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(54) **Sliding support member for boom, boom for construction machinery comprising the same, and method for assembling boom for construction machine**

Schiebestützelement für Ausleger, Ausleger für Baumaschinen, der das Element umfasst, und Verfahren zur Montage eines Auslegers für eine Baumaschine

Élément de support coulissant pour flèche, flèche pour machine de construction le comprenant et procédé d'assemblage de la flèche pour machine de construction

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(73) Proprietors:
• **Kobelco Cranes Co., Ltd.**
Shinagawa-ku, Tokyo
Tokyo 141-8626 (JP)
• **Kabushiki Kaisha Kobe Seiko Sho (Kobe Steel, Ltd.)**
Kobe-shi,
Hyogo 651-8585 (JP)

(72) Inventors:
• **Yokoyama, Shunsuke**
Akashi-shi Hyogo 674-0063 (JP)
• **Ogawa, Yuichi**
Akashi-shi Hyogo 674-0063 (JP)
• **Motoyama, Isao**
Akashi-shi Hyogo 674-0063 (JP)
• **Hanawa, Yoji**
Kobe-shi Hyogo 651-2271 (JP)
• **Nakayama, Hiroki**
Kobe-shi Hyogo 651-2271 (JP)

(74) Representative: **TBK**
Bavariaring 4-6
80336 München (DE)

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Description

Technical field

[0001] The present invention relates to a sliding support for booms which is provided in a telescopic boom equipped in construction machine such as cranes, and relates to a boom for construction machine comprising such a sliding support member for booms, and a method for assembling a boom for construction machine.

Background art

[0002] Among the booms equipped in construction machine such as cranes or the like, there are such booms as to be extendible and retractable in the axial direction thereof. Fig. 9 illustrates one such case.

[0003] The shown boom comprises, sequentially from a base end side thereof (right-hand side of the figure), a plurality of cylindrical boom members 11, 12, 13 and 14. Among these boom members, the boom member 11 nearest to the base end is supported on a crane body side, not shown, by way of a pin or the like, allowed to be raised and lowered. The boom member 12 has such an outer shape as to be insertable into the boom member 11 from the front end of the latter. Likewise, the boom member 13 has such an outer shape as to be insertable into the boom member 12 from the front end of the latter, and the boom member 14 nearest to the free end has such a shape as to be insertable into the boom member 13 from the front end of the latter. Accordingly, each of the boom members 12, 13 and 14 is disposed so as to be surrounded by the boom member immediately outwards thereof, allowed to slide in the axial direction relative to the immediately outer boom member. Involving their slides, the boom as a whole extends and retracts in the axial direction.

[0004] Taking into consideration of the load acting on each boom member of a so-called telescopic boom such as the one shown in Fig. 9, there is performed, as shown in the schematic diagram of Fig. 10, (i) a modulation of the cross-sectional shape of each boom member from an ordinary box shape (rectangular shape) into an asymmetrical shape, or (ii) provision of sliding support members 4, 3 and 2 at least under the front end of the boom members 13, 12 and 11 in order to slidably support the boom members 14, 13 and 12 inward of the respective boom members 13, 12 and 11. The specific reasons are as follows.

i) As to cross-sectional shape of the boom members

[0005] In the above-mentioned boom, a downward hanging load W acts on the leading end of the boom member 14. The boom member 14, subjected to the hanging load W , takes an upward reaction force F_u from the front end of the outward boom member 13, while the rear end of the boom member 14 takes a downward re-

action force F_d from the boom member 13. As the boom extends, the reaction force is given also on each of the boom members 13 and 12, from the outward boom member.

[0006] The upwards reaction force F_u acting on each of the boom members 14, 13 and 12 functions as a vertical compressive load which causes the possibility of buckling of the boom members. In view of this, there is recently adopted a boom member cross-sectional shapes effective for averting such buckling, for instance the shape shown in Fig. 10, wherein the lower portion of the boom member is convexly curved downward.

ii) As to sliding support member

[0007] As described above, an upwards reaction force F_u acts on the lower portion of the boom members 14, 13 and 12 from the front end of the outward boom members 13, 12 and 11, respectively, thereby generating great frictional forces between the front end portions of the boom members 13, 12 and 11 and the boom members 14, 13 and 12 sliding inward of the front end portions, respectively. This makes it necessary to provide sliding support members at the front end of the boom members 14, 13 and 12 for supporting the boom members 13, 12 and 11 from below while sliding, with low frictional resistance, against the outer peripheral face of the outward boom members 13, 12 and 11.

[0008] Conventional members often used as the sliding support members 4, 3 and 2 are for instance sliding pads shaped so as to conform to an inner peripheral face of an outward boom member (hereafter referred to as "outer boom member") and an outer peripheral face of an inward boom member (hereafter referred to as "inner boom member"), as shown in Fig. 10. The sliding pads are fixed to the inner peripheral face at the front end of the outer boom members, each having an inner face which supports the inner boom members slidably in the axial direction involving a slide against the outer peripheral face of the inner boom members.

[0009] However, these conventional sliding pads shaped so as to fill the gap between boom members are problematic in terms of versatility. Specifically, booms whose boom members have different cross-sectional shape from each other require different sliding pads for each such cross-sectional shape, even when the difference in cross-sectional shape are slight. This precludes mass production of the sliding pads.

[0010] In view of this, JP 2005-255337 A, which is considered to disclose the most relevant prior art, discloses splitting sliding support member into multiple unit pieces to increase the versatility of the sliding support member. These unit pieces are made up of short slide plates of shape equal to each other. The slide plates are closely overlaid on the inner peripheral face of the outer boom member so as to be lined up along the inner peripheral face. The slide plates are fixed by a fixing member mounted on the outer boom member so as to restrain a plate

group comprising an array of the slide plates from both sides in both of longitudinal and peripheral directions.

[0011] The above conventional sliding support member, however, has the following problems to be solved.

1) Mounting the sliding support member onto the outer boom member requires complicated operation. The slide plates are not independently restrained on the side of the outer boom member but only an entire slide plate group including the slide plates peripherally arranged is restrained from both ends in the peripheral direction by use of the fixing member; therefore, the positions of the slide plates are extremely unstable until mounting the fixing member is finished, which makes the operation of the slide plates difficult. This drawback becomes more marked as the number of slide plates increases.

2) It is impossible to finely adjust the relative positions of the outer boom member and the inner boom member. It is effective for smooth slide between boom members to center the outer boom member and the inner boom member (to adjust the center axes of both of the boom members), but the slide plates disclosed in the above Patent document have all the same shape and constant thickness, which cannot permit the fine adjustment of the relative position between the boom members.

[0012] In order to perform the adjustment, it might be considered to replace appropriate slide plates among the multiple slide plates disclosed in the above Patent document with other slide plates of different thickness; however, it is actually difficult. Since, as described above, each of the slide plates is not locked directly to the outer boom member but only caught between the other outer boom members on its both sides in the peripheral direction, removing just some of the slide plates and inserting other slide plates in their stead are difficult to accomplish in practice. Moreover, arranging slide plates of different thicknesses involves significant level differences between the slide plates, which prevent the slide plates other than the thickest plates from contacting the outer peripheral face of the inner boom member, thereby concentrating an upward load on the inner boom member at a limited region: this may make the boom down-rated in strength.

[0013] Furthermore, sliding support members are known from US 3 837 502 A and JP 9 208 186 A.

Disclosure of the Invention

[0014] In the light of the above, it is an object of the present invention to provide a sliding support member for booms easily mountable on an outer boom member while allowing an adjustment of a position of an inner boom member relative to the outer boom member. A further object of the present invention is to provide a boom

for construction machine comprising the sliding support member for booms, and to provide a method for assembling a boom for construction machine.

[0015] According to the present invention, the above object is solved with a sliding support member having the features of claim 1.

[0016] The sliding support member is assembled by an easy operation compared with a conventional case where a plurality of sliding pads are merely arranged in the peripheral direction. Specifically, installing the holder on the inner peripheral face of the outer boom member and inserting a plurality of the sliding pads individually into the holder from the front end side of the outer boom member to let the holder hold the sliding pads enable the sliding pads to be arranged at a plurality of positions spaced in the peripheral direction.

[0017] Besides, the sliding support member facilitates an adjustment of the position of the inner boom member relative to the outer boom member. For instance, preparing a plurality of types of sliding pads of different thicknesses and selecting appropriate ones to be used among the sliding pads enable the position of the sliding contact surfaces of the sliding pads, i.e. the support position of the inner boom member, to be matched to a position corresponding to an above-described target position.

[0018] This adjustment can be carried out, for instance, by replacing appropriate sliding pads with other sliding pads of thicknesses different from that of the former, or by interposing adjusting spacers between the sliding pads and the holder. Even if sliding pads are removed during the above operation, the other remaining sliding pads are individually held by the holder, thus keeping the position of these sliding pads not destabilized. The sliding pad replacement operation is therefore easier than conventional replacement of slide plates.

[0019] Moreover, since the sliding pads are held by the holder at positions spaced in the peripheral direction, even some height difference among the sliding contact surfaces arise no abrupt level differences between the sliding contact surfaces of the sliding pads, differently from a conventional sliding support member whose sliding pads are overlaid so as to be close to each other in the peripheral direction. This permits all the sliding contact surfaces of the sliding pads to contact the outer peripheral face of the inner boom member, regardless of the above-mentioned height differences.

[0020] The holder comprises a main body fixed to the inner peripheral face of the outer boom member, and a plurality of peripheral-direction restraining portions provided at respective positions spaced in the peripheral direction of the boom to protrude, by less than thickness of the sliding pads, from the main body towards the outer peripheral face of the inner boom member, the holder forming a pad insertion recess into which the sliding pads can be inserted from the front end side of the boom on the inner face of the main body, between the peripheral-direction restraining portions, and having such a shape that the peripheral-direction restraining portions restrain

the sliding pads inserted into the pad insertion recesses from both ends in the peripheral direction of the boom while the main body restrains the sliding pads from the outer side of the radial direction of the boom. The holder, while having a simple structure wherein a plurality of the peripheral-direction restraining portions protrudes from a common main body, can hold and space the sliding pads.

[0021] Furthermore, the holder, if having three or more number of the peripheral-direction restraining portions to form the pad insertion recess between each couple of the peripheral-direction restraining portions adjacent to each other, can hold a plurality of the sliding pads together.

