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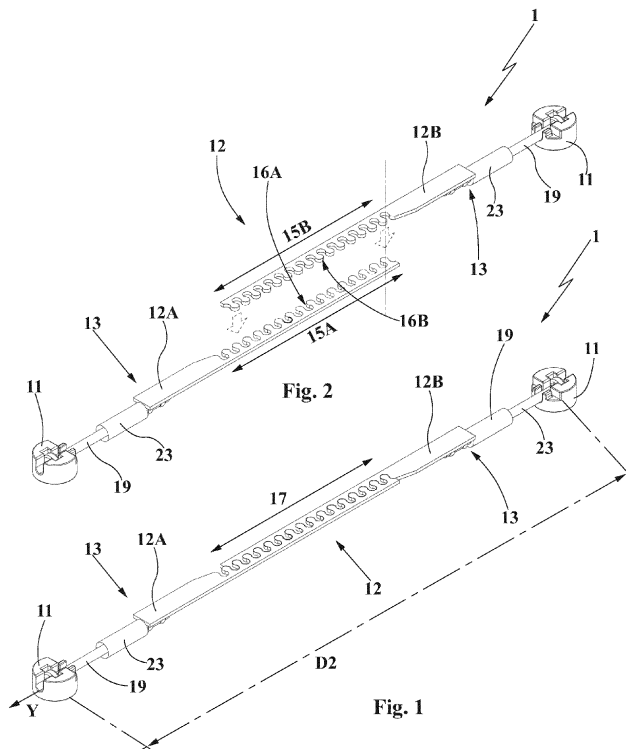
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(54) **TIE ROD AND METHOD FOR MOUNTING THE SAME**

(57) Tie rod for straightening a door/panel/shutter which comprises: two engagement bodies (11) intended to be mechanically embedded in the thickness (S) of the door/panel/shutter in a non-centered manner with respect to a middle longitudinal plane (P) thereof, at two lateral edges (9, 10); and a rod (12) connected at the ends (13) to the two engagement bodies (11). Screw / nut screw means (19) are then provided for adjusting the length of the rod (12) subtended between the two en-

gagement bodies (11). The rod (12) consists of a first and a second segment (12A, 12B) provided, for corresponding sections (15A, 15B) of their axial extension, with respective first and second shaped profiles (16A, 16B), which are mechanically couplable with each other with shape coupling for a variable shared section (17) in order to adjust the overall axial length of the rod (12) as a function of the height of the door/panel/shutter (2).



## Description

### Field of application

**[0001]** The present invention refers to a tie rod for straightening a door/panel/shutter and to a method for mounting said tie rod on a door/panel/shutter, according to the preamble of the respective main independent claims.

**[0002]** The present tie rod is intended to be employed in the field of production of doors/windows and in particular of production of wooden doors and similar materials (such as hollow-core panels or multilayer sandwich of different materials) or even in the field of interior decoration for producing doors/panels/shutters of furniture pieces, for the purpose of flattening the profile of the doors/panels/shutters if it no longer has the condition of planarity, given that it has been warped in an aesthetically and/or functionally undesired manner.

**[0003]** The tie rod, according to the present invention, is susceptible of being employed with doors/panels/shutters of any type, both slidable and shutter, and of any size in order to correct undesired deformations; in particular, it is advantageously intended to be mounted on large-size doors/panels/shutters i.e. on doors/panels/shutters produced with materials and production processes that are inexpensive or in any case unsuitable for ensuring the non-deformability thereof over time.

**[0004]** The tie rod, object of the present invention, is therefore generally inserted in the industrial field of production of doors/windows and in the field of production of interior decoration articles, i.e. also in the field of production of metal accessories for doors or furniture pieces.

### State of the art

**[0005]** As is known, in the field of production of doors/windows or of furniture pieces, the doors/panels/shutters can be warped or deformed over time, assuming a concave form on an internal or external face of the door/panel/shutter; for example a door can assume a convexity towards the interior of a room or towards the outside thereof.

**[0006]** Such deformation, in addition to being aesthetically unacceptable, may compromise the perfect functionality of the door/panel/shutter, for example preventing a perfect closure or a perfect sealing on a provided seal of the fixed frame.

**[0007]** Generally, in the case of hinged doors/panels/shutters, the deformation mainly takes place at the free edge opposite that constrained, at which the hinges are associated for connection to the door frame or to the upright of the door/panel/shutter of the furniture piece, since the hinges oblige at least a partial alignment with such constrained edge.

**[0008]** The causes of such deformation are first of all ascribable to the production process of the door/panel/shutter and to the tensions that start in particular fol-

lowing the gluing steps, especially if attained with hot pressing and/or with quick production cycles.

**[0009]** As is known, for example, the doors for interiors are generally constituted by a hollow-core panel or by a sandwich composed of: two more external panels, e.g. made of chipboard, MDF or plywood, by a perimeter frame, e.g. made of solid wood (e.g. fir, but otherwise also of derivative wood-based materials such as chip) and by a light honeycomb-shaped structure which is inserted within the frame, e.g. made of cardboard, as spacer of the two external reinforcement panels of the door. The two external panels are usually glued on the frame with cold or hot pressing.

**[0010]** The sandwich thus made is a raw manufactured product which is then covered with very thin wood sheets or with laminated sheets for making doors of wood or laminate. Otherwise, the sandwich is directly painted in the various finishes in order to make, for example, lacquered doors.

**[0011]** The gluing of the panels to the frame, especially if made with hot pressing, can involve the generation of internal pressures between the different glued fibers, which over time lead to the warping of the door/panel/shutter.

**[0012]** A further cause of deformation of the door/panel/shutter can be traced to the presence of temperature and/or humidity differences existing between the two sides of the door/panel/shutter. For example, in the case of an internal door of a home, the internal face of the door directed for example towards a room can be subjected to environmental conditions different from that of the external face directed for example towards a hallway or kitchen.

**[0013]** Such different environmental conditions can involve a different response of the two faces of the door/panel/shutter, thus with the generation of the above-described undesired deformation.

**[0014]** The aforesaid deformation is also encountered quite often in the case of large-size doors/panels/shutters, in which a small angle of the panel can lead to a large-size deformation at the center of the door/panel/shutter. Deformations are more easily encountered also in the case of inexpensive products, i.e. in the case of use of light materials with low mechanical strength, as in the case of wood seasoned poorly or for a short time period.

**[0015]** In order to overcome this drawback, tie rods for straightening the doors/panels/shutters are widespread on the market; such tie rods are associated in a non-centered manner with respect to the middle plane or with an internal face or with an external face of the door/panel/shutter and in a visible position or embedded within the thickness of the door/panel/shutter.

