the winding roller.

**[0010]** One of the problems of this known system is the fact that the flexible steel tongues can score the slats, spoiling them, of the shutter with which they come into contact. Besides the evident damage to the appearance of the shutter, this effect may also compromise the resistance of the shutter to atmospheric agents, affecting the surface finishing thereof. Another problem of the known flexible tongues is the need to use a steel with a high elastic limit, that is to say, with a high load yield strength, for example, a harmonic steel, which ensures a high resistance and flexibility of the appendixes with the engaging teeth, and to prevent the plasticization or permanent deformation thereof following the compression thereof for coupling in the slots of the winding roller, which would reduce the security of the coupling and would make it necessary to replace it. Taking account of the fact that for each shutter at least two or three coupling members are necessary, it is evident that the unit cost of these tongues, multiplied by the number of doors and windows to be fitted with the windable closures in a residential building, has a substantial effect on the overall installation cost of the shutters.

### Statement of invention

**[0011]** An object of the present invention is to overcome the disadvantages of the prior art by providing a simple and economical system for connecting the windable structures of shutters and similar windable closures to the respective winding rollers. Another object of the invention is to provide coupling members of the windable structures with respect to winding rollers of the standard type, for example, but not only, octagonal winding rollers

which are provided with openings and slots which are rectangular along the extent thereof. Another object of the invention is to provide coupling members for shutters and the like which are reliable and economical. Another object of the invention is to provide coupling members which are simple to install and replace without any need to remove the shutter from the guides thereof or the winding roller from the housing thereof.

**[0012]** These objects and other objects, together or individually, are achieved by the present invention as defined in the appended claims.

**[0013]** According to a first aspect, a coupling member for a shutter and similar windable closures, which are intended to be wound on a related winding roller, comprises a main body with a coupling end, which is shaped so as to retain an end of a windable closure. The coupling end can be formed so as to be adapted to various types of windable closures, both of the standardized type and specific types of manufacturers of windable closures. The main body of the coupling member further comprises an end which is opposite the coupling end and which comprises a coupling appendix with respect to a winding roller, which is provided to have at least one rectangular coupling opening. The coupling appendix is shaped so as to comprise a coupling head which projects from a stem which is thinner than the coupling head. The coupling head defines at least two opposing teeth, or projections, which are generally wider, considering the spatial requirement from a projecting end of a tooth to the end of an opposite tooth, than the width of the rectangular coupling opening in the winding roller. At the same time, the at least two teeth are narrower, still considering the spatial requirement from a projecting end of a tooth to the end of an opposite tooth, than the height of the rectangular opening in the winding roller. It is thereby possible to secure the member to the winding roller by introducing the teeth in the direction of the height of the rectangular opening and then rotating them substantially through 90° so that they remain blocked inside the rectangular opening.

**[0014]** According to an advantageous aspect, the main body of the coupling member may be elongate and flat so as to be able to readily construct the coupling appendix by forming two opposing teeth with a small thickness.

**[0015]** According to another advantageous aspect, the main body of the coupling member may be constructed so as to be torsionally flexible in a resilient manner so that it is possible to twist it in order to rotate the coupling appendix substantially through 90° with respect to a non-twisted position for coupling the coupling member to the winding roller, bringing it temporarily into a configuration for insertion inside the rectangular opening in the winding roller. The resilience of the main body allows the coupling member to automatically return into the non-twisted configuration.

**[0016]** According to another advantageous aspect, the main body of the coupling member may comprise a longitudinal portion which is formed with two parallel

branches which are separated transversely from each other by a central slot which promotes the resilient torsion of the main body.

**[0017]** According to another advantageous aspect, the main body and the coupling end are made from plastics material. This makes the coupling member much lighter and more economical with respect to the ones of the prior art. Furthermore, the plastics material does not notch or spoil the slats of the shutter when it is wound on the winding roller.

**[0018]** According to another advantageous aspect, the coupling end may be constructed so as to be integral with the main body and is also made from plastics material. This contributes to making the coupling member light and economical, an aspect which is very relevant if it is considered that normally at least two coupling members are necessary for each shutter of a building. The reduction of the unit cost of the coupling members therefore brings about a substantial reduction in the installation cost of all the shutters of a building.

**[0019]** According to an advantageous variant, the coupling end of the coupling member may be made of metal rather than integrally from plastics material like the main body. The coupling end may be part of a metal insert which is fixed to the main body made of plastics material in accordance with various techniques, for example, by injection-moulding or other functionally equivalent systems.

**[0020]** In order to couple a shutter, or similar windable closure, to a winding roller, it is possible to use at least two coupling members of the type indicated above. To this end, there are provided on the winding roller at least two rectangular openings. Each of the at least two coupling members is secured to an upper slat of the shutter or similar windable closure by means of the respective coupling end. The coupling appendix of each coupling member is coupled to the winding roller by securing the respective coupling head in a respective rectangular opening in the winding roller.