[0022] More preferably, the holder further has a rear-side restraining portion, the rear-side restraining portion protruding, by less than the thickness of the sliding pads, from the main body at a position further rearward than the peripheral-direction restraining portions towards the outer peripheral face of the inner boom member, to restrain, from the rear end of the boom, the sliding pads inserted into the pad insertion recesses. The holder, while having a simple structure wherein the rear-side restraining portion merely protrudes from the main body, can restrain the sliding pads from the rear end side of the boom, requiring no other members for the rear-side restriction.

[0023] The outer face of the main body is preferably shaped so as to conform to the inner face of the outer boom member. The main body with so shaped an outer face can be fixed stably on the inner peripheral face of the outer boom member.

[0024] The sliding support member for booms according to the present invention may comprise a single holder holding all of the sliding pads, or may comprise a plurality of holders disposed lined up in the peripheral direction of the outer boom member, the sliding pads dispersedly held by the holders. In a sliding support member thus comprising a plurality of holders, the number of the sliding pads each holder has to hold is small, which allows each of the holder to be small and to have a simple structure. Moreover, the holders, the relative position between which is free to be set, can be suitably arranged on the inner peripheral face of the outer boom member so as to conform to the shape of the inner peripheral face, even when the shape is complex or highly curved.

[0025] The present invention also provides a boom for construction machine, the boom comprising an inner boom member whose lower portion has a cross-sectional shape convexly curved downwards and an outer boom member having an inner peripheral face shaped so as to surround an outer peripheral face of the inner boom member, the boom extending and retracting through displacement of the inner boom member in an axial direction relative to the outer boom member; the boom characteristically comprising: the above-mentioned sliding support member for a boom, the sliding support member being fixed to the inner peripheral face of at least a lower portion

of the outer boom member to support the inner boom member slidably in the axial direction; a holder fixing member that fixes the holder included in the sliding support member for a boom to the inner peripheral face of the outer boom member; and a pad-restraining member that restrains the sliding pads held by the holder, from a front end side of the outer boom member.

[0026] In this boom, the holder being fixed to the inner peripheral face of the outer boom member by way of the holder fixing member, the sliding pads held by the holder are restrained from the front end side of the outer peripheral face, thereby being fixed to predetermined positions by a simple structure.

[0027] Specifically, the holder fixing member preferably comprises a rear-side fixing member set up on the inner peripheral face of the outer boom member to restrain the holder from the rear end side of the outer boom member; peripheral direction fixing members set up on the inner peripheral face of the outer boom member to restrain the holder from both sides in the peripheral direction of the outer boom member; and a front-side fixing member detachably set up at the front end of the outer boom member to restrain the holder and the sliding pads held by the holder, from the front end side of the outer boom member, as the pad-restraining member. The front-side fixing member thus function also as the pad-restraining member, thereby simplifying the overall structure.

[0028] For instance, the front-side fixing member preferably has an inner-side end protruding inward beyond the inner peripheral face of the outer boom member, and is fixed to the front end face of the outer boom member so as to position the inner-side end in front of the sliding pads with no contact with the inner boom member.

[0029] In case where the holders are disposed at a plurality of respective positions lined up in the peripheral direction of the outer boom member, the peripheral direction fixing members can be suitable when provided, for instance, so as to protrude inward from the inner peripheral face of the outer boom member, between the holders adjacent to each other. Thus, the peripheral direction fixing member can serve two holders positioned on both sides of the peripheral direction fixing member.

[0030] The above-described boom for construction machine can be easily assembled in accordance with a method that comprises, for instance, a step of setting up a holder on an inner peripheral face of an outer boom member constituting the boom; a step of inserting an inner boom member constituting the boom into the outer boom member; a step of inserting sliding pads between the inner peripheral face of the outer boom member and the outer peripheral face of the inner boom member inserted into the outer boom member to let the holder hold the sliding pads, and adjusting a position of the inner boom member relative to the outer boom member by selecting a sliding pad having a thickness corresponding to target positions of the inner boom member, among a plurality of types of the sliding pads having different thick-

nesses; and a step of restraining the sliding pads on the holder following the adjustment.

[0031] In case of using a holder fixing member comprising the rear-side fixing member, the peripheral direction fixing members and the front-side fixing member, the following method allows the adjustment using the sliding pads and fixing of the pads thereafter to be easily completed: the method includes a step of providing up a rear-side fixing member and peripheral direction fixing members on the inner peripheral face of an outer boom member constituting the boom; a step of setting up a holder on the inner peripheral face of the outer boom member so as to let the holder be restrained by the rear-side fixing member and the peripheral direction fixing members; a step of inserting sliding pads between the inner peripheral face of the outer boom member and the outer peripheral face of the inner boom member inserted into the outer boom member, to let the holder hold the sliding pads, and adjusting a position of the inner boom member relative to the outer boom member by selecting a sliding pad having a thickness corresponding to a target position of the inner boom member, among a plurality of types of the sliding pads having different thicknesses; and a step of fitting a front-side fixing member to the front end of the outer boom member, following the adjustment.

Brief Description of the Drawings

[0032]

[Fig. 1] Fig. 1 is an exploded perspective-view diagram of a characterizing portion of a boom according to a first embodiment of the present invention.

[Fig. 2] Fig. 2 is a cross-sectional front-view diagram showing a sliding support member provided in the boom.

[Fig. 3] Fig. 3 is a cross-sectional side-view diagram showing the sliding support member and a fixing structure thereof.

[Fig. 4] Fig. 4 is a perspective-view diagram showing a sliding pad comprised in the sliding support member, and a holder holding the sliding pad.

[Fig. 5] Fig. 5 is a cross-sectional front-view diagram showing the arrangement of a sliding support member according to a second embodiment of the present invention.

[Fig. 6] Fig. 6 is a cross-sectional front-view diagram showing the arrangement of a sliding support member according to a third embodiment of the present invention.

[Fig. 7] Fig. 7 is a cross-sectional front-view diagram showing the arrangement of a sliding support member according to a fourth embodiment of the present invention.

[Fig. 8] Fig. 8 is side-view diagram showing the lower portion of a boom according to a fifth embodiment of the present invention.

[Fig. 9] Fig. 9 is a side-view diagram showing an

example of an extendible and retractable boom.

[Fig. 10] Fig. 10 is a cross-sectional front-view diagram showing an example of a cross-sectional shape of the boom.

Description of Embodiment

[0033] A first embodiment of the present invention will be explained based on Figs. 1 to 4. In the present embodiment, the boom member 12 among the boom members 11, 12, 13 and 14 shown in Fig. 9 corresponds to an "inner boom member", and the boom member 11 corresponds to an "outer boom member shaped so as to surround an inner boom member", such that the sliding support member according to the present invention is provided therebetween; however, it is also performed that the boom members 13 and 14 shown in Fig. 9 correspond to "inner boom members" and the boom members 12 and 13 correspond to "outer boom members", such that the sliding support member is appropriately used between the inner boom members and the outer boom members: or all the boom members comprised in the boom may have sliding support members according to the present invention provided between boom members adjacent to each other.

[0034] Fig. 1 shows boom members 11, 12 constituting a boom according to the present embodiment. Each of the boom members 11 and 12 has a top wall, a pair of side walls extending downwards from both ends of the top wall, and a bottom wall to which the pair of side walls connect. Each of the top wall and upper portions of the side walls has a flat-plate shape, while the bottom wall and a lower portion of both side walls, constituting a lower portion of the boom member, have a cross-sectional shape convexly curved downwards. The lower portion of each the boom members 11 and 12 of the present embodiment is strictly formed to a polygonal shape through bending a flat plate at a plurality of sites, appearing curved when seen at a distance.

[0035] The inner peripheral face of the boom member 11 has such a shape as to surround the outer peripheral face of the boom member 12 leaving an appropriate gap outside the boom member 12. The boom member 12 can slide relative to the boom member 11 along the axial direction. This sliding contributes to an extension and a retraction of the boom as a whole.

[0036] The sliding support member supports the lower side and the left and right sides of the boom member 12 while allowing the boom member 12 to slide in the axial direction, in a state where the sliding support member is fixed to the inner peripheral face of the lower portion at the front end of the boom member 11.

[0037] The sliding support member comprises a plurality of sliding pads 20 and holders 30 that hold the sliding pads 20 shown in Figs. 2 to 4. The sliding pads 20 are disposed at a plurality of positions along the peripheral direction of the boom member 11 respectively. The holders 30 are disposed at corresponding positions so as to

individually hold respective sliding pads 20: that is, the sliding support member shown in Figs. 2 to 4 comprises a plurality of sliding pads 20 and a plurality of holders 30 that hold the sliding pads 20 individually, the holders 30 being fixed at appropriate positions on the inner peripheral face of the boom member 11 (at least positions at the lower portion of the boom member 11).

[0038] In the examples of the figures, the sliding pads 20 are shaped as flat parallelepipeds, each of the sliding pads 20 having, on the top face thereof, a sliding contact surface 20a slidably contacting the outer peripheral face (lower face in Figs. 2 to 4) of the inward boom member 12. The material of the sliding pads 20 preferably has a certain strength and a low coefficient of friction against the outer peripheral face of the boom member 12. Specific suitable examples of the material include, for instance, polyacetal resins.

[0039] Each of the holders 30 integrally comprise a parallelepiped-shaped main body 32, and a pair of peripheral-direction restraining portions 34 and a rear-side restraining portion 36. The restraining portions 34 and 36 protrude upwards from a top face 32a of the main body 32, thus forming a pad insertion recess 38 above the main body 32 and inward of the restraining portions 34 and 36, into which pad insertion recess 38 each sliding pad 20 can be inserted from the front end of the boom member 11.

[0040] The main body 32 has a lower face (outer face) 32b of a shape in accordance with the inner peripheral face of the boom member 11 (flat shape in this case). The body 32 has width and length dimensions (dimensions in a direction parallel to the boom axial direction) greater than width and length dimensions of the sliding pads 20 respectively.

