

1999025 PC

Title: Attachment device for a glass pane at a mounting fixed to a structure

Description

This invention relates to an attachment device for a glass pane at a mounting fixed to a structure, with an outside and an inside clamping element fixing the glass pane between them, and with a spatial articulated support for the attachment device at the inside clamping element.

DE 195 19 527 A reveals a device of the aforementioned species, where a girder connected to a mounting fixed to a structure is supported at a clamping element inside the structure. The support is realised by means of a girder's mounting head flexible elastically supported in a clamping element's mounting chamber in the girder's axial direction, whereby the mounting head is supported in a mounting chamber with additional lateral play, tolerating that the girder, respectively its mounting head, parallel dislocates with regard to the glass pane's plane under the influence of wind pressure. The mounting head's elastic resilience is conceived by means of disc springs or permanently elastic material, which arrangement in the mounting chamber permanently exerts a restoring force on the girder respectively on the glass pane, likewise a positioning of the girder orthogonally with regard to the glass pane, and ultimately results in tension introduced into the glass pane. Moreover, important tolerances between the borehole in the glass pane and the point of connection at the mounting fixed to a structure can not be compensated.

DE 44 00 979 A1 also reveals a device of this species, where the clamping element (locating bearing) inside the structure presents, at the envelope surface oriented towards the mounting, a ball-shaped surface on which leans a compensating part with complement spherical calotte surface. The clamping element is provided with a through borehole for the reception of the clamp screw coupling the clamping elements and of a holding screw penetrating a liner and the compensating part and engaging into the clamping element. Said known device can compensate building tolerances between the borehole in a glass pane and a sub-construction (mounting), a flexible elastic support for the glass pane at the mounting is not provided, once the assembly is finished.

DE 44 45 724 A1 describes a similar device, where a clamping element inside the structure presents a ball-shaped surface at its envelope surface oriented towards the mounting, where a retaining part's pivoting bearing sits close to its complement surface, whereby the pivoting bearing is held with lateral play in a union nut. Once the assembly is finished, no relative motion of the glass pane is possible with regard to the retaining part.

Furthermore a supporting element for a fastening bolt at a suspension device is published by EP 0 784 129 A1, where a plate of the suspension device is clamped between two planoconvex lenses which flat surfaces indirectly abut against the plate, one of the lenses being in abutment with its convex surface at a clamping element inside

the structure, and the other lens being in indirect abutment with a nut receiving the fastening bolt.

When attaching highly sensible glass panes, for example in connection with silicium panes for photovoltaic power production, the previously known attachment devices do not meet the requirements. Already low wind pressure, respectively relatively inferior deformations due to thermal development will lead to breaking the silicium elements and to loosing the proper purpose of the glass pane.

The object of the invention is to improve an attachment device of the before-mentioned species so that on the one hand a stress-free adaptation of the attachment device is possible, taking into account major building tolerances during assembly, and that on the other hand, once the assembly is realised, between the attachment device and the glass pane sufficient elasticity is given, so that wind pressure or thermal stress is absorbed by the attachment device without introducing stress into the glass pane.

The invention solves the problem with the teaching according to claim 1.

Accordingly, an inside clamping element presents, after its envelope surface opposite to the glass pane, a conical or crowned surface built by a permanently elastic spring member, surface against which the complement surface of an internal coupling bell's envelope is adjustable with variable initial tension, whereby between the coupling bell and an attachment bolt on the one hand and an attachment bolt and a mounting on

the other hand respectively one stiffening spatial articulation is arranged.

According to the inventional solution, wind pressure and thermal stress is absorbed by the coupling bell's elastic support at the interior clamping element, as also once the assembly is completed, a relative motion of both parts towards each other is possible without introducing restoring forces into the glass pane. This is guaranteed thanks to the adjustable initial tension between the clamping element and the coupling bell. The repeated partitioning of the attachment device into at least two more spatial articulations not only provides an advantageous adaptation possibility to major building tolerances, but, once rigidly tightened after the assembly is completed, the individual articulated points of the spatial articulation also form so-called system points having a certain self-elasticity, additionally contributing to the stress-free suspension of the glass pane.

Further features of the invention are characterised by the sub-claims.

With regard to one inventional embodiment, on its envelope surface opposite to the glass pane, the interior clamping element itself can present a conical or crowned surface, basically according to claim 1, the conical or crowned surface can be formed by the permanently elastic spring member, even though the clamping element has got a planar execution.

Furthermore, the inside clamping element is provided with a through borehole with female

thread and centring for the reception of a clamp screw linking the clamping elements and a coupling bell regulating screw linking the coupling bell with the inside clamping element, whereby in further execution of the invention the permanently elastic spring member is realised as permanently elastic cushion arranged between the conical or crowned surface of the inside clamping element oriented towards the glass pane and the coupling bell's complement surface. The permanently elastic cushion is fastened by means of the before-described coupling bell regulating screw in a way that not only the permanently elastic cushion itself absorbs stress introduced into the glass pane, but tolerates the coupling bell's relative displacement with regard to the permanently elastic cushion with the result that the glass pane is suspended completely stress-free.