**[0021]** A method for coupling a shutter or similar windable closure to a winding roller using a coupling member of the type indicated above may particularly comprise coupling the coupling end of the coupling member to an upper slat of a shutter or similar windable closure. Therefore, it is possible to twist the main body of the coupling member in order to rotate the coupling head substantially through 90° in a given direction. It is thereby possible to insert the coupling head into a rectangular opening in the winding roller. By then releasing the main body of the coupling member, it allows the resilient return thereof into the initial configuration, thereby bringing about a rotation of the coupling head substantially through 90° in the opposite direction so that it is secured inside the rectangular opening in the winding roller.

**[0022]** With the reverse method, it is possible to uncouple the shutter or similar windable closure. In this case, it is possible to carry out the method initially by twisting the main body of the coupling member in order to

rotate the coupling head substantially through 90° in a given direction. Therefore, it is possible to extract the coupling head from the rectangular opening in the winding roller and to thereby release the main body of the coupling member in order to allow the resilient return thereof into the initial configuration, thereby bringing about a rotation of the coupling head substantially through 90° in the opposite direction.

## 10 Brief description of the drawings

**[0023]** Additional features and advantages will be appreciated from the following detailed description of a preferred embodiment with reference to the appended drawings which are given purely by way of non-limiting example and in which:

- Figure 1 is a perspective view of a first example of a coupling member for windable closures incorporating characteristics of the present invention;
- Figures 2 and 3 show two steps of the coupling of the coupling member of Figure 1 with respect to a winding roller of a windable closure;
- Figure 4 is a perspective view of a second example of a coupling member for windable closures incorporating characteristics of the present invention; and
- Figures 5 and 6 show, similarly to Figures 2 and 3, two steps of the coupling of the coupling member of Figure 4 to a winding roller of a windable closure.

## Detailed description

**[0024]** In the exemplary embodiments below, there will be described characteristics which allow the invention to be carried out. The characteristics described can be combined with each other in various manners and are not necessarily limited to the precise embodiment to which the drawings and the relevant description refer. In other words, a person skilled in the art in the sector who reads the following description will know how to obtain the information items which are advantageous in order to know the method for carrying out one or more of the features described by combining it with one or more of the other features described without the particular formulation of the description, paragraphs, phrases or drawings constituting a limitation on the possibility of isolating one or more of the features described and illustrated in order to combine them with one or more of any of the other features described and illustrated. In greater detail, in the present description any combination of any two features which are expressly described must be understood to be expressly described even if the features are extracted individually from the specific context in which they may be beside or combined with other different features, taking account of the competences and knowledge of a person skilled in the art in the sector who understands the possibility of functionally combining the features without it being necessary to functionally apply the other different

features. Unless otherwise specified, each and any element, member, means, system, component, object which is described and illustrated in the present description has to be understood to be individually described and autonomously able to be modified and able to be separated from and/or combined with each and any other element, member, means, system, component, object which is described and illustrated. The materials, forms and functions which are described and illustrated do not limit the present invention but instead are only set out in order to allow a person skilled in the art to understand and carry out the invention according to preferred though non-exclusive embodiments.

**[0025]** Now with reference to Figure 1, a first example of a coupling member 1 for windable closures is illustrated as a perspective view, for example, shutters and the like. The coupling member 1 is used to connect the windable structure of a windable closure, for example, the structure which is formed by the slats of a shutter (not visible in the Figures) to a winding roller 2 (illustrated in Figures 2 and 3). In order to couple a shutter to the winding roller, there are generally used at least two or three coupling members 1 or even more if the shutter is wide or heavy. The coupling members 1 are mounted with spacing from each other so as to distribute the lifting force over the length of the upper slat of the shutter.

**[0026]** The coupling member 1 comprises a main body 3 which is preferably flat and preferably elongate in a longitudinal direction X-X which widens transversely, with great radii 4, in order to define a coupling end 5 for the coupling to a shutter or other windable closure. The coupling end 5 is profiled so as to define a groove 6 with a coupling portion 7 which can retain in known manner the upper slat of a shutter. The form and the structure of the coupling end 5 can vary widely with respect to the one illustrated in Figure 1 in order to be adapted to different types of windable structures. The great radii 4 reduce the concentrations of forces in the transition zone from the body 3 towards the coupling end 5 thereof. The great width of the coupling end 5 allows the traction force which is applied during lifting via the coupling member 1 to be distributed over a greater surface of the upper slat of the shutter.

**[0027]** There is formed along the middle X-X of the body 3 a long slot 8 which involves a majority of the length of the body 3. The slot 8 defines on the main body 3 two branches 9 which are mutually parallel. At the end of the main body 3, opposite the coupling end 5, the two branches 9 join each other in a planar zone 10 which terminates with a coupling appendix 11.