[0041] Both peripheral-direction restraining portions 34 protrude upwards from the two ends of the main body 32 in the width direction (direction parallel to the peripheral direction of the boom member 11), and the rear-side restraining portion 36 protrudes upwards from the rear end of the main body 32 so as to join the rear ends of both peripheral-direction restraining portions 34. The protruding dimension of the restraining portions 34 and 36 are set smaller than the thickness of the sliding pad 20; the distance between the inner-side faces of both peripheral-direction restraining portions 34 is set slightly greater than the width of the sliding pad 20; and the distance from the front-side face of the rear-side restraining portion 36 up to the front end face of the main body 32 is set to be substantially the same as the length of the sliding pad 20.

[0042] Therefore, the sliding pad 20 can be restrained on both sides in the peripheral direction and rear side, the sliding contact surface 20a of the sliding pad 20 being positioned higher than the restraining portions 34 and 36, when the sliding pad 20 is inserted, from the front of the pad insertion recess 38, into the pad insertion recess 38 surrounded by the restraining portions 34 and 36.

[0043] Each holder 30 is fixed to the inner peripheral

face of the boom member 11 by way of a holder fixing member. The holder fixing member, as shown in Fig. 2, comprises a plurality of peripheral direction fixing members 40 for restraining respective holders 30 from both sides in the peripheral direction; a rear-side fixing member that restrains the holders 30 from the rear end side (right side in Fig. 3) of the boom member 11; and a front cap 42 for restraining the holder 30 from the front end side (left side in Fig. 3) of the boom member 11.

[0044] The peripheral direction fixing members 40, each having smaller height than the height of the holders 30, are fixed to the outer peripheral face of the boom member 11 by welding or the like so as to protrude inward from the outer peripheral face of the boom member 11. The peripheral direction fixing members 40 is positioned so as to be capable of flanking each holder 30 on both sides (on the left and right in Fig. 2), at the home position of the holder 30.

[0045] The rear-side fixing member, in the present embodiment, comprises a holder protective member 44 and a plurality of back stoppers 18.

[0046] The holder protective member 44 is provided for preventing direct contact between the rear end face of the holder 30 and the back stoppers 18 to avert damage to the lower portion of the rear end face of the holder 30 due to the contact. The holder protective member 44, formed of a metal plate, is fastened to the rear end of the holder 30 by way of a bolt 43 so as to cover the rear end face of the holder 30. The holder protective member 44 may also be formed to have a frontal shape straddling a specific plurality of holders 30 adjacent to each other (i.e. a shape conforming to the inner peripheral face of the lower portion of the boom member 11) to have a function of connecting holders 30.

[0047] The back stoppers 18 are shaped as chips and previously fixed, by welding or the like, to the inner peripheral face of the lower portion of the boom member 11, spaced in the peripheral direction at positions removed by a given distance from the front end of the boom member 11 in the axial direction. The distance from the boom member 11 to the front end of the back stoppers 18 is set to be equal to the sum of the dimensions of the sliding pad 20 in the front-rear direction (longitudinal direction) and the dimensions of the holder protective member 44 in the front-rear direction (thickness direction).

[0048] The front cap 42 is removably fitted to the front end of the outward boom member 11 and shaped so as to restrain, in that fitted state, the holders 30 and the sliding pads 20 held by the holder 30, from the front end side of the boom member 11. Specifically, the front cap 42 is of substantially U-shape extending along the front edge of the lower portion of the boom member 11, having such a peripheral length as to be capable of including the entire arrangement area of the holders 30. The front cap 42 has an inner-side end 42a and is fixed, by way of a bolt 41, to the end face of a flange 11a formed on the front end of the boom member 11, so that the inner-side

end 42a protrudes inward beyond the inner peripheral face of the boom member 11 and has such a protruding dimension that the inner-side end 42a is positioned in front of the sliding pad 20 without contacting the inward boom member 12.

[0049] In short, the front cap 42 constitutes a front-side fixing member which is fitted to restrain the holder 30 from the front end side of the boom member 11, while functioning also as a pad-restraining member restraining the sliding pad 20 held in the holder 30 from the same direction.

[0050] In this embodiment, in addition to the sliding pads 20, there are mounted on the outward boom member 11 a pair of right and left sliding pads 22 (Fig. 1) for supporting the inward boom member 12 from above. The sliding pads 22, which are so shaped as to be capable of slidably contacting upper right and left corners of the boom member 12, are mounted on the upper corners of the boom member 11 at the front end thereof, by way of brackets 24.

[0051] The boom can be assembled, for instance, in accordance with the following procedure.

[0052] Step 1. Each the holder 30 is set, joined to the holder protective member 44, on the inner peripheral face of the boom member 11 to which the back stoppers 18 and the peripheral direction fixing members 40 have been fixed beforehand. Specifically, each of the holders 30 is disposed at such a position that the holder 30 is restrained from both sides in the peripheral direction by a pair of the peripheral direction fixing members 40 corresponding to the holder 30 and the holder protective member 44 comes contact with the back stopper 18 from its front side.

[0053] Step 2. The boom member 12 is inserted, from the front end of the boom member 11, into the space inside the holders 30 and further inside the boom member 11. To be inserted, the boom member 12 is held at an appropriate position above the holders 30, for instance being suspended by another crane. For example, in case where the upper sliding pads 22 should be mounted on the boom member 11, the boom member 12 is held at a position where the sliding pads 22 and the upper left and right corners of the boom member 12 abut each other.

[0054] The sequence of the step 1 and the step 2 can be reversed. Specifically, the holders 30 may be set on the inner peripheral face of the boom member 11 after the insertion of the boom member 11 into the boom member 12.

[0055] Step 3. Each the sliding pad 20 is inserted into the gap between the inner peripheral face of the lower portion of the boom member 11 and the outer peripheral face of the lower portion of the boom member 12 to be held in the corresponding holder 30. Specifically, the sliding pads 20 are inserted, from the front end of the boom member 11, into the pad insertion recesses 38 formed in the holders 30, respectively. The insertion of the sliding pads 20 establishes an adjustment of a relative position of the boom member 12 with respect to the boom member

11 (so-called centering).

[0056] Specifically, a plurality of types of pads having slightly different thicknesses are prepared as the sliding pads 20, and, among these pads, there are selected those that correspond to the dimensions of the gap between the top face 32a of the main body 32 of the holders 30 and the outer peripheral face of the inward boom member 12 to be inserted into the pad insertion recesses 38 formed in the holders 30. Alternatively, suitable sliding pads 20 may be precisely fitted into all the insertion recesses 38 respectively, and thereafter the sliding pads 20 at positions to be adjusted may be removed and sliding pads having a different thickness are substitutively inserted.

[0057] Upon replacement of the sliding pads 20, the other sliding pads 20 are so restrained by their respective holders 30, that removing the sliding pads 20 does not destabilize the position of the other sliding pads 20. Besides, since the holders 30 hold the sliding pads 20 so as to keep a suitable gap between each couple of the sliding pads 20 adjacent to each other, no abrupt level differences can be produced between the sliding contact surfaces 20a of the sliding pads 20, even if there are slight differences between the thicknesses of the sliding pads 20 (i.e. even if there are slight height differences between the sliding contact surfaces 20a of the sliding pads 20). This enables all the sliding contact surfaces 20a to slidably contact the outer peripheral face of the boom member 12, despite such height differences.

[0058] As other methods for adjusting the position of the boom member 12 than the replacement of the sliding pads 20 as described above, effective may be interposing spacers formed of for instance a thin metal plate between the rear face (lower face) of the sliding pads 20 and the top face 32a of the main body 32 of the holders 30. It is also effective to affix a metal plate as a reinforcing member at a specific site of the sliding pad 20 which site comes into contact with the holder 30 (for instance, at the lower or rear face of the sliding pad 30), because the material of the sliding pads 20 required to have a low-friction property (for instance, a polyacetal resin) is ordinarily softer than that of the holder 30, which are structural members (for instance, nylon or polyamide resin).

[0059] Step 4. Following the accomplishment of the adjustment of step 3, the front cap 42 is fixed to the flange 11a at the front end of the boom member 11. The holders 30 and the sliding pads 20 held by the holders 30 are thereby restrained from both sides in the front-rear direction and the peripheral direction. The mounting operation is thus completed.

[0060] In the present invention, the way in which the holders 30 are fixed can be decided arbitrarily. For instance, the peripheral direction fixing members 40 is not absolutely required to be disposed on both sides of the holders 30 in the width direction thereof. As shown in Fig. 5 for a second embodiment, the peripheral direction fixing members 40 may be disposed just on both sides, in the width direction, of the holders 30 in contact with each

other; or, as shown in Fig. 6 for a third embodiment, the peripheral direction fixing members 40 may be disposed between the holders 30 adjacent to each other to serve the two holders 30.

[0061] In any of the embodiments above, an appropriate gap, as shown in Figs. 2 and 3, kept between the sliding pads 20 adjacent to each other prevents the significant level differences between the sliding contact surfaces 20a of the sliding pads 20 from being occurred. Keeping the gap also allows the sliding contact surface 20a of the sliding pads 20 to be adapted to the outer peripheral face of the inward boom member 12, even when the curvature of the latter is significant (the latter has high curvature). Specifically, even if the boom member 12 includes a highly curved portion in halfway such as the portion A in Fig. 5 or shown in Fig. 6, arranging the sliding pads 20 so as to position the highly curved portion between the sliding pads 20 allows the sliding contact surface 20a of the sliding pads 20 to satisfactorily slidably contact the outer peripheral face of the boom member 12, regardless of the curvature.

[0062] As effective means for achieving comfortable sliding contact, as shown in Fig. 7 for a fourth embodiment, it is also effective to tilt the top face 32a of the main body 32 of the holders 30 relative to the inner peripheral face of the outward boom member 11. The tilting involves tilting the sliding contact surface 20a of the sliding pads 20. In this embodiment, the sliding contact surface 20a therefore can make a surface contact with the outer peripheral face of the boom member 12, without any particular change of the shape of the sliding pads 20, even when the outer peripheral face of the inward boom member 12 is oblique relative to the inner peripheral face of the outward boom member 11.

[0063] The sliding support member according to the present invention may comprise a holder which holds a plurality of sliding pads together. Also the shape and the thickness of such a holder may be appropriately adapted in accordance with the shape and the structure of the inner boom member and the outer boom member in which the sliding support member is used. The sliding support member according to the present invention can also be used together with conventional sliding pads (sliding pads so shaped as to fill the gap between the outer peripheral face of the outer boom member and the outer peripheral face of the inner boom member).

