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Description

The present invention relates generally to architecture and more particularly to improvements in the construction of large area glass walls or windows. It concerns a mounting by which glass plates can be connected to a supporting structure. However the mounting of the invention may be utilised in other applications e.g. for mounting other types of plate.

It is a common architectural practice to construct the exterior walls of buildings of toughened glass. Under present manufacturing constraints, the largest practical plate available is of about 2 m width and up to 3 m length. The thickness can vary generally from 6 mm to 16 mm, a common thickness being 12 mm. Such plates are brittle and heavy and the damage resulting from fracture after installation can be very serious. Such plates are normally affixed at their edges to rigid supporting frame members which, however, interrupt the continuity of the facade. Systems have been proposed for avoiding the use of such frames but only through the use of other undesirable constraints. Thus, the present inventors have exhibited a structure designed for interior use where wind force is not a problem and where plates of glass are arranged edge to edge with the edges sealed by a resilient silicone sealant. The plates are supported by rigid mountings secured through bores in the glass plates. It has also been proposed in EP—A—136064 to arrange double glazed panels edge to edge to provide a continuous outer facade. However the necessary reinforcement against bending stresses is provided by the use of fins or other rigid structure extending at right angles to the glass plates and which interrupt vision from the interior. This arrangement also utilises rigid bolts inserted through bores in the glass plates.

The problem of enabling the construction of a continuous wall of glass plates providing an uninterrupted external facade and substantially uninterrupted interior vision is solved in an ingenious manner by means of the invention which enables large glass plates to be suspended in a substantially moment-free manner. The mountings permit sufficient freedom of movement to the plates that reaction to bending forces is not transmitted to the plates from the mountings. Resilient constraints may be provided e.g. by cables under tension to limit the amount of movement within the array and this may be independently controlled.

In accordance with one aspect of the invention there is provided a mounting particularly but not exclusively suitable for the moment-free suspension of plates e.g. of glass comprising a ball member and a socket member joined to permit spherical pivoting motion, the socket member being securable through a bore in the plate with the point of pivot generally in the median plane of the plate, and the ball member having a ball portion rigid with a stem portion which is connectable to a support structure.

The invention includes use of such a mounting for the moment-free suspension of one or more glass plates.

The invention also includes as an aspect an array of glass plates arranged edge to edge and suspended utilising such a mounting in a substantially moment-free manner which permits limited deformation of the array e.g. under wind force.

An embodiment of a mounting according to the invention and of a preferred form of mounting structure is hereafter described with reference to the accompanying drawings in which:

Fig. 1 illustrates in divided cross-section a mounting according to the invention secured to a glass plate,

Fig. 2 is a partly exploded and partly cross-sectional perspective view of part of an array of glass plates according to the invention, and

Fig. 3 is a perspective view further illustrating the manner in which the array is supported.

Turning to Figure 1 there is shown a mounting I comprising a ball member 10 and a socket member 12 joined to permit spherical pivoting motion, the socket member being secured through a bore 19 in a glass plate P with the axis of pivot X generally in the median plane of the plate. The ball member 10 has a ball portion 11 rigid with a stem portion 13 which is connectable to a support structure.

The ball member and socket member are preferably of stainless steel. The ball member may be of 17/4/PH grade and the socket of 306 grade.

The socket portion 12 has an enlarged head 20 having a frustoconical surface 21 designed to seat within a countersink 22 in the exterior surface of the plate P, which countersink extends to a depth less than half the thickness of the plate P. The frustoconical surface 21 joins with a cylindrical surface 23 which is threaded at 24, at the end opposite to the head, to receive a nut 14.

The socket member 12 is separated from the interior bore surface of the plate P by an annular gasket 15 of a material which is softer than that of the socket and plate. This may be a suitably weather-resistant plastics material but is preferably of annealed aluminium e.g. 1008 grade and e.g. 2 to 3 mm thick.

The exterior surfaces of the head 20 and gasket 15 are preferably planar as shown so as to continue the exterior surface 25 of the plate P. As shown it is preferred to form the corresponding surface 26 of the ball portion to be planar also with the head, ball portion and gasket constituting a plane surface which will in use lie flush with the surface 25 of the plate.