**[0028]** The coupling appendix 11 comprises a short stem 12 which projects from the body 3 and which is aligned with the middle X-X but slightly inclined with respect to the plane of the body 3. The stem 12 terminates with a coupling head 13 which is wider than it is thick. The end 14 of the coupling head 13 is rounded while the coupling head 13 widens to form two teeth 15 at the side adjacent to the stem 12. For reasons which will become

clear below, the overall width of the coupling head 13 in the region of the teeth 15 is approximately double the thickness of the coupling head 13. The dimensions of the coupling head 13 are determined on the basis of the dimensions of rectangular openings, which are generally standardized and which may be located in the winding rollers. For example, in the typical case of rectangular openings of 8 x 5 mm, the width of the coupling head 13 in the region of the teeth 15 is greater than 5 mm and less than 8 mm, therefore, for example, between 7 and 7.5 mm. The thickness of the coupling head 13 in this case is slightly less than 5 mm, for example, between 4 and 4.5 mm. The coupling member is made from a plastics material, for example, nylon or another polyamide. As a result of these dimensions, the coupling head 13 is much more solid than the resilient steel tongues of the coupling members of the prior art.

**[0029]** As can be seen in Figure 2, the coupling member 1 is secured to the winding roller 2 by inserting the coupling head 13 into a rectangular opening 16 which is provided in the winding roller 2. Most of the winding rollers have rectangular openings with standardized dimensions, for example, 4 x 8 mm, with the long side of the rectangular opening being orientated transversely with respect to the axis of the winding roller 2.

**[0030]** In order to insert the coupling head 13 into the rectangular opening 16, the body 3 is twisted through 90°, regardless of whether this is in the clockwise or counter-clockwise direction, in such a manner that the coupling head 13 is present with the teeth 15 substantially aligned with the long side of the rectangular opening 16. The torsion of the body 3 is promoted by the formation thereof with the two branches 9 which are separated by the slot 8. It is thereby possible to insert the coupling head 13 in the rectangular opening 16 on the winding roller 2. Once the coupling head 13 is inside the winding roller 2, the torsion on the body 3 is released in such a manner that it returns resiliently into the non-deformed configuration, as illustrated in Figure 2. In so doing, the coupling head 13 rotates through 90° with respect to the direction in which it was introduced into the opening 16 so that the teeth 15 remain blocked by the short side of the rectangular opening 16. The coupling head 13 is thereby retained inside the winding roller 2 which thereby secures to itself the shutter which is coupled to the other coupling end 5 of the coupling member 1.

**[0031]** Figure 4 illustrates as a perspective view a second example of a coupling member 10 which is similar to the coupling member 1 described above in terms of functionality and formation. Reference numerals identical to those of Figures 1 to 3 identify identical elements in the two exemplary embodiments.

**[0032]** The coupling member 20 also comprises a main body 21 which is also preferably flat and preferably elongate in a longitudinal direction X-X which widens transversely in order to define a coupling end 5, the characteristics of which have already been described above with reference to the coupling member 1. There

is formed along the middle X-X of the body 21 a slot 22 which involves a good portion of the length of the body 3. The slot 22 defines on the main body 21 two branches 23 which are mutually parallel and which join each other in a junction area 24. Two appendices 25 extend in continuation of the branches 23 towards the end of the body 21 in order to define a housing 26, which is U-shaped in the Figure and in which there is fixed a metal insert 27 which is flat and relatively flexible. The connection between the body 21 and the metal insert 27 may be brought about mechanically, by injection-moulding the two elements in such a manner that the plastics material of the body 21 incorporates a portion of the metal insert 27 which can be provided for the purpose with corrugations or openings in the zone which is surrounded by the plastics material of the body 21 so as to promote the fixing of the two elements to each other. The body 21 may be connected to the metal insert 27 with other methods, for example, by means of bonding or with screws, rivets or other means of the type.

**[0033]** At the end opposite the coupling end 5, the metal insert 27 terminates with a coupling appendix 28 which comprises a slot 29 from which a coupling head 30 projects. The end 31 of the coupling head 30 is rounded while at the side adjacent to the slot 29 the coupling head 30 widens substantially in steps to form two teeth 32. Similarly to what has been described above with regard to the coupling head 13, the coupling head 30 also has a total width, in the region of the teeth 32, which is greater than the width of the rectangular openings in the winding roller 2 but less than the height thereof. For example, in the typical case of rectangular openings of 8 x 5 mm in the winding roller 2, the width of the coupling head 30 in the region of the teeth 32 is greater than 5 mm and less than 8 mm, for example, between 7 and 7.5 mm. The thickness of the coupling head 30 is defined by the thickness of the metal insert 27 which in any case is less than the width of the rectangular opening and is typically a couple of millimetres.