[0064] Fig. 8 shows an example of a fifth embodiment where the present invention is applied to a seven-stage boom having seven boom members 11, 12, 13, 14, 15, 16 and 17. The boom members 11 to 17 are sequentially arranged from the inner side of the boom; in this boom, whether each boom member corresponds to an inner boom member or an outer boom member depends on the relationship of the boom member with respect to the other boom members. For instance, the boom member 12 corresponds to an "inner boom member" in its relationship with the boom member 11, while corresponding to an "outer boom member" in its relationship with the

boom member 13.

[0065] Should be noted that Fig. 8 shows only the right half of the lower portion of the boom members 11 to 17 because the left half of the boom members are symmetrical on the right half in shape and structure.

[0066] In the present embodiment, there are mixed sliding support members according to the present invention and conventional sliding pads between boom members adjacent to each other. The sliding support members according to the present invention is applied to the highly curved portions and the portions with a large distance between and the boom members for making full use of their advantages, while conventional sliding pads are applied to the other portions.

[0067] As to the boom members 11 to 16 except the innermost boom member 17, there are formed respective comparatively small gaps between the boom members adjacent to each other; therefore, sliding pads 26 each having a conventional structure are provided at the region of the bottom where curvature is small, and likewise, sliding pads 27 and 28 having a conventional structure are provided at the sides. Meanwhile, the sliding support members according to the present invention are provided at regions of large curvature between the bottom and the sides (hereafter referred to as "intermediate region").

[0068] Each of the sliding support members comprises a plurality of sliding pads 20 (four sliding pads in the figure) distributed in the peripheral direction in the intermediate region, and a holder 30 that holds the sliding pads 20 together. Each of the holders 30 has a curved body 32 extending along the inner peripheral face of the outer boom member (e.g., the boom member 11 in the relationship with the boom member 12) in the entire intermediate region, and three or more (five in the present embodiment) peripheral-direction restraining portions 35 protruding inward at both ends of the main body 32 and at intermediate positions of the latter, in the peripheral direction, thus forming pad insertion recesses 38 (a total of four in the present embodiment) between each couple of the peripheral-direction restraining portions 35 adjacent to each other.

[0069] The reference numerals P1 to P5 shown in Fig. 8 correspond to bending points (points of significant curvature) of the intermediate boom member 14. Among these points P1 to P5, P1 and P5 are positioned at both ends of the intermediate region. The position at which the holder 30 holds the sliding pads 20 is so set as to position the intermediate points P2, P3, P4 between respective sliding pads 20. This setting of the positions ensures comfortable sliding contact between the sliding pads 20 and the outer peripheral face of the inner boom member.

[0070] On the other hand, as to the innermost boom member 17 and the boom member 16 immediately outward therefrom, between which a large gap exists, sliding pads 26 having a conventional structure are provided only at the region of the bottom, while sliding support members according to the present invention are provided

in the intermediate region and the lateral regions. The sliding support members used in the boom members 11 to 16, having basically the same structure, are provided with holders 30A and 30B having respective main bodies 32A and 32B thicker than the main body 32 of the holders 30, conforming to the gap between the boom members 17 and 16. In the intermediate region, where the curvature of the boom member 17 is greater than that of the other boom members 11 to 16, used as the sliding support members are sliding pads 20' of smaller width than that of the sliding pads 20.

[0071] As is the case in the fifth embodiment, the sliding pads and holders of the sliding support members according to the present invention can be freely designed in accordance with the shape and the structure of the outer boom member and the inner boom member to which they are applied.

[0072] Provided are a sliding support member for booms easily mountable on an outer boom member and allowing position adjustment of an inner boom member relative to the outer boom member; a boom for construction machine having the sliding support member for booms; and a method for assembling a boom for construction machine. The sliding support member slidably supports an inner boom member 12 while fixed to an outer boom member 11, having a plurality of sliding pads 20 and a holder 30 holding them. Each of the sliding pads 20 has a surface 20a for contacting the inner boom member 12. The holder 30 is fixed to the inner peripheral face of the outer boom member 11 to hold the sliding pads 20 allowing them to be inserted and removed through the front end of the outer boom member 11.

Claims

1. A sliding support member for a boom of construction machine, the boom comprising an inner boom member (12) whose lower portion has a cross-sectional shape convexly curved downwards and an outer boom member (11) having an inner peripheral face shaped so as to surround an outer peripheral face of the inner boom member (12) to extend and retract through displacement of the inner boom member (12) in an axial direction relative to the outer boom member (11), wherein the sliding support member is capable of supporting the inner boom member (12) slidably in the axial direction in a state where the sliding support member is fixed to the inner peripheral face of at least a lower portion of the outer boom member (11),
the sliding support member comprising:

a plurality of sliding pads (20) each having a sliding contact surface (20a) capable of slidably contacting the outer peripheral face of the inner boom member (12); **characterized in that** the sliding support member further comprises

a holder (30) which is fixable to the inner peripheral face of at least the lower portion of the outer boom member (11) and holds the sliding pads (20) so as to allow the sliding pads (20) to be inserted and removed through a front end of the outer boom member (11) at a plurality of positions spaced in the peripheral direction of the inner boom member (12) in such an attitude of the sliding pad (20) that the sliding contact surfaces (20a) of the sliding pads (20) slidably contact the outer peripheral face of the inner boom member (12), wherein

the holder (30) comprises a main body (32) fixable to the inner peripheral face of the outer boom member (11) and a plurality of peripheral-direction restraining portions (32) which are spaced in the peripheral direction of the boom and protrude, by less than thickness of the sliding pads (20), from the main body (32) towards the outer peripheral face of the inner boom member (12), and

the holder forms pad insertion recesses (38), into which the sliding pads (20) can be inserted from the front end side of the boom, on the inner face of the main body (32) between peripheral-direction restraining portions (34), the holder (30) having such a shape that the peripheral-direction restraining portions (34) restrain the sliding pads (20) inserted into the pad insertion recesses from both ends in the peripheral direction of the boom and the main body (32) restrains the sliding pad (20) from the outer side of the radial direction of the boom.

2. The sliding support member for a boom according to claim 1, wherein the holder (30) has three or more peripheral-direction restraining portions (34), forming the pad insertion recess (38) between each couple of the peripheral-direction restraining portions (34) adjacent to each other.
3. The sliding support member for a boom according to claim 1 or 2,
wherein the holder (30) further has a rear-side restraining portion (36) protruding from the main body (30) towards the outer peripheral face of the inner boom member (12) at a position further rearward than the peripheral-direction restraining portions (34), by less than the thickness of the sliding pads (20), to restrain the sliding pads (20) inserted into the pad insertion recesses (38) from the rear end of the boom.
4. The sliding support member for a boom according to any of claims 1 to 3, wherein the outer face of the main body (30) is shaped conforming to the inner face of the outer boom member (11).

5. The sliding support member for a boom according to any of claims 1 to 4, comprising a plurality of holders (30) disposed lined up in the peripheral direction of the outer boom member to hold the sliding pads (20) distributedly.

6. A boom for a construction machine, the boom comprising an inner boom member (12) whose lower portion has a cross-sectional shape convexly curved downwards and an outer boom member (11) having an inner peripheral face shaped so as to surround an outer peripheral face of the inner boom member (12) to extend and retract through displacement of the inner boom member (12) in an axial direction relative to the outer boom member (11), the boom comprising:

a sliding support member for a boom according to any of claims 1 to 5, the sliding support member supporting the inner boom member (12) slidably in the axial direction in a state where the sliding support member is fixed to the inner peripheral face of at least a lower portion of the outer boom member (11);

a holder fixing member that fixes the holder included in the sliding support member for a boom to the inner peripheral face of the outer boom member; and

a pad-restraining member (42) that restrains the sliding pads held by the holder (30), from a front end side of the outer boom member (11).

7. The boom for construction machine according to claim 6, wherein the holder fixing member comprises a rear-side fixing member (18) which is provided on the inner peripheral face of the outer boom member (11) and restrains the holder (30) from the rear end side of the outer boom member (11); peripheral direction fixing members (40) which are provided on the inner peripheral face of the outer boom member (11) and restrain the holder (30) from both sides in the peripheral direction of the outer boom member; and a front-side fixing member (42) detachably provided at the front end of the outer boom member so as to restrain, in an fitted state, the holder (30) and the sliding pads (20) held by the holder from the front end side of the outer boom member (11) by the front-side fixing member (42) as the pad-restraining member (42).

8. The boom for construction machine according to claim 7, wherein each of the front-side fixing member (42) has an inner-side end protruding inward beyond the inner peripheral face of the outer boom member (11), and is fitted to the front end face of the outer boom member (11) so as to have such a protruding configuration position that the inner-side end is positioned in front

of the sliding pads (20) without contacting the inner boom member (11).

9. The boom for construction machine according to claim 7 or 8, wherein a plurality of holders (30) are disposed at respective positions lined up in the peripheral direction of the outer boom member (11), and the peripheral direction fixing members (40) are provided so as to protrude inward from the inner peripheral face of the outer boom member (11) between the holders (30) adjacent to each other.

10. A method for assembling a boom for construction machine according to any of claims 6 to 9, the method comprising:

a step of arranging a holder (30) of a sliding support member according to any one of claims 1 to 5 on an inner peripheral face of an outer boom member (11) constituting the boom;

a step of inserting an inner boom member (12) constituting the boom into the outer boom member (11);

a step of inserting sliding pads (20) between the inner peripheral face of the outer boom member (11) and the outer peripheral face of the inner boom member (12) inserted into the outer boom member (11) so as to let the holder (30) hold the sliding pads (20), and adjusting a position of the inner boom member (12) relative to the outer boom member (11) by selecting a sliding pad having a thickness corresponding to a target position of the inner boom member (12), among a plurality of types of the sliding pads (20) having different thickness; and

a step of restraining the sliding pads (20) on the holder (30) by way of the pad-restraining member (42), following the adjustment.