**[0016]** Such tie rods consist of a rod which is associated at the ends with two bodies for engaging the panel of the door/panel/shutter. By acting on a screw/nut screw mechanism interposed on the rod or associated with the connection between rod and engagement bodies, it is

thus possible to force - by moving apart or approaching - the two engagement bodies so as to move apart or approach the upper and lower ends of the door/panel/shutter and consequently act on the position of the plane with which the tie rod is associated, respectively

**[0017]** More in detail, in accordance with a first embodiment of known type, the tie rod comprises a rod composed of two segments, each associated at a first end with an intermediate screw / nut screw mechanism and at the other second end with a respective engagement body embedded in a seat of the panel of the door/panel/shutter. Each segment is axially engaged with the respective engagement body and is free to rotate with respect to its axial extension axis. At least one rod segment continues beyond the engagement body, being accessible with its second free end at the upper and/or lower thickness of the door/panel/shutter for an easy adjustment. Such second end has for such purpose an impression for receiving a tool such as a wrench or Allen wrench or a screwdriver with which it is possible to rotate the rod segment and consequently determine the screwing or unscrewing of its first end with respect to the screw / nut screw mechanism. In this manner, the length of the rod subtended between the two engagement bodies is thus varied, and such bodies consequently exert a thrust or draw action on the two upper and lower ends of the door/panel/shutter, allowing a return to planarity thereof.

**[0018]** In accordance with a second embodiment of known type, the tie rod comprises a rod made of a single body, which terminates at the two ends with nut screws, each adjustably engaged by screws whose head is rotatably housed in a seat made of a corresponding engagement body integral with the panel of the door/panel/shutter. The heads of the screws are accessible by a milling made in the upper or lower thickness of the door/panel/shutter.

**[0019]** In this manner, by rotating the head of the screw with a suitable tool, it is possible to push or pull the two engagement bodies through the rod, such bodies approaching or moving away from each other.

**[0020]** Finally, in accordance with a third embodiment, generally employed in association with doors/panels/shutters of furniture pieces, the tie rod comprises two engagement bodies embedded in seats made on an internal face, not visible, of the door/panel/shutter and joined together by a rod which runs on the surface of the of the door/panel/shutter and is divided into two segments by a screw / nut screw mechanism. The latter comprises a bush, which is engaged at its two ends to the threaded ends of the two rod segments and is externally accessible with a wrench in order to be rotated so as to pull or push the two engagement bodies close to or away from each other.

**[0021]** The tie rods per doors/panels/shutters of known type described briefly above have in practice shown that they do not lack drawbacks.

**[0022]** A considerable drawback derives from the fact

that the doors/panels/shutters, for example the doors/panels/shutters for the interior doors, are available on the market in various models with different sizes, i.e. with length that generally can vary between about 2 meters and about 3 meters. Therefore, such different sizes of doors require tie rods with height corresponding to the door model.

**[0023]** Such circumstance involves the drawback of increasing the production costs and the storage costs.

**[0024]** It is known to modify the tie rods by cutting to size - to the desired length - the rods which join the engagement bodies, in order to adapt them to the specific door size. Nevertheless, such circumstance involves difficult operations of measuring and cutting the rod as a function of the length of the door/panel/shutter and depending on the screw/nut screw mechanism it may be necessary to modify the terminals of the rod so that it can be associated with the engagement bodies.

#### Presentation of the invention

**[0025]** Therefore, in this situation, the problem underlying the present invention is to overcome the drawbacks of the abovementioned prior art, by providing a tie rod for straightening a door/panel/shutter which is easily adaptable to the different sizes of doors/panels/shutters existing on the market, without requiring complex adaptation operations.

**[0026]** A further object of the present invention is to provide a tie rod for straightening a door/panel/shutter, which is simple and inexpensive to attain.

**[0027]** A further object of the present invention is to provide a method for mounting a tie rod on a door/panel/shutter which does not require complex and costly adaptations in order to be mounted on doors/panels/shutters of different size.

**[0028]** A further object of the present invention is to provide a tie rod for straightening a door/panel/shutter and a method for the mounting thereof, which are safe and entirely reliable in operation.

#### Brief description of the drawings

**[0029]** The technical characteristics of the invention, according to the aforesaid objects, can be clearly seen in the contents of the enclosed claims and the advantages thereof will be more evident in the following detailed description, made with reference to the enclosed drawings which represent several merely exemplifying and non-limiting embodiments of the invention, in which:

- Figure 1 shows a first perspective view of a tie rod for straightening a door/panel/shutter, object of the present invention;
- Figure 2 shows the tie rod for straightening a door/panel/shutter represent in figure 1 with two rod segments thereof illustrated separated from each other;

- Figure 3 shows a detail of the tie rod of figure 1, object of the present invention, in a perspective view and relative to a first end thereof with the following represented: a rod portion, a threaded bush, an engagement body and an adjustment screw;
- Figure 4 shows the detail of the tie rod of figure 3 with the single components illustrated separate from each other;
- Figure 5 shows the panel of a door/panel/shutter with a layer removed in order to display two tie rods according to the invention inserted in millings of the frame of the panel of the door/panel/shutter;
- Figure 6 shows the panel of a door/panel/shutter with a layer removed in order to display two tie rods according to the invention inserted in millings of the frame of the panel of the door/panel/shutter and illustrated with increased size in order to better appreciate the different components;
- Figures 7 and 8 show two actuation operations of the tie rod in order to flatten the panel of the door/panel/shutter, respectively through an action of approaching and an action of moving-apart provided engagement bodies of the tie rod;
- Figures 9, 10, 11 and 12 show a sequence of four steps of a method according to the invention for mounting a tie rod on a door/panel/shutter.

#### Detailed description

**[0030]** With reference to the enclosed drawings, reference number 1 overall indicates a tie rod for straightening a door/panel/shutter, object of the present invention.

**[0031]** The tie rod 1 according to the invention is intended to be employed for bringing back to planarity the panels of doors/panels/shutters of doors or furniture pieces which - due to environmental or production causes - may have lost the perfect planarity of their position after their production or even after years.

**[0032]** Hereinbelow, reference will mainly be made to the preferred application of the present invention, i.e. in association with a door/panel/shutter 2 of a door, whether it is of slidable or hinged type, it being intended however that the tie rod according to the invention can be applied on doors/panels/shutters and walls of different type such as of cupboards/cabinets, partitions etc.