**[0034]** The advantage of this coupling member 20 with respect to the solutions of the prior art are the reduced weight and cost in addition to the fact that the reduced metal portion does not come into contact with the shutter, thereby preventing it from becoming spoiled.

**[0035]** As can be seen in Figures 5 and 6, the coupling member 20 is secured to the winding roller 2 substantially in the same manner as described above with reference to the first embodiment of Figures 2 and 3. The coupling head 30 is inserted into the rectangular opening 16 of the winding roller 2 by twisting the body 21 through 90°, irrespective of whether this is in the clockwise or counter-clockwise direction, as illustrated in Figure 5, so that the coupling head 30 is present with the teeth 32 substantially aligned with the long side of the rectangular opening 16. The torsion of the body 21 is promoted by the formation thereof with the two branches 23 separated by the slot 22. It is thereby possible to insert the coupling head 30 into the rectangular opening 16 in the winding

roller 2. Once the coupling head 30 is inside the winding roller 2, the torsion on the body 21 is released so that it returns resiliently into the non-deformed configuration, as illustrated in Figure 6. In so doing, the coupling head 20 rotates through 90° with respect to the direction in which it was introduced into the opening 16 so that the teeth 32 remain blocked by the short side of the rectangular opening 16. The coupling head 30 is thereby retained inside the winding roller 2 which thereby secures to itself the shutter which is coupled to the other coupling end 5 of the coupling member 20.

**[0036]** Naturally, the principle of the invention remaining the same, the forms of embodiment and details of construction may be varied widely with respect to those described and illustrated, without thereby departing from the scope of the present invention.

## Claims

1. A coupling member for a shutter and similar windable closures which are windable onto a related winding roller, comprises a main body with a coupling end, which is suitable for retaining an end of a windable closure, and an opposing end which comprises a coupling appendix for coupling to a winding roller provided with at least one rectangular coupling opening, wherein the coupling appendix comprises a coupling head which projects from a stem which is thinner than the coupling head which defines two opposing teeth, which are generally wider than the width of the rectangular coupling opening in the winding roller and narrower than the height of the rectangular opening in the winding roller.
2. A coupling member according to claim 1, wherein the main body is elongate and flat.
3. A coupling member according to claim 1 or claim 2, wherein the main body of the coupling member is torsionally flexible in a resilient manner so that it is possible to twist it in order to rotate the coupling appendix substantially through 90° with respect to a non-twisted position for coupling the coupling member to the winding roller.
4. A coupling member according to any one of the preceding claims, wherein the main body comprises a longitudinal portion which is formed with two parallel branches which are separated from each other by a central slot which promotes the resilient torsion of the main body.
5. A coupling member according to any one of the preceding claims, wherein the main body and the coupling end are made from plastics material.
6. A coupling member according to claim 5, wherein the

coupling end is integral with the main body and is also made from plastics material.

7. A coupling member according to claim 5, wherein the coupling end is made of metal and is part of a metal insert which is fixed to the main body made of plastics material. 5
  
8. Use of at least two coupling members according to any one of the preceding claims to couple a shutter or similar windable closure to a winding roller, in which there are provided at least two rectangular openings, in which each of the at least two coupling members is secured to an upper slat of the shutter or similar windable closure by means of the respective coupling end, the coupling appendix of each coupling member being coupled to the winding roller by securing the respective coupling head in a respective rectangular opening in the winding roller. 10  
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9. A method for coupling a shutter or similar windable closure to a winding roller using a coupling member according to any one of claims 1 to 7, comprising the steps of: 25
  - coupling the coupling end of the coupling member to an upper slat of a shutter or similar windable closure;
  - twisting the main body of the coupling member in order to rotate the coupling head substantially through 90° in a given direction; 30
  - inserting the coupling head into a rectangular opening in the winding roller;
  - releasing the main body of the coupling member in order to allow the resilient return thereof into the initial configuration, thereby bringing about a rotation of the coupling head substantially through 90° in the opposite direction so that it is secured inside the rectangular opening in the winding roller. 35  
40
  
10. A method for uncoupling a shutter or similar windable closure from a winding roller after it has been coupled thereto by means of the method of claim 8, comprising the steps of: 45
  - twisting the main body of the coupling member in order to rotate the coupling head substantially through 90° in a given direction;
  - extracting the coupling head from the rectangular opening in the winding roller; 50
  - releasing the main body of the coupling member in order to allow the resilient return thereof into the initial configuration, thereby bringing about a rotation of the coupling head substantially through 90° in the opposite direction. 55