11. The method according to claim 10, the method further comprising:

a step of providing a rear-side fixing member (18) and peripheral direction fixing members (40) on an inner peripheral face of an outer boom member (11) forming the boom; wherein the step of arranging the holder (30) is a step of setting up the holder (30) on the inner peripheral face of the outer boom member (11) so as to let the holder (30) be restrained by the rear-side fixing member (18) and the peripheral direction fixing members (40); and a step of fitting a front-side fixing member (42) to the front end of the outer boom member (11), following the adjustment.

Patentansprüche

1. Gleitstützelement für einen Ausleger einer Baumaschine, wobei der Ausleger ein Innenauslegerelement (12), dessen unterer Abschnitt eine konvex nach unten gekrümmten Querschnittsform hat, und ein Außenauslegerelement (11) aufweist, dessen Innenumfangsfläche so geformt ist, dass sie eine Außenumfangsfläche des Innenauslegerelements (12) umgibt, um durch Verschieben des Innenauslegerelements (12) in einer Achsrichtung relativ zu dem Außenauslegerelement (11) auszufahren und einzufahren, wobei das Gleitstützelement in der Lage ist, das Innenauslegerelement (12) in der Achsrichtung gleitfähig in einen Zustand zu stützen, in dem das Gleitstützelement an die Innenumfangsfläche zumindest eines unteren Abschnitts des Außenauslegerelements (11) befestigt ist, wobei das Gleitstützelement folgendes aufweist:

eine Vielzahl von Gleitbelägen (20), die jeweils eine Gleitkontaktfläche (20a) haben, die in der Lage ist, gleitfähig mit der Außenumfangsfläche des Innenauslegerelements (12) in Kontakt zu kommen, **dadurch gekennzeichnet, dass** das Gleitstützelement ferner folgendes aufweist:

einen Halter (30), der an die Innenumfangsfläche zumindest des unteren Abschnitts des Außenauslegerelements (11) fixierbar ist und die Gleitbeläge (20) so hält, dass den Gleitbelägen (20) ermöglicht wird, an einer Vielzahl von in der Umfangsrichtung des Innenauslegerelements (12) beabstandeten Positionen in einer solchen Haltung des Gleitbelags (20), dass die Gleitkontaktflächen (20a) der Gleitbeläge (20) mit der Außenumfangsfläche des Innenauslegerelements (12) in gleitfähigem Kontakt sind, durch ein vorderes Ende des Außenauslegerelements (11) eingesetzt und abgenommen zu werden, wobei

der Halter (30) einen Hauptkörper (32), der an die Innenumfangsfläche des Außenauslegerelements (11) fixierbar ist, und eine Vielzahl von Umfangsrichtungsrückhalteabschnitten (32) aufweist, die in der Umfangsrichtung des Auslegers beabstandet sind und um weniger als die Dicke der Gleitbeläge (20) von dem Hauptkörper (32) in Richtung der Außenumfangsfläche des Innenauslegerelements (12) vorragen, und der Halter Belageinsetzvertiefungen (38), in welche die Gleitbeläge (20) von der vorderen Endseite des Auslegers eingesetzt werden können, an der Innenfläche des Hauptkörpers (32) zwischen den Umfangsrich-

tungsrückhalteabschnitten (34) ausbildet, wobei der Halter (30) eine solche Form hat, dass die Umfangsrichtungsrückhalteabschnitte (34) die in die Belageinsetzvertiefungen eingesetzten Gleitbeläge (20) von beiden Enden in der Umfangsrichtung des Auslegers zurückhält und der Hauptkörper (32) die Gleitbeläge (20) von der Außenseite der Radialrichtung des Auslegers zurückhält.

2. Gleitstützelement für einen Ausleger gemäß Anspruch 1, wobei der Halter (30) drei oder mehrere Umfangsrichtungsrückhalteabschnitte (34) aufweist, die die Belageinsetzvertiefung (38) zwischen jedem zueinander benachbarten Paar der Umfangsrichtungsrückhalteabschnitte (34) ausbildet.
3. Gleitstützelement für einen Ausleger gemäß Anspruch 1 oder 2, wobei der Halter (30) ferner einen rückseitigen Rückhalteabschnitt (36) hat, der von dem Hauptkörper (30) in Richtung der Außenumfangsfläche des Innenauslegerelements (12) an einer Stelle vorragt, die um weniger als die Dicke in der Gleitbeläge (20) weiter hinten als die Umfangsrichtungsrückhalteabschnitte (34) liegt, um die von dem hinteren Ende des Auslegers in die Belageinsetzvertiefungen (38) eingesetzten Gleitbeläge (20) zurückzuhalten.
4. Gleitstützelement für einen Ausleger gemäß einem der Ansprüche 1 bis 3, wobei die Außenfläche des Hauptkörpers (30) so geformt ist, dass sie mit der Innenfläche des Außenauslegerelements (11) konform ist.
5. Gleitstützelement für einen Ausleger gemäß einem der Ansprüche 1 bis 4, ferner mit einer Vielzahl von Haltern (30), die in der Umfangsrichtung des Außenauslegerelements aufgereiht angeordnet sind, um die Gleitbeläge (20) verteilt zu halten.
6. Ausleger für einen Baumaschine, wobei der Ausleger ein Innenauslegerelement (12), dessen unterer Abschnitt eine konvex nach unten gekrümmte Querschnittsform hat, und ein Außenauslegerelement (11) mit einer Innenumfangsfläche hat, die so geformt ist, dass sie eine Außenumfangsfläche des Innenauslegerelements (12) umgibt, um sie durch Verschieben des Innenauslegerelements (12) in einer Achsrichtung relativ zu dem Außenauslegerelements (11) auszufahren und einzufahren, wobei der Ausleger folgendes aufweist:

ein Gleitstützelement für einen Ausleger gemäß einem der Ansprüche 1 bis 5, wobei das Gleitstützelement das Innenauslegerelement (12) gleitfähig in der Achsrichtung in einem Zustand

stützt, in dem das Gleitstützelement an der Innenumfangsfläche zumindest eines unteren Abschnitts des Außenauslegerelements (11) fixiert ist;

ein Halterfixierelement, das den in dem Gleitstützelement für einen Ausleger enthaltenen Halter an der Innenumfangsfläche des Außenauslegerelements fixiert, und

ein Belagrückhalteelement (42), das die durch den Halter (30) gehaltenen Gleitbeläge von einer Vorderendseite des Außenauslegerelements (11) zurückhält.

7. Ausleger für eine Baumaschine gemäß Anspruch 6, wobei

das Halterfixierungselement ein rückseitiges Fixierungselement (18) aufweist, das an der Innenumfangsfläche des Außenauslegerelements (11) vorgesehen ist und den Halter (30) von der hinteren Endseite des Außenauslegerelements (11) zurückhält; Umfangsrichtungsfixierungselemente (40), die an der Innenumfangsfläche des Außenauslegerelements (11) vorgesehen sind und den Halter (30) von beiden Seiten in der Umfangsrichtung des Außenauslegerelements zurückhalten; und ein Vorderseitenfixierungselement (42), das an dem vorderen Ende des Außenauslegerelements abnehmbar vorgesehen ist, um den Halter (30) und die durch den Halter gehaltenen Gleitbeläge (20) in einem abgebrachten Zustand von der Vorderendseite des Außenauslegerelements (11) durch das vorderseitige Fixierungselement (42) als das Belagrückhalteelement (42) zurückzuhalten.

8. Ausleger für eine Baumaschine gemäß Anspruch 7, wobei

jedes der Vorderseitenfixierungselemente (42) ein innenseitiges Ende hat, das einwärts hinter die Innenumfangsfläche des Außenauslegerelements (11) vorragt und an die Vorderendfläche des Außenauslegerelements (11) angebracht ist, sodass es eine solche vorragende Konfigurationsposition hat, dass das innenseitige Ende vor den Gleitbelägen (20) positioniert ist, ohne mit dem Innenauslegerelement (11) in Kontakt zu sein.

9. Ausleger für eine Baumaschine gemäß Anspruch 7 oder 8, wobei eine Vielzahl von Haltern (30) an jeweiligen in der Umfangsrichtung des Außenauslegerelements (11) aufgereihten Positionen angeordnet sind und die Umfangsrichtungsfixierungselemente (40) so vorgesehen sind, dass sie von der Innenumfangsfläche des Außenauslegerelements (11) zwischen den zueinander benachbarten Haltern (30) einwärts vorragen.

10. Verfahren zum Zusammenbauen eines Auslegers für eine Baumaschine gemäß einem der Ansprüche

6 bis 9, wobei das Verfahren folgendes aufweist:

einen Schritt des Anordnens eines Halters (30) eines Gleitstützelements gemäß einem der Ansprüche 1 bis 5 an einer Innenumfangsfläche des Außenauslegerelements (11), das den Ausleger bildet;

einen Schritt des Einsetzens eines Innenauslegerelements (12), das den Ausleger bildet, in das Außenauslegerelement (11);

einen Schritt des Einsetzens von Gleitbelägen (20) zwischen die Innenumfangsfläche des Außenauslegerelements (11) und die Außenumfangsfläche des Innenauslegerelements (12), das in das Außenauslegerelement (11) eingesetzt ist, um den Halter (30) die Gleitbeläge (20) halten zu lassen, und des Einstellens einer Position des Innenauslegerelements (12) relativ zu dem Außenauslegerelement (11) durch Auswählen eines Gleitbelags, der eine Dicke hat, die einer Sollposition des Innenauslegerelements (12) entspricht, unter einer Vielzahl von Bauarten der Gleitbeläge (20), die verschiedene Dicken haben; und

einen Schritt des Zurückhaltens der Gleitbeläge (20) an dem Halter (30) mittels des Belagrückhalteelements (42) auf das Einstellen folgend.

11. Verfahren gemäß Anspruch 10, wobei das Verfahren folgendes aufweist:

einen Schritt des Bereitstellens eines Rückseitenfixierungselements (18) und Umfangsrichtungsfixierungselementen (40) an einer Innenumfangsfläche des Außenauslegerelements (11), das den Ausleger bildet; wobei

der Schritt des Anordnens des Halters (30) ein Schritt des Aufsetzens des Halters (30) auf die Innenumfangsfläche des Außenauslegerelements (11) ist, damit der Halter (30) durch das Rückseitenfixierungselement (18) und die Umfangsrichtungsfixierungselemente (40) zurückgehalten werden; und

einen Schritt des Anbringens des Vorderseitenfixierungselements (42) an das vordere Ende des Außenauslegerelements (11) auf das Einstellen folgend.