The stem portion 13 has its axis Y—Y passing through the point of pivot X and normal to the surface 26. The stem portion 13 of the ball member comprises a flange 27 which connects with the ball portion 11 via a neck 28 which tapers from the flange to the ball portion. The socket portion 12 has an internal surface portion 29 adjacent to the neck which is outwardly flared and spaced from the neck 28 by a gap 18. The tapering

of the neck and the flare of the surface 29 are frustoconical and of differing conical angle so that the bounding surfaces of the gap 18 in the central position of the stem portion are V-shaped in cross section. These surfaces are generally radial to the point X and constitute terminal abutting surfaces defining the limits of pivot.

To provide a degree of resilience in the permitted pivoting motion of the ball member relative to the socket member, a damping ring 17 of resilient material such as rubber is present at least partly within the gap 18 and is secured in position by the flange 27 as illustrated.

The socket member is deformed around the ball portion in known manner. The diameter of the flange 27 is less than the diameter of the cylindrical portion 23 of the socket member so that the unit composed of the ball member and socket member can be inserted through the plate P from the exterior with the gasket 15 in position around the socket member. The unit can then be secured in place by means of the nut 14 to a desired locking pressure. A washer 16 e.g. of plastics is present between the nut 14 and plate P. The gasket 20 extends beyond the thickness of the plate P generally by the thickness of the washer 16. To allow for any possible protrusion of the gasket 20, the nut 14 is countersunk at 30.

A specific mounting will normally be designed for a given thickness of plate to enable the axis of pivot X to lie appropriately close to the median plane of the plate for maximum performance. However small departures e.g. of 1 or 2 mm within a thickness of plate of e.g. 12 mm may be accommodated. The nut 14 is also preferably of stainless steel e.g. of 306 grade.

It will be apparent that the mounting permits the glass plate to pivot within the constraints of the gap 18 so that with the stem portion supported horizontally no moment reaction forces will be transmitted through the plate, so that any bending moment supplied e.g. by wind force will cause the plate to pivot and remain moment-free. To provide lateral movement (along the axis Y—Y) the stem portion 13, e.g. in the case of centrally situated plates of an array, may be supported against a resilient supporting structure formed of pre-stressed cables. The mounting shown is very strong and when constructed generally in the proportions indicated in Figure 1, a column of 2 m × 2 m glass plates may be suspended one from another utilising the mountings at the corners.

Figures 2 and 3 illustrate the manner in which the mountings may be utilised in the support of an array of plates constituting a continuous building wall. This mode of construction has been utilised subsequent to the priority date of this application in the construction of the City of Science and Industry in Paris and a further description will be found in volume 364 (February/March 1986) of the International Review of Architecture and Design ("Techniques & Architecture").

At each intersection between four plates there is provided an H-shaped coupling having a central horizontal strut 40 the ends of which are journalled by means of female bearing members 41 and axle members 42 to upright struts 43. Similar pivot pins 44 journally connect each end of the upright struts 43 to the stem portions 13 of mountings I, the ends of the stem portions 13 being threaded to receive a washer 45 and nut 46.

A central strut 40 has a conical bearing extending towards the interior normal to the plane of the glass to journally receive a damping strut 50.

As shown in Figure 3 the ends of the damping struts 50 are supported against a pre-stressed cable 51 arranged in a bow which is convex from the exterior. A second, oppositely bowed cable 52 connects the struts 50 at intermediate positions. The cables provide a controlled degree of resistence to bowing of the whole array under wind force.

In the building described, square plates of 2 m dimension are arranged in larger squares of four plates by four plates each square being supported from a horizontal beam by a suspension mounting (not shown) at the centre of the upper edge portion of each plate in the upper row which allows the plate to pivot around a point axis similarly to those illustrated. Mountings I as illustrated are arranged at each corner of each plate and are utilised to take the weight of the plates (as well as for bracing as described) except for those in the upper row, which are used only for horizontal bracing. It will be apparent that considerable bowing of each composite panel is permitted under wind force without applying moment forces to the glass at its attachment points.