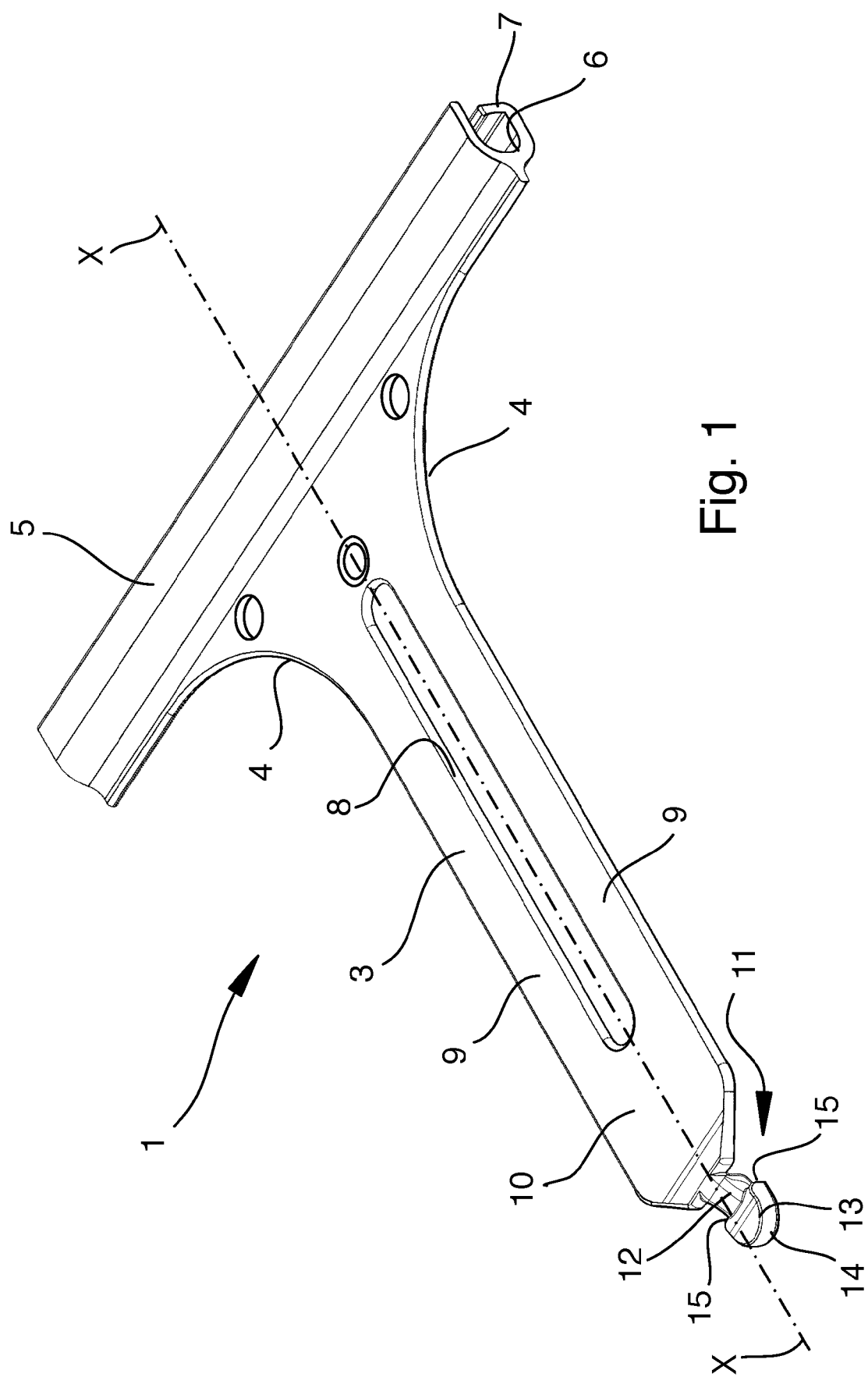
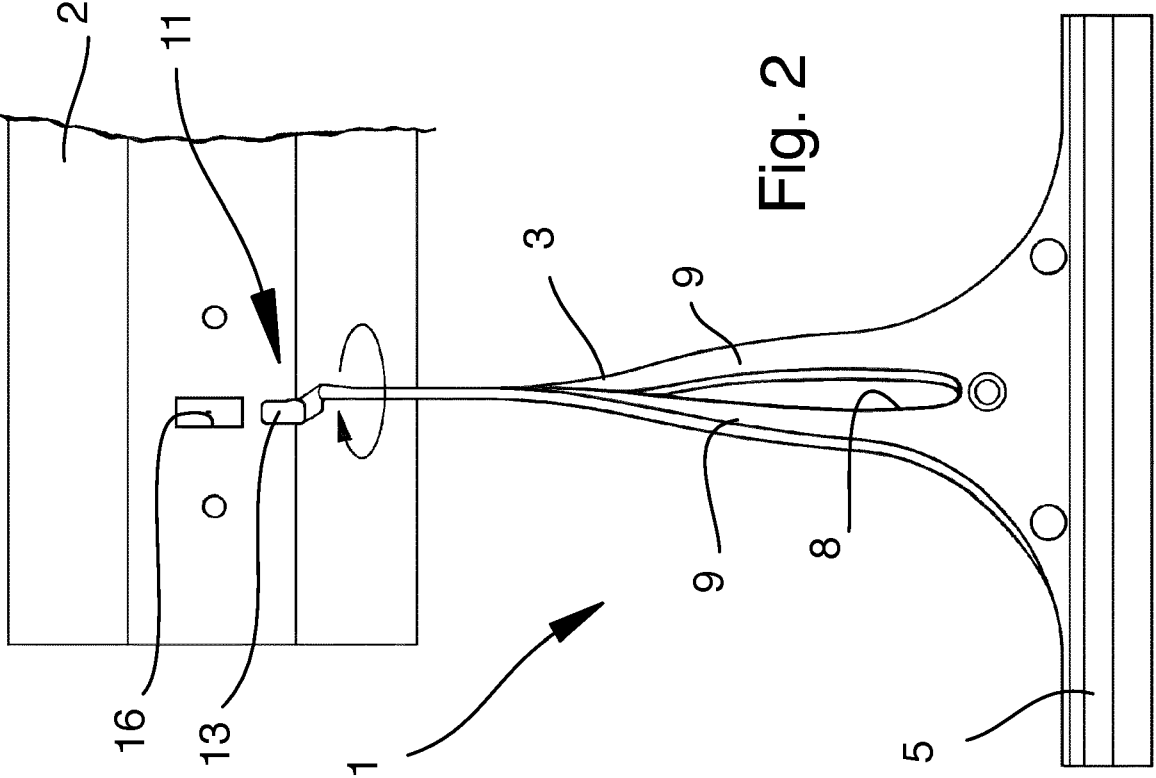