Revendications

1. Élément de support coulissant pour une flèche de machine de construction, la flèche comprenant un élément de flèche interne (12) dont la partie inférieure a une forme de section transversale incurvée de manière convexe vers le bas et un élément de flèche externe (11) ayant une face périphérique interne mise en forme de manière à entourer une face péri-

phérique externe de l'élément de flèche interne (12) pour s'étendre et se rétracter par un déplacement de l'élément de flèche interne (12) dans une direction axiale par rapport à l'élément de flèche externe (11), où l'élément de support coulissant est capable de supporter l'élément de flèche interne (12) en coulissement dans la direction axiale dans un état où l'élément de support coulissant est fixé à la face périphérique interne d'au moins une partie inférieure de l'élément de flèche externe (11),
l'élément de support coulissant comprenant :

une pluralité de patins coulissants (20) ayant chacun une surface de contact coulissant (20a) pouvant entrer en contact coulissant avec la face périphérique externe de l'élément de flèche interne (12) ; **caractérisé en ce que** l'élément de support coulissant comprend en outre un support (30) qui peut être fixé à la face périphérique interne d'au moins la partie inférieure de l'élément de flèche externe (11) et qui maintient les patins coulissants (20) de manière à permettre aux patins coulissants (20) d'être insérés et retirés à travers une extrémité avant de l'élément de flèche externe (11) à une pluralité de positions espacées dans la direction périphérique de l'élément de flèche interne (12) dans une telle disposition du patin coulissant (20) où les surfaces de contact coulissant (20a) des patins coulissants (20) entrent en contact coulissant avec la face périphérique externe de l'élément de flèche interne (12), où le support (30) comprend un corps principal (32) pouvant être fixé à la face périphérique interne de l'élément de flèche externe (11) et une pluralité de parties (32) de retenue de direction périphérique qui sont espacées dans la direction périphérique de la flèche et qui font saillie, d'une distance inférieure à l'épaisseur des patins coulissants (20), à partir du corps principal (32) vers la face périphérique externe de l'élément de flèche interne (12), et le support forme des évidements (38) d'insertion de patins, dans lesquels les patins coulissants (20) peuvent être insérés à partir du côté d'extrémité avant de la flèche, sur la face interne du corps principal (32) entre des parties (34) de retenue de direction périphérique, le support (30) ayant une forme telle que les parties (34) de retenue de direction périphérique retiennent les patins coulissants (20) insérés dans les évidements d'insertion de patins à partir des deux extrémités dans la direction périphérique de la flèche et le corps principal (32) retient le patin coulissant (20) à partir du côté externe de la direction radiale de la flèche.

2. Élément de support coulissant pour une flèche selon

la revendication 1, dans lequel le support (30) possède trois parties (34) de retenue de direction périphérique ou plus, formant l'évidement (38) d'insertion de patin entre chaque couple des parties (34) de retenue de direction périphérique adjacentes les unes aux autres.

3. Élément de support coulissant pour une flèche selon la revendication 1 ou 2, dans lequel le support (30) comporte en outre une partie (36) de retenue côté arrière faisant saillie à partir du corps principal (30) vers la face périphérique externe de l'élément de flèche interne (12) à une position davantage vers l'arrière que celle des parties (34) de retenue de direction périphérique, d'une distance inférieure à l'épaisseur des patins coulissants (20), pour retenir les patins coulissants (20) insérés dans les évidements (38) d'insertion de patins à partir de l'extrémité arrière de la flèche.
4. Élément de support coulissant pour une flèche selon l'une des revendications 1 à 3, dans lequel la face externe du corps principal (30) est mise en forme de manière à s'adapter à la face interne de l'élément de flèche externe (11).
5. Élément de support coulissant pour une flèche selon l'une des revendications 1 à 4, comprenant une pluralité de supports (30) disposés en étant alignés dans la direction périphérique de l'élément de flèche externe pour maintenir les patins coulissants (20) de façon répartie.
6. Flèche pour une machine de construction, la flèche comprenant un élément de flèche interne (12) dont la partie inférieure a une forme de section transversale incurvée de manière convexe vers le bas et un élément de flèche externe (11) ayant une face périphérique interne mise en forme de manière à entourer une face périphérique externe de l'élément de flèche interne (12) pour s'étendre et se rétracter par un déplacement de l'élément de flèche interne (12) dans une direction axiale par rapport à l'élément de flèche externe (11),
la flèche comprenant :

un élément de support coulissant pour une flèche selon l'une des revendications 1 à 5, l'élément de support coulissant supportant l'élément de flèche interne (12) en coulissement dans la direction axiale dans un état où l'élément de support coulissant est fixé à la face périphérique interne d'au moins une partie inférieure de l'élément de flèche externe (11) ;
un élément de fixation de support qui fixe le support inclus dans l'élément de support coulissant pour une flèche à la face périphérique interne de l'élément de flèche externe ; et

un élément (42) de retenue de patins qui retient les patins coulissants maintenus par le support (30), à partir d'un côté d'extrémité avant de l'élément de flèche externe (11).

7. Flèche pour une machine de construction selon la revendication 6, dans laquelle l'élément de fixation de support comprend un élément de fixation côté arrière (18) qui est prévu sur la face périphérique interne de l'élément de flèche externe (11) et qui retient le support (30) à partir du côté d'extrémité arrière de l'élément de flèche externe (11) ; des éléments de fixation de direction périphérique (40) qui sont prévus sur la face périphérique interne de l'élément de flèche externe (11) et qui retiennent le support (30) à partir des deux côtés dans la direction périphérique de l'élément de flèche externe ; et un élément de fixation côté avant (42) prévu de manière amovible au niveau de l'extrémité avant de l'élément de flèche externe de manière à retenir, dans un état monté, le support (30) et les patins coulissants (20) maintenus par le support à partir du côté d'extrémité avant de l'élément de flèche externe (11) par l'élément de fixation côté avant (42) comme l'élément (42) de retenue de patins.

8. Flèche pour une machine de construction selon la revendication 7, dans laquelle chaque élément de fixation côté avant (42) a une extrémité de côté interne faisant saillie vers l'intérieur au-delà de la face périphérique interne de l'élément de flèche externe (11), et est ajusté à la face d'extrémité avant de l'élément de flèche externe (11) de manière à avoir une position de configuration en saillie telle que l'extrémité de côté interne soit positionnée en avant des patins coulissants (20) sans entrer en contact avec l'élément de flèche interne (11).

9. Flèche pour une machine de construction selon la revendication 7 ou 8, dans laquelle une pluralité de supports (30) sont disposés à des positions respectives alignées dans la direction périphérique de l'élément de flèche externe (11), et les éléments de fixation de direction périphérique (40) sont prévus de manière à faire saillie vers l'intérieur à partir de la face périphérique interne de l'élément de flèche externe (11) entre les supports (30) adjacents les uns aux autres.

10. Procédé destiné à assembler une flèche pour une machine de construction selon l'une des revendications 6 à 9, le procédé comprenant :

une étape qui consiste à agencer un support (30) d'un élément de support coulissant selon l'une quelconque des revendications 1 à 5 sur une face périphérique interne d'un élément de

flèche externe (11) constituant la flèche ;
une étape qui consiste à insérer un élément de flèche interne (12) constituant la flèche dans l'élément de flèche externe (11) ;
une étape qui consiste à insérer des patins coulissants (20) entre la face périphérique interne de l'élément de flèche externe (11) et la face périphérique externe de l'élément de flèche interne (12) inséré dans l'élément de flèche externe (11) de manière à permettre au support (30) de maintenir les patins coulissants (20), et à régler une position de l'élément de flèche interne (12) par rapport à l'élément de flèche externe (11) en sélectionnant un patin coulissant ayant une épaisseur correspondant à une position cible de l'élément de flèche interne (12), parmi une pluralité de types des patins coulissants (20) ayant des épaisseurs différentes ; et
une étape qui consiste à retenir les patins coulissants (20) sur le support (30) par l'intermédiaire de l'élément (42) de retenue de patins, suite au réglage.

11. Procédé selon la revendication 10, le procédé comprenant en outre :

une étape qui consiste à fournir un élément de fixation côté arrière (18) et des éléments de fixation de direction périphérique (40) sur une face périphérique interne d'un élément de flèche externe (11) formant la flèche ; où
l'étape d'agencement du support (30) est une étape qui consiste à monter le support (30) sur la face périphérique interne de l'élément de flèche externe (11) de manière à permettre au support (30) d'être retenu par l'élément de fixation côté arrière (18) et les éléments de fixation de direction périphérique (40) ; et
une étape qui consiste à monter un élément de fixation côté avant (42) sur l'extrémité avant de l'élément de flèche externe (11), suite au réglage.