**[0033]** The tie rod 1 according to the present invention is therefore generally susceptible of being employed with doors/panels/shutters of any type, whether slidable or hinged, in order to correct undesired deformations and in particular it is advantageously intended to be mounted on large-size doors/panels/shutters or on doors/panels/shutters produced with materials and production processes unsuitable for ensuring the non-deformability over time, as can occur for example in the case of hollow-core panels for doors obtained with multilayer sandwich of different materials.

**[0034]** The door/panel/shutter of a door 2 (but sometimes also of a furniture piece) generally comprises a

panel 3, for example constituted by a multilayer sandwich, which defines an internal face 4 and an external face 5, that are parallel to each other and separated by a thickness S which delimits an upper edge 7, a lower edge 8 as well as two lateral edges 9, 10, including a first constrained edge 9 connected to the frame of the door/panel/shutter (or to the upright of the furniture piece) by means of hinges, and a second free edge 10, which is parallel to and opposite the first constrained edge 9 (see figure 12).

**[0035]** The panel 3 is substantially extended in a mirrored manner with respect to a middle longitudinal plane P with its two flat and parallel faces equidistant from such plane (in figure 12 the plane P is indicated with a dash/dot line and its projection on the thickness S of the panel is indicated with a dotted line).

**[0036]** The tie rod 1 also comprises, in a *per se* known manner, at least two engagement bodies 11, intended to be mechanically embedded in the panel 3 of the door/panel/shutter 2 in a non-centered manner with respect to the middle plane P of the same panel 3, i.e. arranged closer to one of the two internal or external faces of the door/panel/shutter 2.

**[0037]** In addition, two tie rods 1 are usually provided for each door/panel/shutter arranged at its two lateral edges 9 and 10.

**[0038]** The tie rod 1 also has at least one rod 12, provided with a main extension that is substantially axial Y, which is axially mechanically connected at its first ends 13 to the two engagement bodies 11.

**[0039]** Screw / nut screw means 14 are then provided for lengthening and shortening the length of the rod 12 subtended between the two engagement bodies 11, in order to adjust the tension of the tie rod and consequently straighten the door/panel/shutter.

**[0040]** According to the idea underlying the present invention, the rod 12 comprises at least one first and one second rod segment 12A, 12B, which are provided, for the length of corresponding first and second sections 15A, 15B of their axial extension, with respective first and second shaped profiles 16A, 16B, which are mechanically couplable with each other with shape coupling for a variable shared section 17.

**[0041]** Then, by varying the length of the shared section 17 which couples the shaped profiles 16A and 16B of the two rods 12, it is easily possible to adjust the overall axial length of the entire rod 12.

**[0042]** This allows making rod segments 12A, 12B equivalent to each other (for example about 1.30-1.50 m), which can then be differently connected to each other in order to obtain tie rods susceptible of being employed for all door sizes.

**[0043]** This particular technical feature is extremely advantageous, allowing the production of a single component, i.e. of a single rod segment still capable of satisfying the different application requirements of the clientele, and consequently also allowing storing only such component since in fact the two rod segments are advantageously

fully identical to each other. Consequently, the tie rod, object of the present invention, allows a considerable reduction of the production and storage management costs of its components.

**[0044]** More clearly, by coupling the two segments together, for example arranging a very short shared section, a tie rod is obtained that is very long for very high doors, for example up to 3 meters; by coupling two tie rods, arranging a very long shared section, a tie rod is thus obtained that is very short for very low doors, for example with 2 meters height.

**[0045]** After having associated the tie rod 1 with the panel of the door/panel/shutter 2, in a manner *per se* known as better specified hereinbelow, it will be possible to actuate the screw / nut screw means 14 for adjusting the length of the rod 12 subtended between the two engagement bodies 11 and hence cause a moving-apart thrust action between the engagement bodies 11, aimed to eliminate a concavity on the face of the panel 3 carrying the engagement bodies 11 associated therewith, or for determining an approaching pull action of the engagement bodies 11, aimed to eliminating a convexity on the face of the panel 3 carrying the engagement bodies 11 associated therewith.

**[0046]** The first and the second shaped profiles 16A, 16B advantageously alternate the shape of a male element 16' with the shape of a female seat 16", along the axial extension Y of their respective first and second sections 15A, 15B.

**[0047]** The male elements 16' of the two shaped profiles 16A, 16B are inserted in the female seats 16" of the other facing shaped profile 16A, 16B in order to render the two segments 12A, 12B of rod 12 (see figures 1 and 2) axially integral.

**[0048]** For example, the pitch R between the male elements 16' or between the female seats 16" can be 10 mm such that the length of the rod can vary at intervals of 10 mm and be able to form, with two rod segments 12A, 12B of about a meter and a half each, tie rods for doors with height comprised between 2 meters and 3 meters.

**[0049]** The form of the shaped profiles 16A, 16B - i.e. of the male elements 16' and of the female seats 16" - can be quite varied, able to provide for sawtooth or lobe solutions as in the case illustrated in the enclosed figures.

**[0050]** In accordance with a preferred embodiment of the present invention, the two shaped profiles 16A, 16B define, in the shared section 17 in which they are coupled, a cross section which is substantially unchanged with respect to that of the parts of rod segments 12A, 12B in which the shaped profiles 16A, 16B are not present.

**[0051]** In this manner, the provided milling made in the panel 3 (described hereinbelow), which serves to maintain - assembled and guided - the two rod segments 12A, 12B with the shaped profiles 16A, 16B coupled together for the shared section 17, can be made with regular shape for the entire distance that separates the seats in the panel of the door/panel/shutter for the two engagement

bodies 11.

**[0052]** Advantageously, for this purpose, the rod segments 12A, 12B have the form of elongated plates with the sections bearing the first and the second profile 16A, 16B with reduced width. In this manner, such elongated plates of the two rod segments 12A, 12B define in the shared section 17, in which the two shaped profiles 16A, 16B are coupled, substantially the same cross section that the elongated plates of the rod segments 12A, 12B define in the sections lacking the corresponding shaped profile 16A, 16B.

**[0053]** Consequently, the lateral edges of the rod 12 are substantially parallel for their entire axial extension such that the milling on the panel is correspondingly constituted by a groove with width and depth equal to the width and thickness of the rod 12.

**[0054]** In this manner, the first and the second shaped profile 16A, 16B of the rod segments 12A, 12B are susceptible of being retained coupled with their shared section 17 which actually constrains them, within the groove obtained flush on the panel 3 of the door/panel/shutter 2.