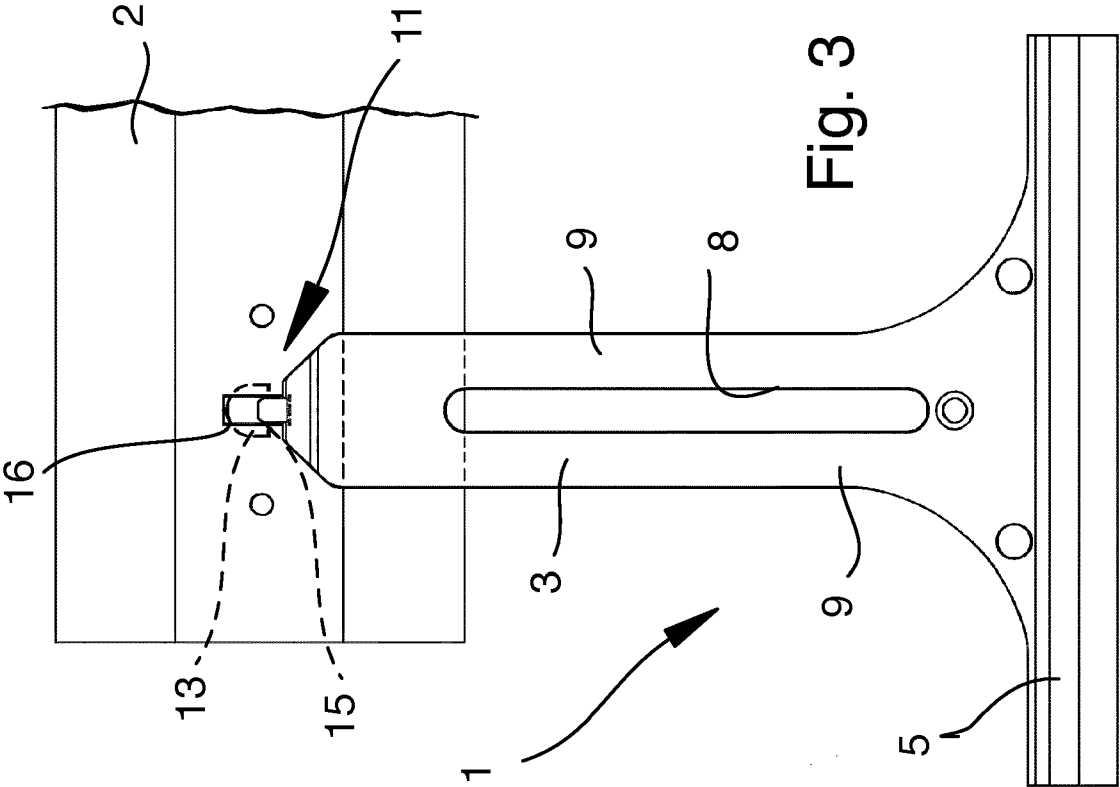