Claims

1. A mounting (I) particularly but not exclusively suitable for the moment-free suspension of plates e.g. of glass (P) comprising a ball member (10) and a socket member (12) joined to permit spherical pivoting motion, the socket member (12) being securable through a bore (19) in the plate (P) with the point of pivot (X) generally in the median plane of the plate, and the ball member (10) having a ball portion (11) rigid with a stem portion (13) which is connectable to a support structure.

2. A mounting according to claim 1 wherein the socket portion has an enlarged head (20) opposite to the stem portion (13).

3. A mounting according to claim 2 wherein the head and ball portion terminate in a common plane surface (26).

4. A mounting according to claim 3 wherein the stem portion (13) has an axis (Y—Y) passing through the point of pivot (X) and normal to said plane surface (26).

5. A mounting according to any of claims 2 to 4 wherein the head (20) has a frustoconical surface (21) joining a cylindrical surface (23) of the socket portion (12) which is threaded (24) at the end opposite to the head.

6. A mounting according to any of claims 2 to 5 in which the stem portion (13) comprises a flange (27) and a neck (28) tapering from the flange to the ball portion and the internal surface (29) of the socket portion adjacent to the neck is outwardly flared and spaced (18) from the neck and wherein a damping ring (17) of resilient material is present at least partly within such space (18) and secured by said flange (27).

7. A mounting according to any preceding claim wherein said socket member (12) is separated from the bore surface by an annular gasket (15) of material softer than that of the socket member.

8. A mounting according to claim 7 wherein the said gasket is of aluminium.

9. A mounting according to claim 7 or claim 8 wherein said socket member is secured to said plate by a nut (14) having a countersink (30) to receive any protruding part of said gasket (15) and wherein a resilient washer (16) is provided for separating said nut from said plate.

10. Use of a mounting according to any preceding claim in the construction of large area glass walls.

11. An array of glass plates (P) arranged edge to edge to define a wall area, wherein the plates are suspended utilising mountings (I) according to any one of claims 1 to 9 in a substantially moment-free manner which permits limited deformation of the array under wind force.

12. An array according to claim 11 in which the mountings are coupled to a bracing structure formed of pre-stressed cables (51, 52).

Patentansprüche

1. Beschlag (I), insbesondere aber nicht ausschliesslich geeignet für die verwindungsfreie Aufhängung von Platten, beispielsweise aus Glas (P), gekennzeichnet durch ein Kugelelement (10) und ein Hülsenelement (12), die so miteinander verbunden sind, dass sie eine sphärische Drehbewegung zulassen, wobei das Hülsenelement (12) in einer Bohrung (19) in der Platte (P) befestigbar ist, derart, dass der Drehpunkt (X) im wesentlichen in der Mittelebene der Platte liegt, und das Kugelelement (10) einen Kugelteil (11) mit einem starren Stielteil (13) zur Verbindung mit einer Stützkonstruktion aufweist.

2. Beschlag nach Anspruch 1, dadurch gekennzeichnet, dass das Hülsenelement gegenüber dem Stielteil (13) einen vergrösserten Kopf (20) aufweist.

3. Beschlag nach Anspruch 2, dadurch gekennzeichnet, dass der Kopf und der Kugelteil durch eine gemeinsame ebene Fläche (26) begrenzt sind.

4. Beschlag nach Anspruch 3, dadurch gekennzeichnet, dass der Stielteil (13) eine durch den Drehpunkt (X) gehende und auf der genannten ebenen Fläche (26) senkrechte Achse (Y—Y) besitzt.

5. Beschlag nach einem der Ansprüche 2 bis 4, dadurch gekennzeichnet, dass der Kopf (20) eine konische Aussenfläche (21) im Anschluss an eine zylindrische Aussenfläche (23) des Hülsenteils (12) besitzt, wobei letztere an dem dem Kopf entgegengesetzten Ende mit einem Gewinde (24) versehen ist.