**[0055]** The screw / nut screw means 14, mentioned above, comprise at least one screw 19 (see figures 3 and 4) provided with a shank 19', engaged in a nut screw 20 constrained to at least one first end 13 of a rod segment 12A, 12B, and with a head 19" rotatably housed in a seat 21 made in a corresponding engagement body 11.

**[0056]** Advantageously the engagement bodies 11 are obtained in a pressure die-cast body made of zamak with the seat 21 for the head 19" of the screw which is continued with a neck 22. Within the latter, the initial part of the shank 19' of the screw 19 is housed. Preferably, the body made of zamak of the engagement body 11 also comprises a semi-annular seat 22' side-by-side the seat 21 in order to support the shank of the screw 19 in a rotatable and axially centered manner.

**[0057]** In accordance with the preferred embodiment of the present invention, the screw/nut screw means 14 also comprise a bush 23, which is fixed to the first end 13 of the rod segment 12A, 12B and bears, obtained at a termination axially directed towards the engagement body 11, the aforesaid nut screw 20.

**[0058]** The bush 23 is advantageously made of metal and is fixed for example by means of a weld to the first end 13 of the relative segment 12A, 12B of rod 12 with the axis of the bush 23, i.e. the axis of the nut screw 20, parallel to the axial extension Y of the rod 12.

**[0059]** The milling 32 on the panel is extended up to reaching the upper and/or lower edge 7, 8 of the panel 3 of the door/panel/shutter 2 in order to allow the access with a tool U to the head 19" of the screw 19 and hence to be able to rotate and thus cause the tightening of the panel 3, bringing it back to planarity if an undesired deformation thereof has occurred.

**[0060]** Also forming the object of the present invention is a method for mounting the above-described tie rod on a door/panel/shutter 2, regarding which the same nomenclature introduced up to now will be maintained herein-

below for the sake of description simplicity.

**[0061]** The method provides for an initial step of arranging a panel 3 of a door/panel/shutter 2 composed of a sandwich formed by at least two external parallel laminar layers 30 (e.g. made of MDF) with a perimeter frame 31 (e.g. made of solid wood, such as fir) interposed therebetween.

**[0062]** Within the frame 31, a honeycomb-like filler material 35 could for example be inserted, which is very light and susceptible of giving structure to the door/panel/shutter 2.

**[0063]** Initially, at least one of the two external laminar layers 30 is separated from the remaining sandwich structure part of the panel 3, i.e. it is separated from the frame 31.

**[0064]** More in detail, the perimeter frame 31 of the panel 3 is provided with two parallel uprights 31A and with two parallel crosspieces 31B which are joined to the uprights at the respective ends in order to form the frame 31 in the shape of a quadrangular frame, in particular rectangular frame.

**[0065]** On the faces directed towards the outside of the two lateral uprights 31A, two corresponding shaped millings 32 (see figure 9) are made, which have, in vicinity to the upper and lower ends of the uprights 31A (i.e. in vicinity to the upper and lower edges 7, 8 of the panels 30), two seats 33 for housing the engagement bodies 11. Such seats 33 are separated from each other by a first distance D1 (figure 9) and are connected together by a groove 34 that continues beyond at least one of the two seats 33 (and preferably beyond both seats 33) up to a corresponding upper or lower edge 7, 8 of the panel 3, in order to render the seat 33 of the engagement body 11 accessible from the edge of the same panel 3 (hence through a terminal milling) for example by means of a screwdriver, a wrench or another tool. The groove can have different depths in order to house the flat sections of the rod segments 12A, 12B and the sections at the first ends 13 in which the bushes 23 are fixed below.

**[0066]** At this point, it is possible to couple together the two segments 12A, 12B of rod, adjusting the length of the shared section 17 of the shaped profiles 16A, 16B, in a manner such to space the engagement bodies 11 by a second distance D2 equal to the first distance D1 between the seats 33 on the frame 31 of the panel 3 of the door/panel/shutter 2.

**[0067]** Subsequently, the tie rod 1 thus assembled is inserted in the milling 32 with the rod 12 composed of the two coupled segments 12A, 12B (and of the two bushes) which is flush-inserted in the groove 34 of the frame 31 of the panel 3 and with the engagement bodies 11, axially mechanically connected to the first ends 13 of the rod 12, which are flush-inserted in the seats 33 of the milling 32 of the frame 21.

**[0068]** It is therefore possible to fix the laminar layer 30, which was separated from the panel 3, to the frame 31 in order to thus form the sandwich and close the milling 32 with the tie rod 1 therein and in particular with the rod

12 guided and closed within the groove 34.

**[0069]** As indicated in the enclosed figures, two tie rods 1 are provided for each door/panel/shutter 2; nevertheless, even only one tie rod could be employed, or more than two tie rods could be employed, such as three tie rods, including two placed at the lateral edges 9, 10 of the door/panel/shutter 2 and one placed at the center of the door/panel/shutter 2.

**[0070]** The finding thus conceived therefore attains the pre-established objects.

## Claims

1. Tie rod (1) for straightening a door/panel/shutter comprising:
  - at least two engagement bodies (11), intended to be mechanically embedded in a panel (30) in a non-centered manner with respect to a middle longitudinal plane (P) of said panel (30);
  - at least one rod (12), provided with a substantially axial extension (Y), which is axially mechanically connected at its first ends (13) to said two engagement bodies (11);
  - screw / nut screw means (19) for adjusting the length of the rod (12) subtended between said two engagement bodies (11);