Fig. 1



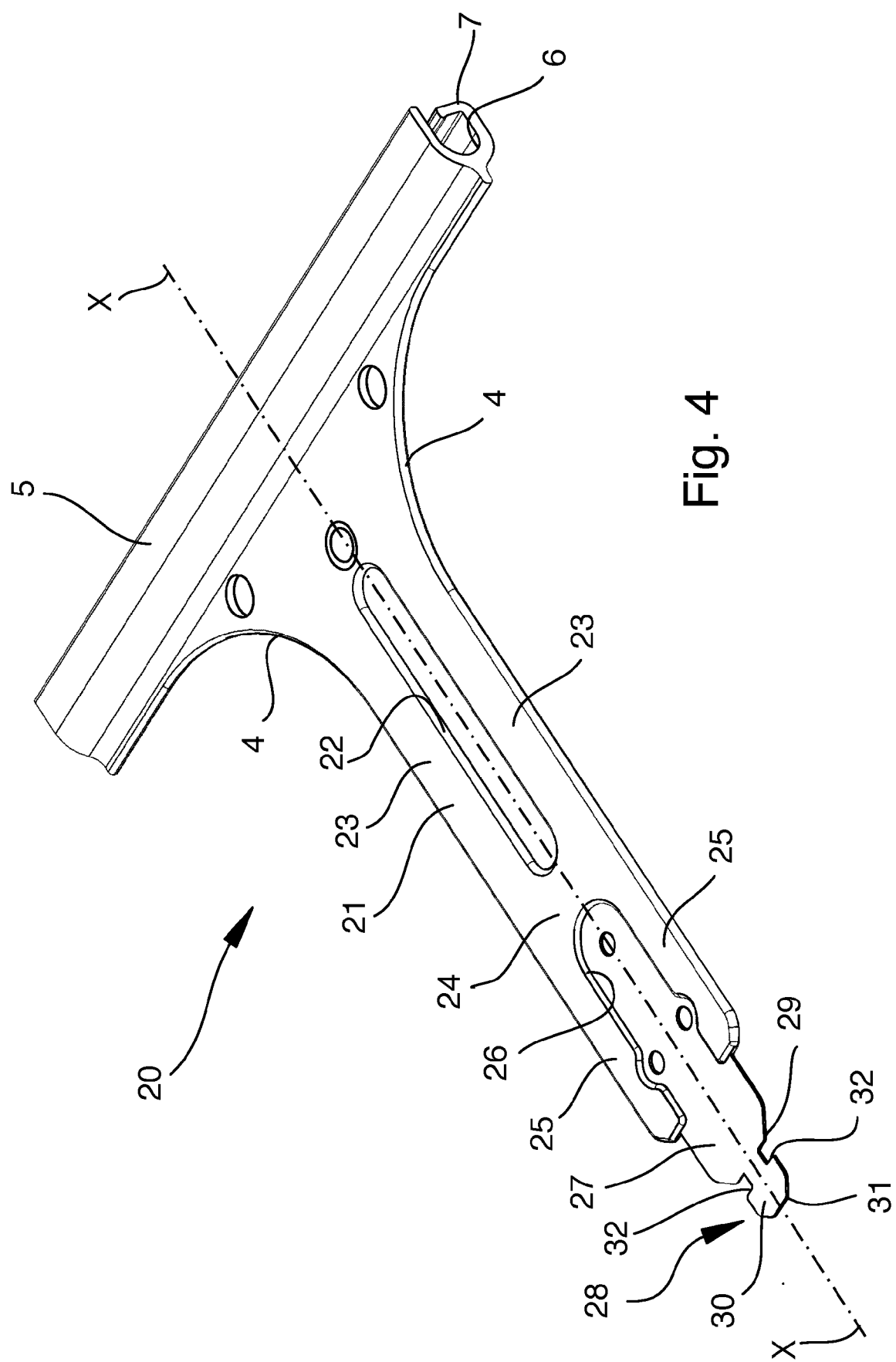
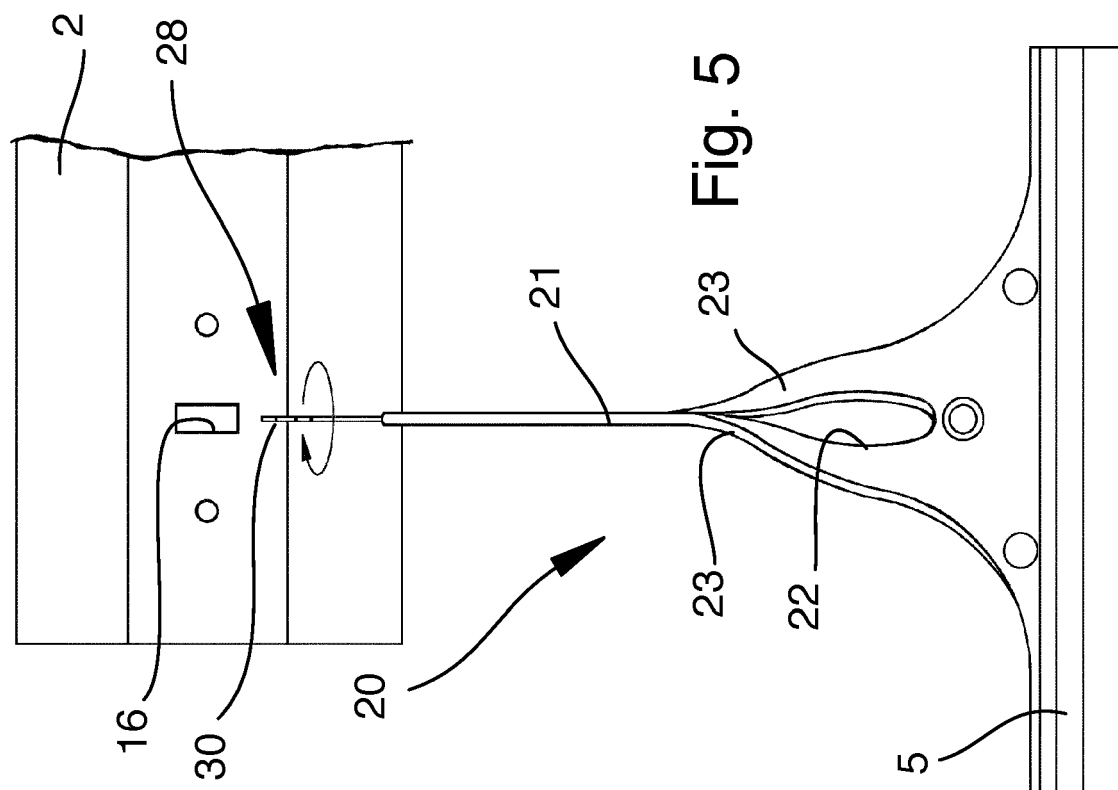
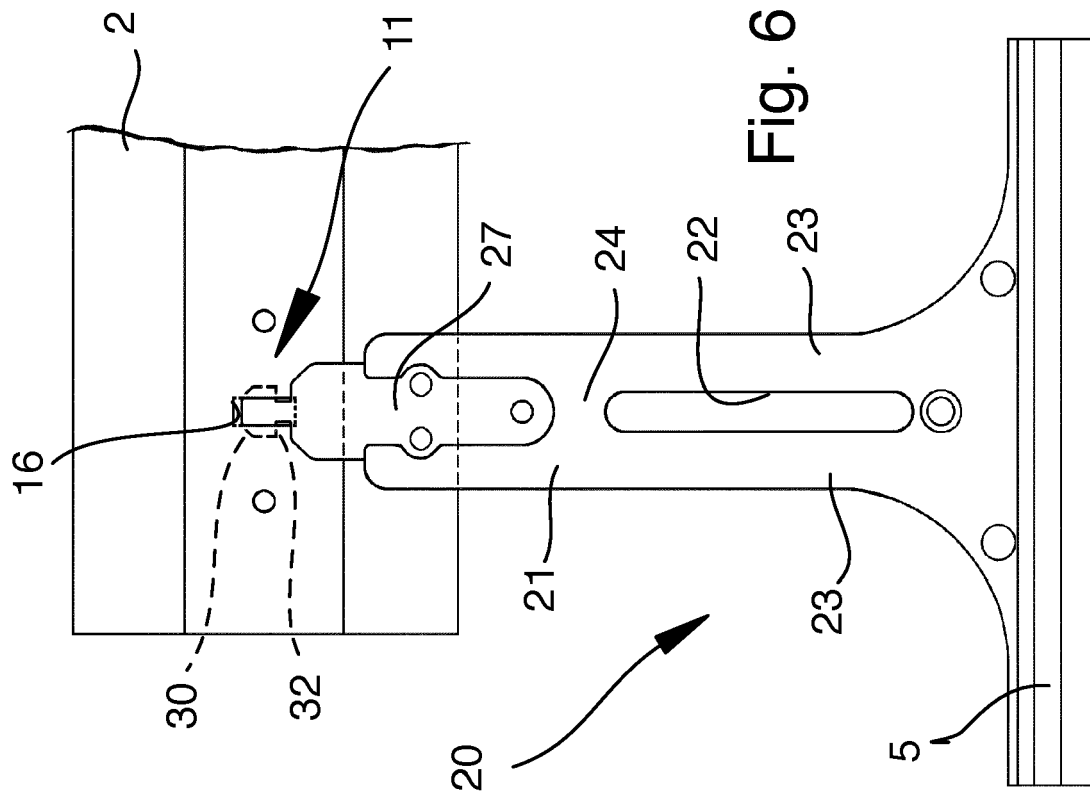


Fig. 4





## EUROPEAN SEARCH REPORT

Application Number

EP 23 20 3116

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category                                                                                                                                                                                                                                                                              | Citation of document with indication, where appropriate, of relevant passages                                                               | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (IPC) |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------|
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