6. Beschlag nach einem der Ansprüche 2 bis 5, dadurch gekennzeichnet, dass der Stielteil (13) einen Flansch (27) und einen vom Flansch zum Kugelteil sich verjüngenden Hals (28) besitzt und dass die Innenfläche (29) des Hülsenelements in der Nähe des Halses aufgeweitet ist, und mit diesem einen Zwischenraum (18) bildet, wobei ein Dämpfungsring (17) aus elastischem Material mindestens teilweise in diesem Zwischenraum (18) angeordnet ist und durch diesen Flansch (27) festgehalten wird.

7. Beschlag nach einem der vorangehenden Ansprüche, wobei das genannte Hülsenelement (12) von der Bohrungsfläche durch eine ringförmige Dichtung (15) aus einem Material, das weicher ist, als das des Hülsenelements, beabstandet ist.

8. Beschlag nach Anspruch 7, dadurch gekennzeichnet, dass die Dichtung aus Aluminium besteht.

9. Beschlag nach Anspruch 7 oder 8, dadurch gekennzeichnet, dass das Hülsenelement mittels einer Mutter (14) an der Platte befestigt ist, die eine Ausnehmung (30) zur Aufnahme eines vorstehenden Teils der Dichtung (15) besitzt und dass eine elastische Scheibe (16) zur Trennung der Mutter von der Platte vorgesehen ist.

10. Verwendung eines Beschlages nach einem der vorangehenden Ansprüche bei der Konstruktion grossflächiger Glaswände.

11. Reihenanordnung von Glasplatten (P), die zur Bildung einer Wandfläche Rand an Rand angeordnet sind, wobei die Platten unter Verwendung von Beschlägen (I) nach einem der Ansprüche 1 bis 9 in einer im wesentlichen verwendungsfreien Weise aufgehängt sind, die eine begrenzte Verformung der Anordnung durch Windkräfte zulässt.

12. Reihenanordnung nach Anspruch 11, bei der die Beschläge mit einer Verspannungskonstruktion verbunden sind, die aus vorgespannten Kabeln (51, 52) gebildet ist.

Revendications

1. Attache (I) apte en particulier mais non exclusivement à la suspension sans moment de plaques telles que des plaques de verre (P), comprenant un élément à sphère (10) et un élément creux de réception de sphère (12) reliés l'un à l'autre pour permettre un mouvement de pivotement sphérique, l'élément creux de réception de sphère (12) pouvant être fixé dans un alésage (19) de la plaque (P), le point de pivotement (X) étant généralement dans le plan médian de la plaque, et l'élément à sphère (10) comprenant une portion de sphère (11) d'un seul tenant avec une portion de tige (13) qui peut être reliée à une structure de support.

2. Attache selon la revendication 1, dans laquelle la portion de réception de sphère com-

prend une tête élargie (20) à l'opposé de la portion de tige (13).

3. Attache selon la revendication 2, dans laquelle la tête et la portion de sphère se terminent par une surface plane commune (26).

4. Attache selon la revendication 3, dans laquelle la portion de tige (13) comprend un axe (Y—Y) qui passe par le point de pivotement (X) et qui est perpendiculaire à ladite surface plane (26).

5. Attache selon l'une quelconque des revendications 2 à 4, dans laquelle la tête (20) présente une surface tronconique (21) contiguë d'une surface cylindrique (23) de la portion de réception de sphère (12), qui est filetée (en 24) à l'extrémité opposée à la tête.

6. Attache selon l'une quelconque des revendications 2 à 5, dans laquelle la portion de tige (13) comprend une bride (27) et un collet (28) de forme conique allant en se réduisant depuis la bride vers la portion de sphère, et la surface interne (29) de la portion de réception de sphère qui est adjacente au collet est évasée vers l'extérieur et espacée (en 18) du collet, et dans laquelle un boudin d'amortissement (17) en matériau élastique est présent au moins en partie dans un tel espace (18) et maintenu par ladite bride (27).