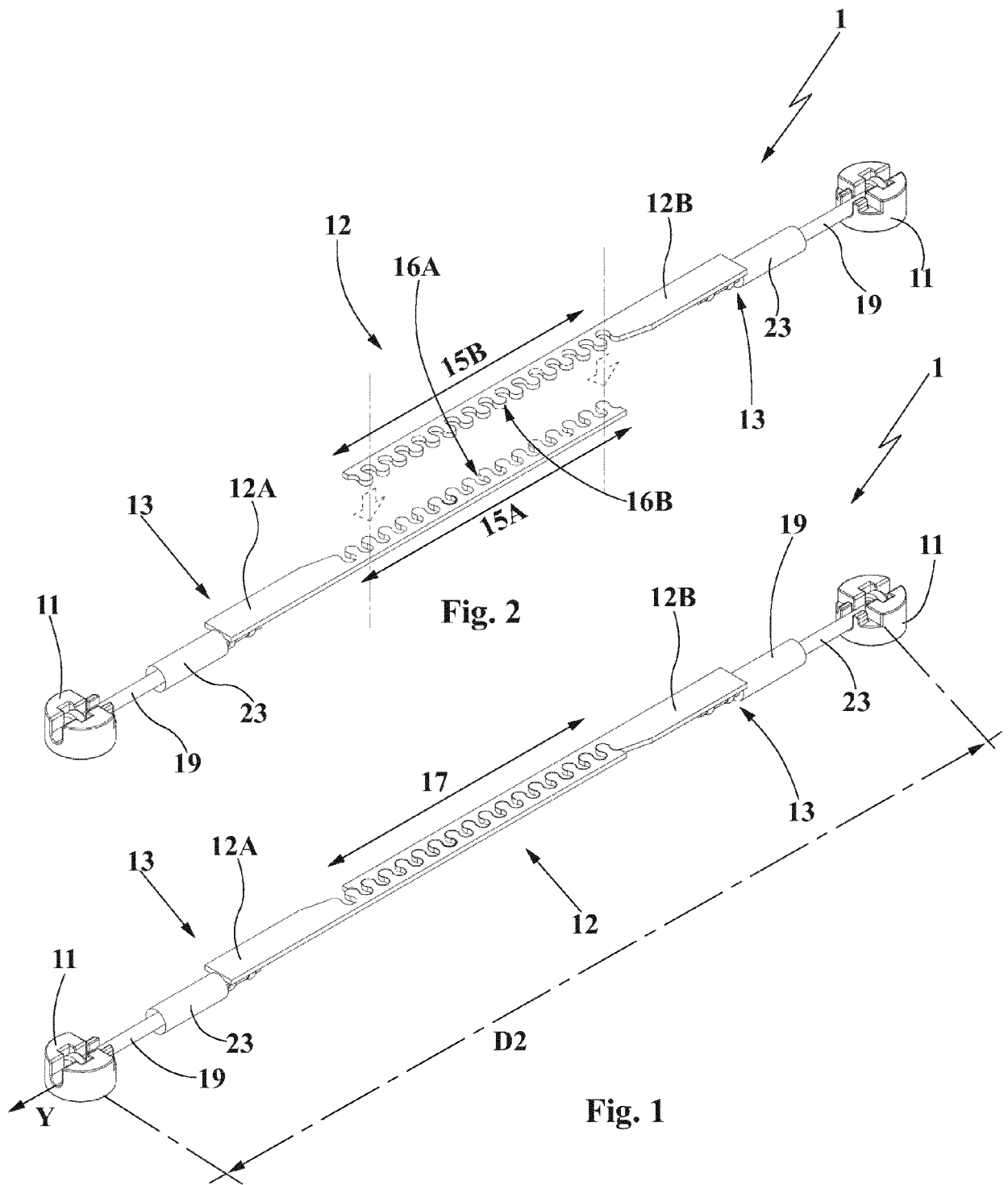
**characterized in that** said rod (12) comprises at least one first and one second rod segment (12A, 12B) provided, for corresponding first and second sections (15A, 15B) of their axial extension, with respective first and second shaped profiles (16A, 16B), which are mechanically couplable with each other with shape coupling for a variable shared section (17), in order to adjust the overall axial length of said rod (12).
2. Tie rod (1) for straightening a door/panel/shutter according to claim 1, **characterized in that** said first and second shaped profiles (16A, 16B) alternate the shape of a male element (16') with the shape of a female seat (16'') along the axial extension (Y) of their respective first and second section (15A, 15B).
3. Tie rod (1) for straightening a door/panel/shutter according to any one of the preceding claims, **characterized in that** said first and second shaped profiles (16A, 16B) define, in the shared section (17) in which they are coupled, substantially the same cross section as the rod segments (12A, 12B) of the sections lacking said first and second shaped profile (16A, 16B).
4. Tie rod (1) for straightening a door/panel/shutter according to any one of the preceding claims, **characterized in that** said rod segments (12A, 12B) are in

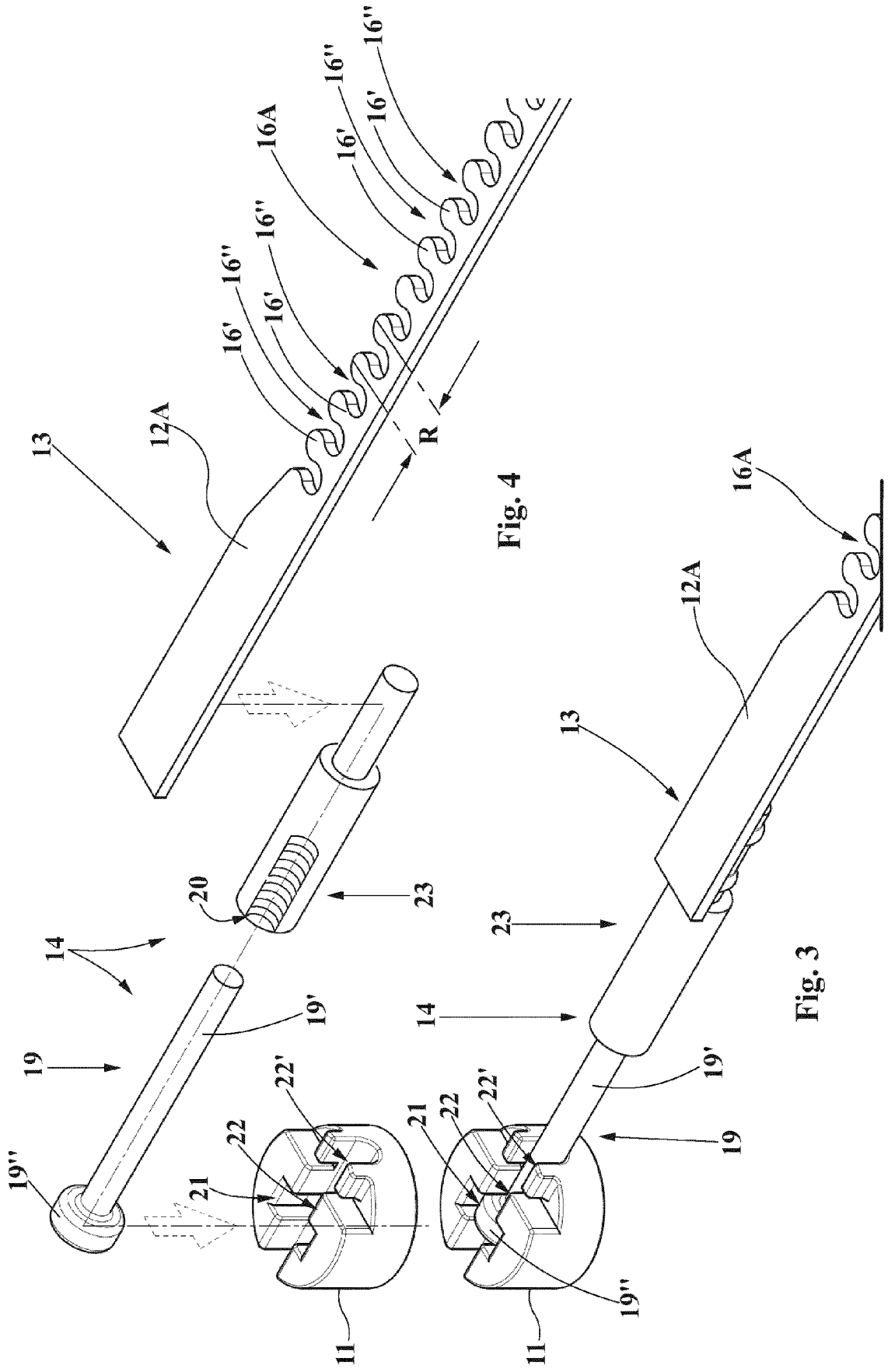
the form of elongated plates, with the sections bearing said first and second shaped profiles (16A, 16B) with reduced width.