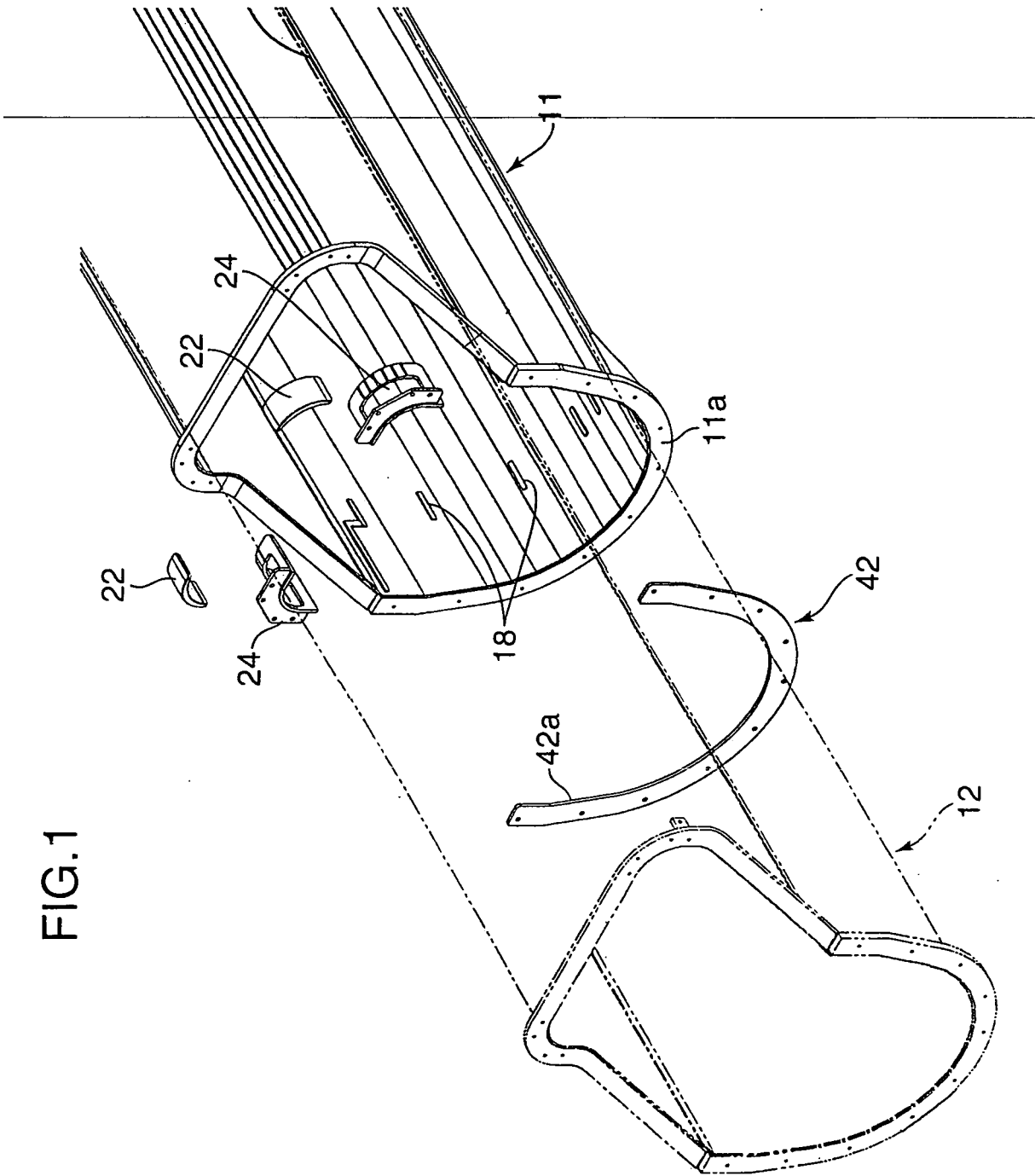


FIG. 1

FIG.2

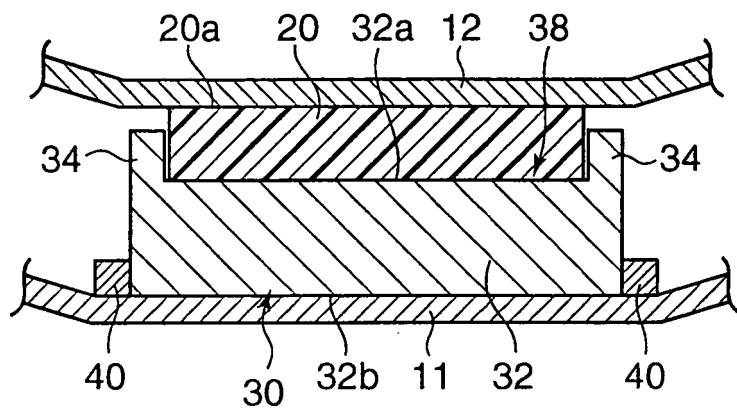


FIG.3

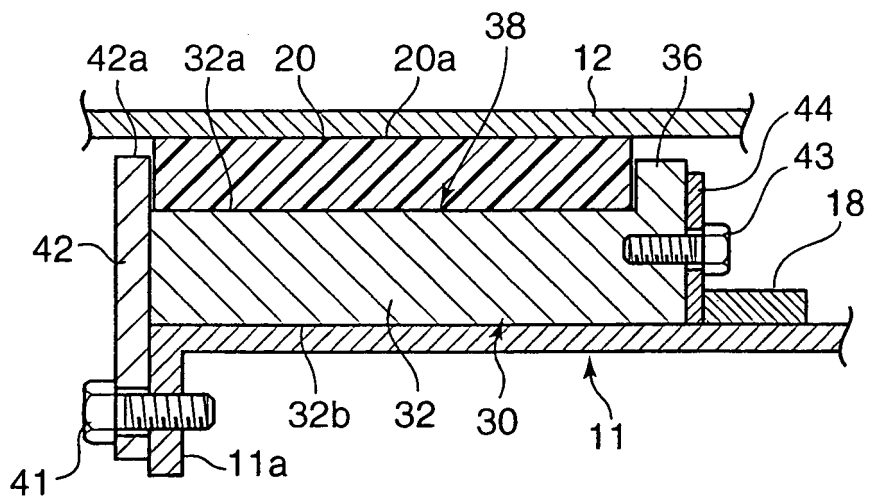


FIG.4

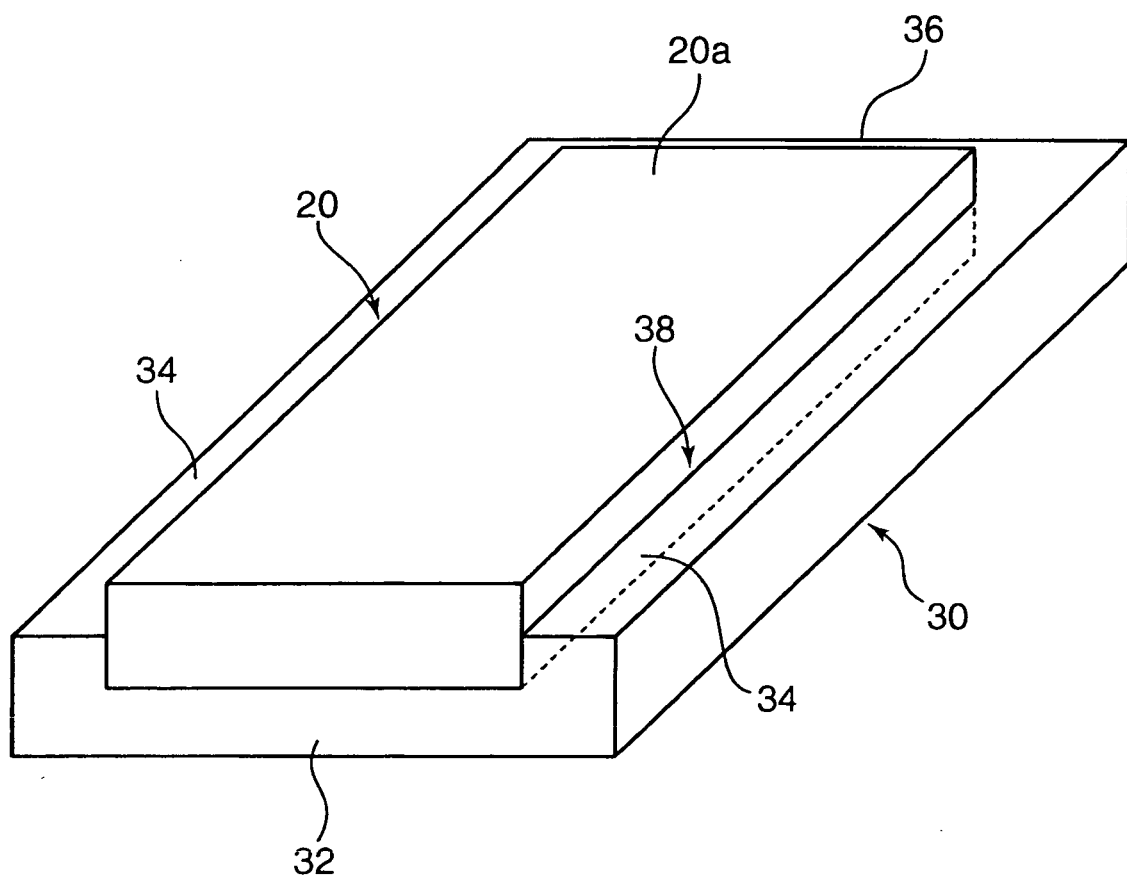


FIG.5

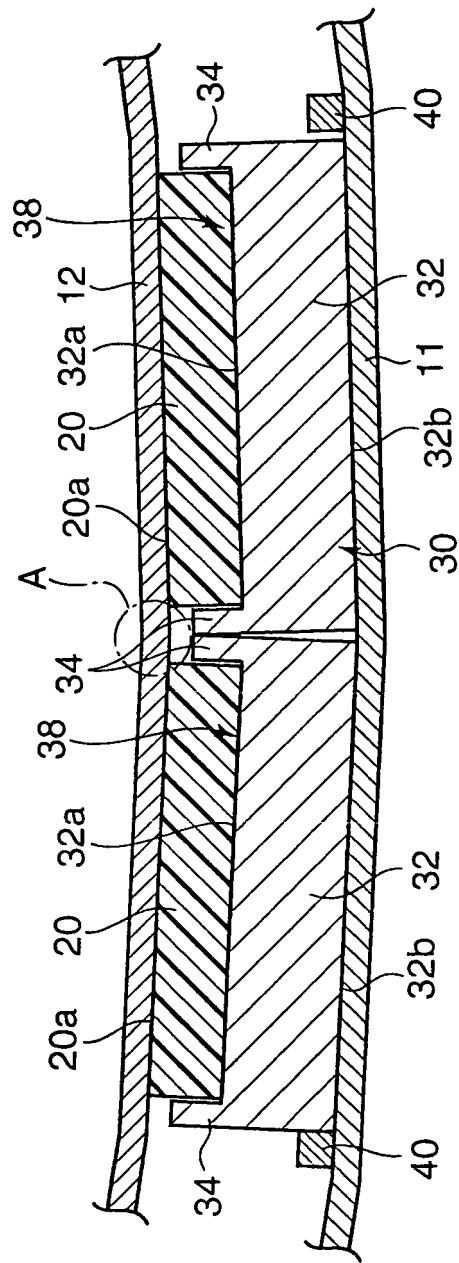


FIG. 6

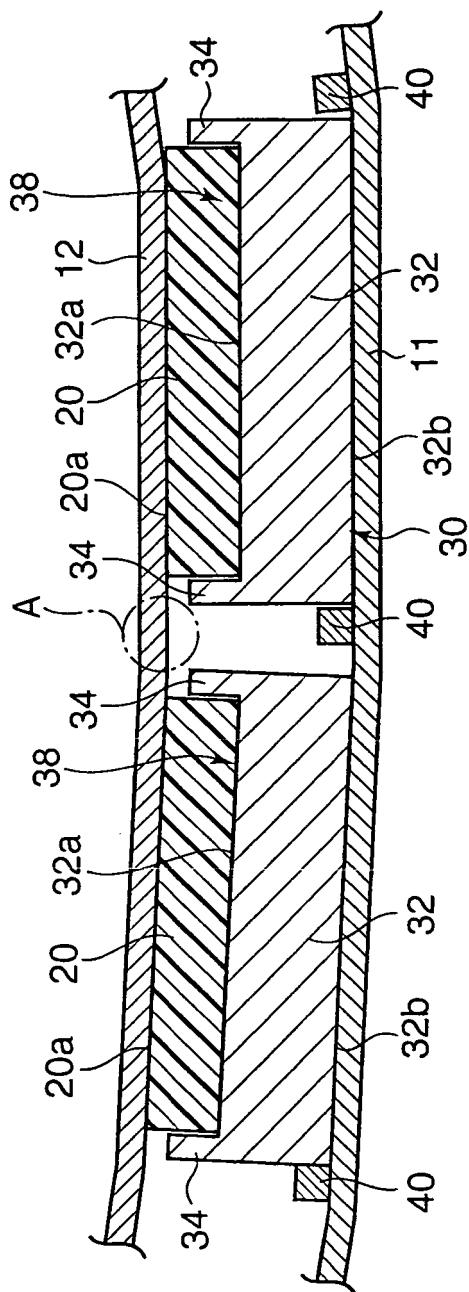