7. Attache selon l'une quelconque des revendications précédentes, dans laquelle l'élément creux de réception de sphère (12) est séparé de la surface de l'alésage par un joint annulaire (15) en un matériau plus mou que celui de l'élément creux de réception de sphère.

8. Attache selon la revendication 7, dans laquelle ledit joint est en aluminium.

9. Attache selon la revendication 7 ou la revendication 8, dans laquelle ledit élément creux de réception de sphère est fixé à ladite plaque par un écrou (14) comportant une partie fraisée (30) pour recevoir toute partie en saillie dudit joint (15), et dans laquelle une rondelle élastique (16) est prévue pour séparer ledit écrou de ladite plaque.

10. Utilisation d'une attache selon l'une quelconque des revendications précédentes pour la construction de murs en verre de grande surface.

11. Ensemble de plaques de verre (P) disposées bord contre bord pour définir la surface d'un mur, dans lequel les plaques sont suspendues en utilisant les attaches (I) selon l'une quelconque des revendications 1 à 9 d'une manière sensiblement sans moment qui permet une déformation limitée de l'ensemble sous l'effet de la force du vent.

12. Ensemble selon la revendication 11, dans lequel les attaches sont accouplées à une structure de haubanage formée par des câbles de précontrainte (51, 52).

FIG. 1

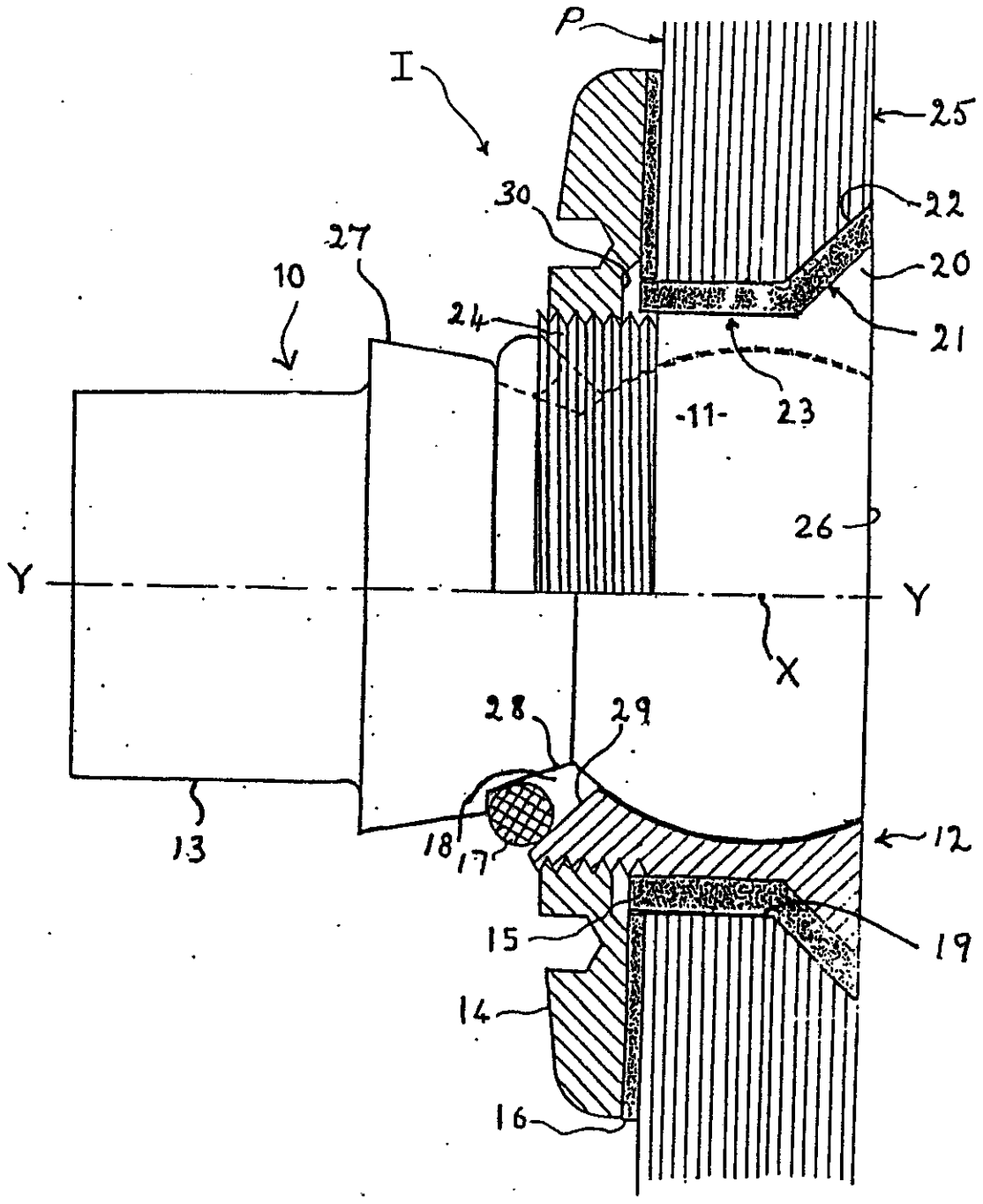


FIG. 2

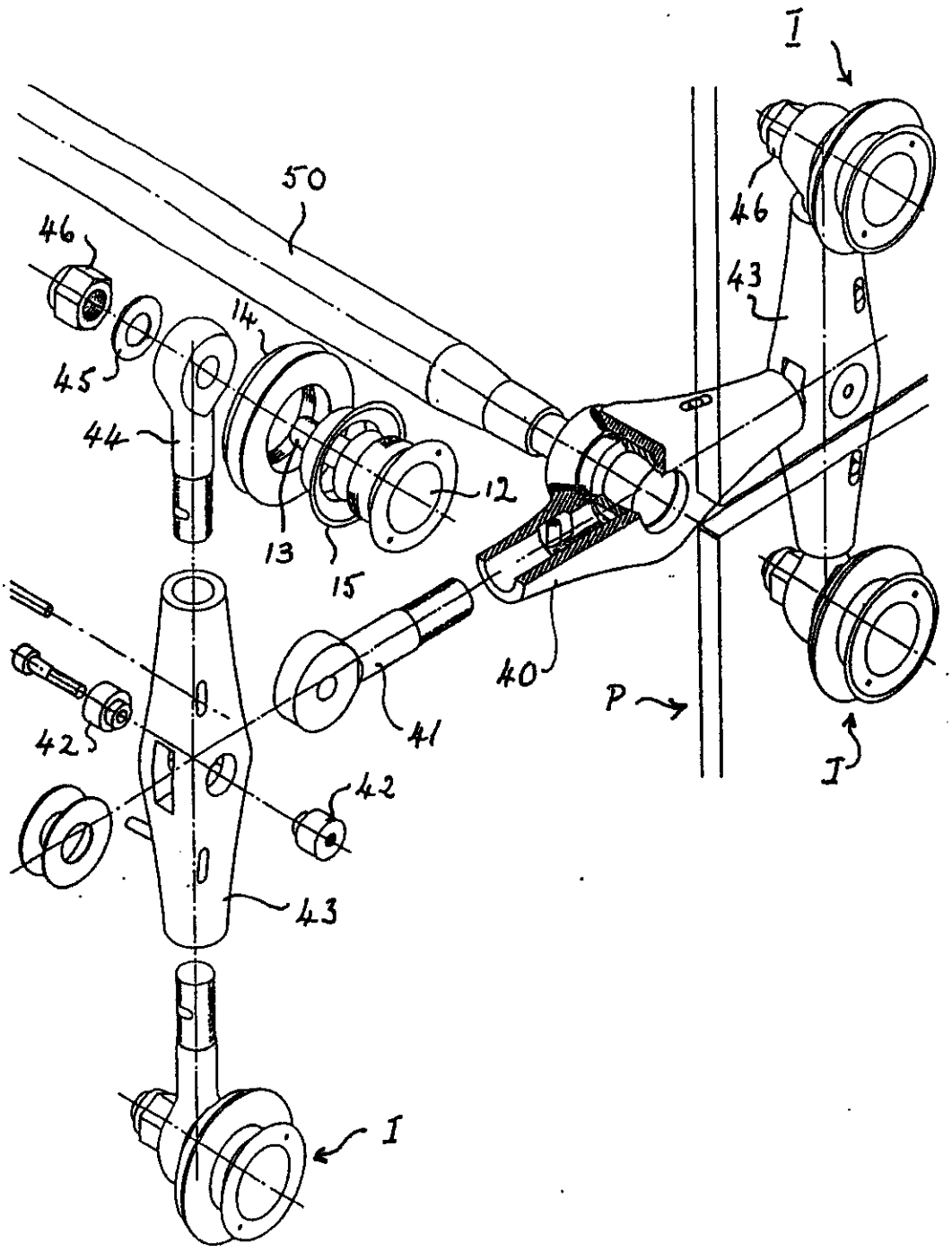
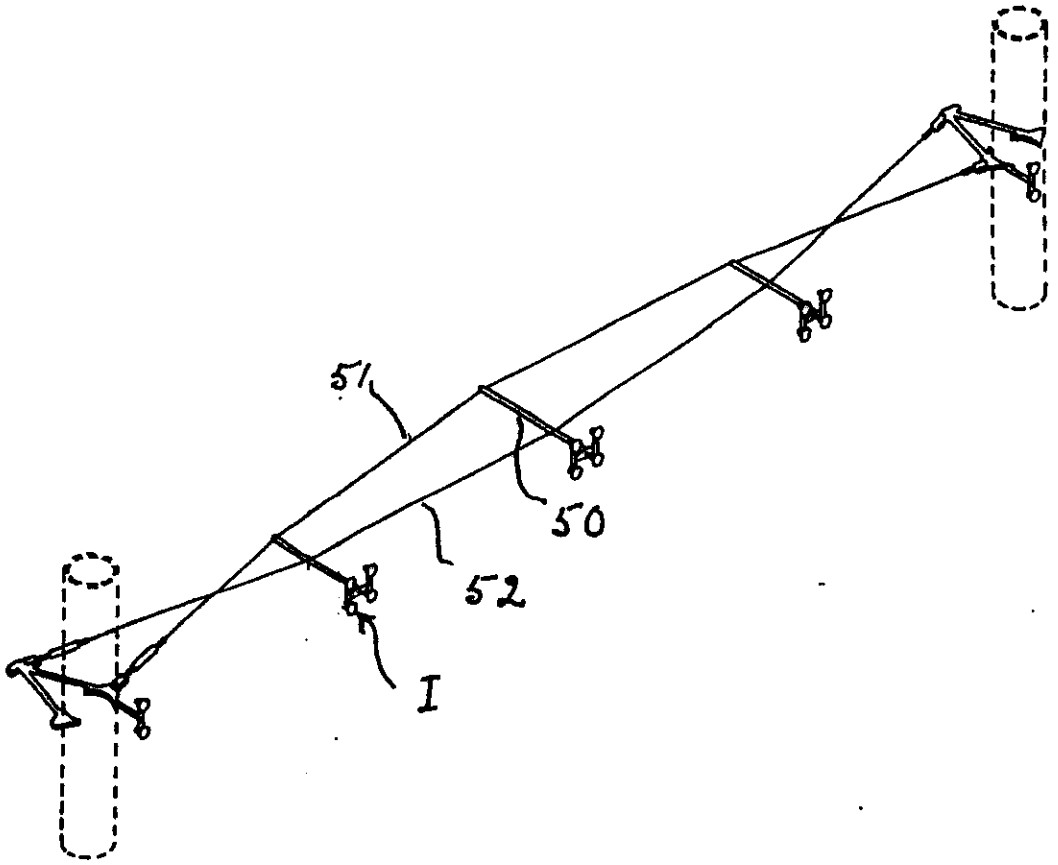


FIG.3



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02.05.1995 LA SOCIETE RFR, 4 Rue Maillard, 75011 Paris, France
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