5. Tie rod (1) for straightening a door/panel/shutter according to claims 3 and 4, **characterized in that** the elongated plates of said two rod segments (12A, 12B) define, in the shared section (17) in which said first and second shaped profiles (16A, 16B) are coupled, substantially the same cross section that the elongated plates of the rod segments (12A, 12B) define in the sections lacking said first and second shaped profile (16A, 16B); the lateral edges of the rod (12) being substantially parallel for their entire axial extension (Y).
6. Tie rod (1) for straightening a door/panel/shutter according to any one of the preceding claims, **characterized in that** it is associable with a door/panel/shutter (2) provided with at least one panel (3) defining an internal face (4) and an external face (5) that are parallel to each other and separated by a thickness (S) which defines at least one upper edge (7) and at least one lower edge (8); said first and second shaped profiles (16A, 16B) being susceptible of being retained coupled for said shared section (17) thereof, within a groove (34) obtained flush on the panel (30) of said door/panel/shutter (2).
7. Tie rod (1) for straightening a door/panel/shutter according to any one of the preceding claims, **characterized in that** said screw / nut screw means (14) comprise at least one screw (19) provided with:
  - a shank (19') engaged in a nut screw (20) fixed to at least one first end (13) of one said rod segment (12A, 12B), and
  - a head (19") rotatably housed in a seat (21) made in at least one said engagement body (11).
8. Tie rod (1) for straightening a door/panel/shutter according to claims 6 and 7, **characterized in that** the head (19") of said screw (19) is susceptible of being driven in rotation with a tool (U) at an upper or lower edge (7, 8) of the panel (3) of said door/panel/shutter (2).
9. Tie rod (1) for straightening a door/panel/shutter according to claim 7, **characterized in that** said screw/nut screw means (14) comprise a bush (23), which is fixed to the first end (13) of at least one said rod segment (12A, 12B) and is provided with said nut screw (20) axially directed towards said engagement body (11).
10. Method for mounting a tie rod (1) according to any one of the preceding claims, on a door/panel/shutter provided with at least one panel (3) defining an in-

ternal face (4) and an external face (5) that are parallel to each other and separated by a thickness (S) which defines at least one upper edge (7) and at least one lower edge (8); said method being **characterized in that**:

- it arranges the panel (3) of a door/panel/shutter (2), composed of a sandwich formed by at least two parallel laminar layers (30) with a perimeter frame (31) interposed therebetween;
- at least one laminar layer (30) being initially separated from said frame (31); the frame (31) of said panel (3) being provided with two parallel uprights (31A) with two corresponding shaped millings (32) made on a face thereof directed outward, such millings having, in vicinity to the upper and lower ends of said uprights (31), two seats (33) for housing said engagement bodies (11) separated from each other by a first distance (D1) and connected together by a groove (34) that continues beyond at least one of said seats (33) for said engagement body (11), making it accessible from an upper or lower edge (7, 8) of said panel (3);
- it couples together the two segments (12A, 12B) of rods (12), adjusting the length of the shared section (17) of the shaped profiles (16A, 16B) in a manner such to space the engagement bodies (11) by a second distance (D2) equal to the first distance (D1) between said seats (33) on the frame (31) of the panel (30) of said door/panel/shutter (2);
- it inserts each tie rod (1), with the rod (12) composed of two coupled segments (12A, 12B) and with the engagement bodies (31) axially mechanically connected to the first ends of the rod, flush in the shaped milling (32) of the frame (31), with the rod (12) that is flush-inserted in the groove (34) and with the engagement bodies (11) that are inserted in the seats (33);
- it fixes the laminar layer (30) separated from the panel (3) to the frame (31) in order to form the sandwich of the panel (3) and close the milling (32) with the tie rod (1) therein.