FIG.7

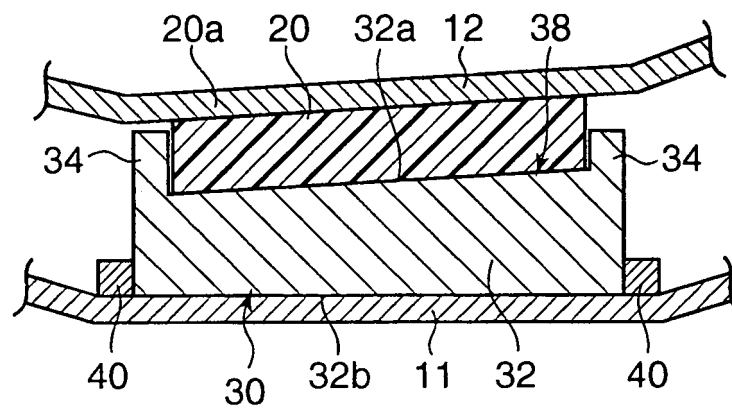


FIG.8

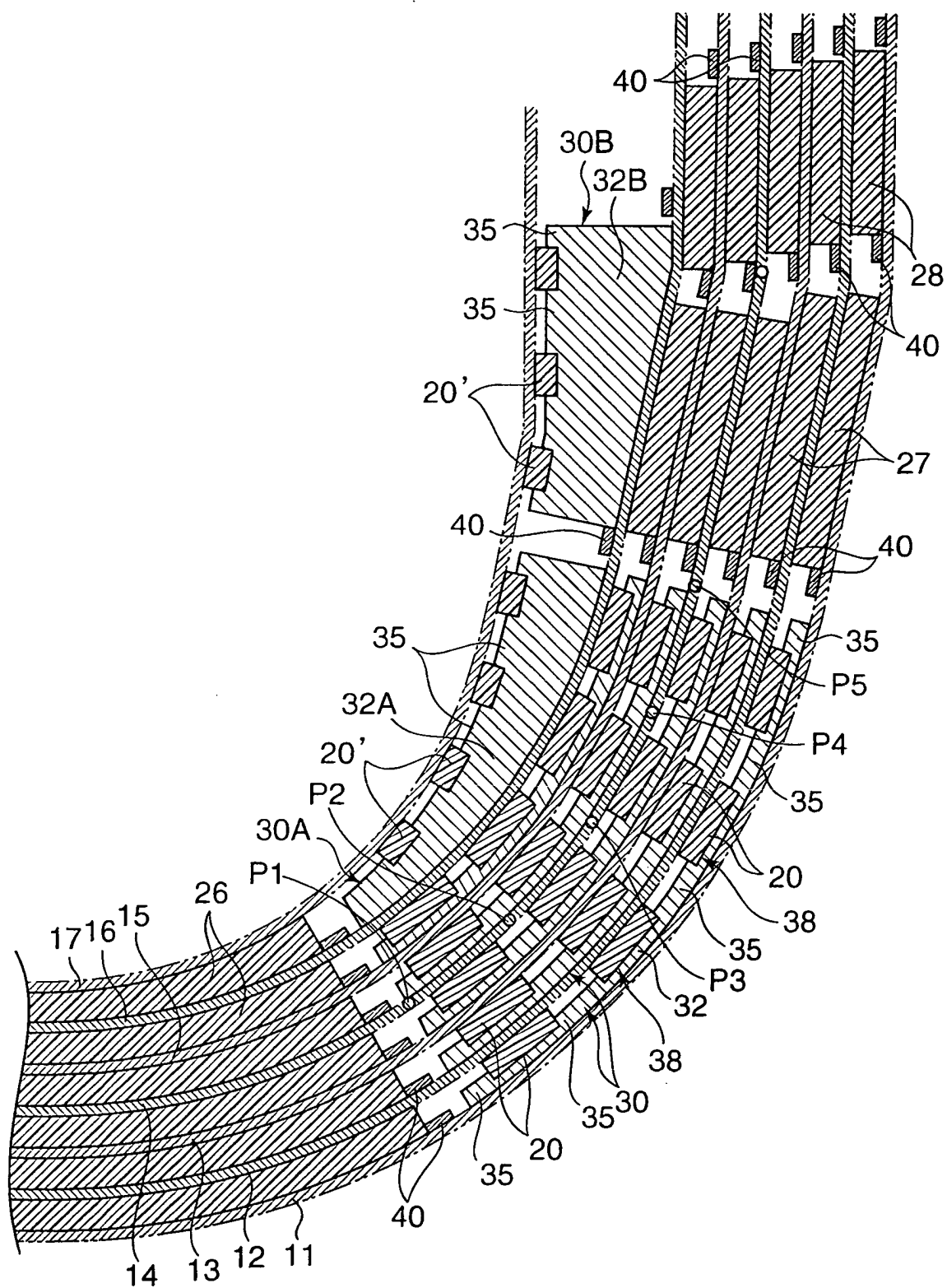


FIG.9

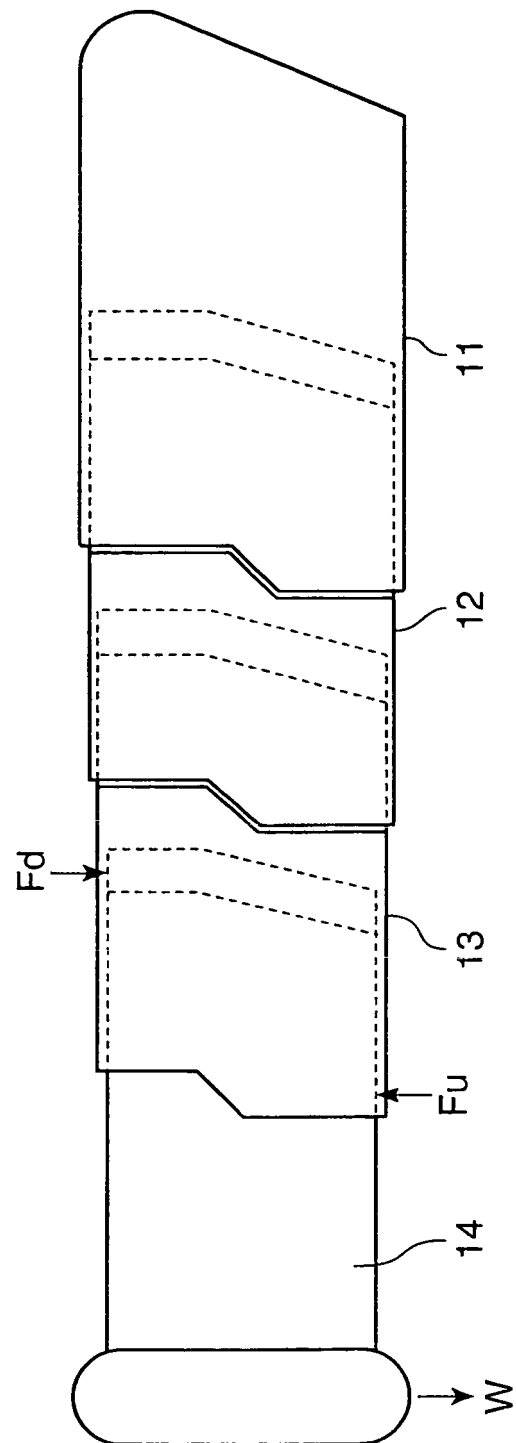
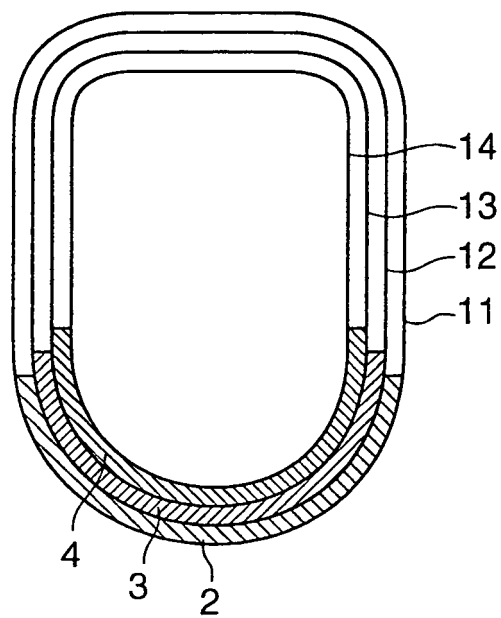


FIG.10



REFERENCES CITED IN THE DESCRIPTION

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