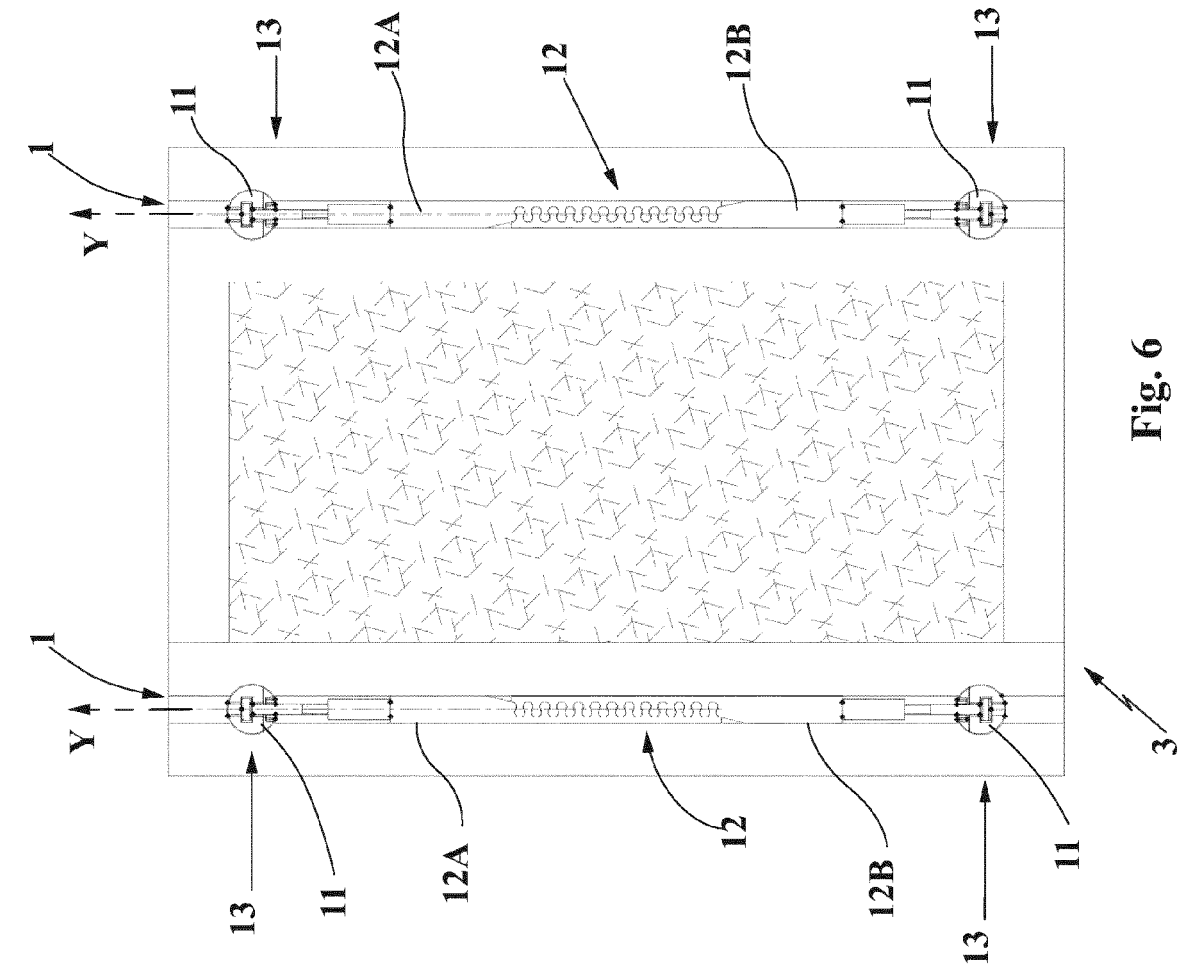


Fig. 5

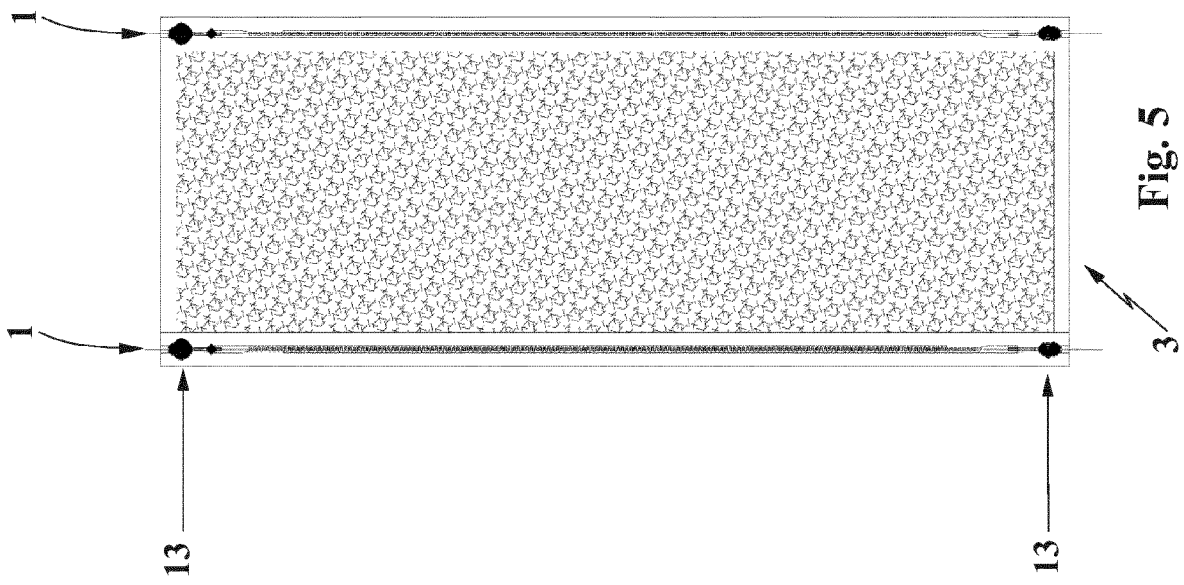


Fig. 6

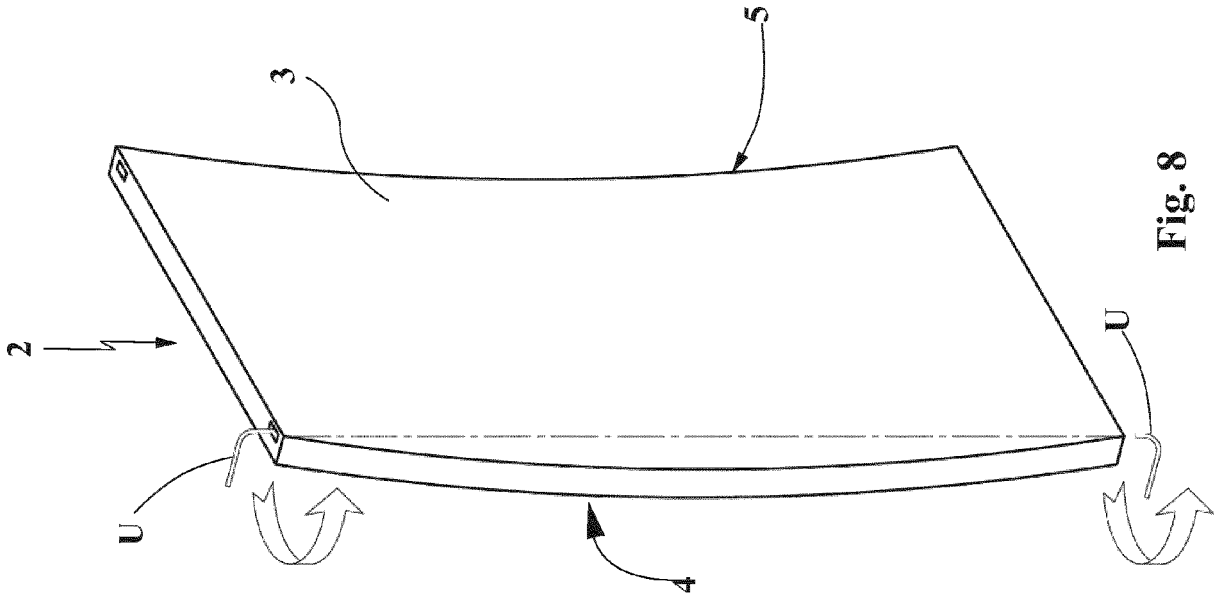


Fig. 8

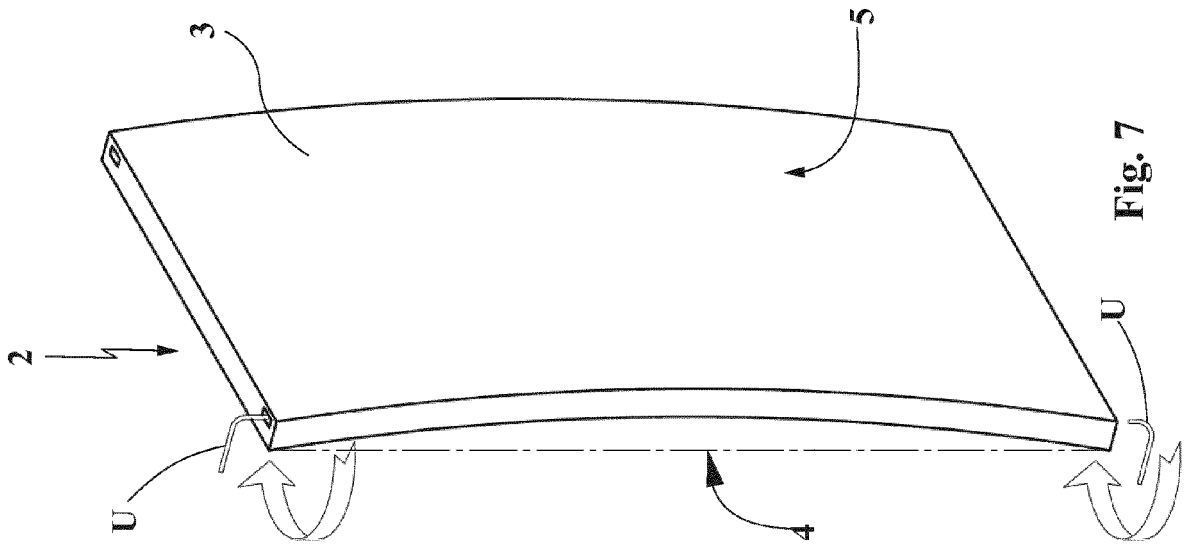
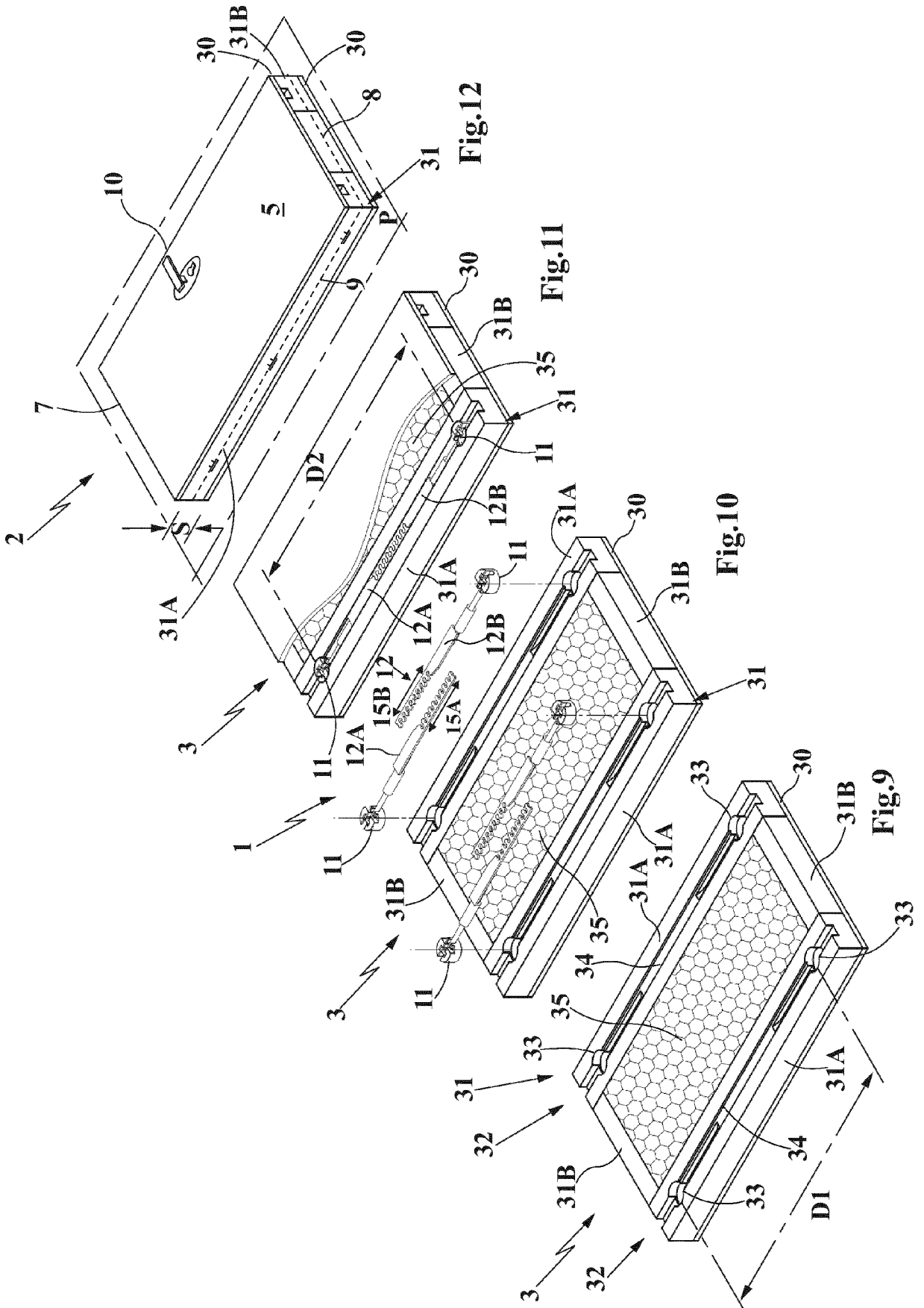


Fig. 7





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