According to one special inventional feature, the coupling bell shows on its side oriented towards the mounting a cylindrical male threaded extension, between which and the coupling bell in the area of the coupling bell's bottom is conformed an inward oriented flange for the support of the coupling bell's regulating screw head. Thus, due to the play provided between the flange and a coupling bell regulating screw's shaft, it is possible to conceive the arrangement of a lens in fact in form of a disc between the flange and the coupling bell regulating screw's head such that the coupling bell regulating screw's shaft can oscillate with regard to the coupling bell. This oscillation is encouraged if the flange's locating face and the lens'

complement surface are conceived conically or crowned. In this case, it has been advantageous to employ a non-metallic lens, for example made of gliding hard rubber. By doing so, in fact an
5 additional spatial articulation has been achieved between the coupling bell and the inside clamping element and therefore the glass pane.

Yet another spatial articulation consists in the fact that the coupling bell extension's fore-part
10 oriented against the mounting is curved like a concave lens, whereby a pot-formed union nut, overlapping the coupling bell extension's male thread, displays an inner pot bottom area curved correspondingly opposite to the coupling bell
15 extension's fore-part, in a way that between the coupling bell extension's fore-part and the union nut's pot-bottom, two convex lenses can be positioned, their flat surfaces being in abutment. Once the assembly is completed, the
20 before-described union nut is able to stiffen said spatial articulation.

In one advantageous inventional embodiment the planoconvex lens sitting close to the union nut's pot-bottom area forms part of a nut receiving the
25 attachment bolt offering the possibility to screw the attachment bolt more or less into the nut with the intention to realise a reduction or extension of the whole attachment device. In order to realise said spatial articulation, the
30 nut's shaft is dimensioned such to pass with play through a borehole in the union nut's pot-bottom.

Yet another spatial articulation can be achieved in said manner in the area of the direct connection of the attachment bolt with the

mounting, in that the attachment bolt passes with play through a borehole in the mounting and the mounting is tightened between a nut and a counter-nut, whereby between the nut and the counter-nut on the one hand and the mounting on the other hand is provided respectively one planoconvex lens abutting with its flat surface against the mounting and the nut and the counter-nut display complementary surfaces with regard to the lens. Here again, it is question of a during assembly adjustable and adaptable and once the assembly is completed, stiffening spatial articulation, whereby a distance sleeve may be used between the last described spatial articulation building the connection to the mounting and the spatial articulation built by the coupling bell and the union nut.

The execution of the clamping element outside the structure fixing the glass pane, is fundamentally arbitrary; it may be conceived as already known as clamping disc or counter-sunk screw without having any influence on the practicable stress-free attachment of the glass pane, thanks to the invention.

Hereinafter the invention is explained in more detail on the basis of different embodiment examples. It shows:

Figure 1: a cross-sectional view of an attachment device.

Figure 2: the cross-sectional view according to figure 1, the glass pane being inclined with regard to the mounting.

Figure 3: the cross-sectional view according to figure 1 with modified outside clamping element.

Figures 4 - 13: details of the interior clamping element, of the coupling bell, of the lens abutting against the screw bell of the coupling bell regulating screw, of the nut receiving the attachment bolt and of the union nut, respectively in perspective and cross-sectional view.

In the drawings, identical components are, where required, specified by the same references.

An attachment device 1 according to figure 1 includes two clamping elements 4 and 5 between which a glass pane 2 is fastened. The glass protection installed in a well-known way and visible in the drawing is not specified in detail. In the embodiment example, the inside clamping element 5 comprises a conical envelope surface 14 to which is annexed a permanently elastic spring member executed as permanently elastic cushion 19 propping up on a projection 53, thus the spring member practically builds the clamping element's 5 proper envelope surface 6. A coupling bell's 10 inner envelope 9 with a complement surface 8 adjoins this envelope surface 6. A clamp screw 17 extends through a through borehole 16 (cf. figures 4 and 5) of the clamping element 5 and links both clamping elements 4 and 5. For this purpose, the through borehole 16 presents a female thread 15. A coupling bell regulating screw 18 engages into the same female thread 15 which screw head 24

leans on a flange 23 of the coupling bell's 10
cylindrical extension 21. A preferably elastic
lens 27 is provided between the flange 23 and the
screw head 24, which lens leans on a flange's 23
5 locating face 28, in a way that at this place a
spatial articulation is realised within the
limits of a play 26, as shown in figure 2. For
this purpose, the lens 27 is equipped with a
complement surface 29. The coupling bell's 10
10 cylindrical extension 21 beginning in the area of
the bottom 22 presents a concave-curved fore-part
30 oriented towards the mounting 3. The inner
pot-bottom area 32 of a union nut 31 has got a
correspondingly opposite curvature, so that two
15 lenses 34 and 35 can be arranged between the
extension's 21 fore-part 30 and a union nut's 31
pot-bottom 39, which lenses' flat surfaces 33
abut and the one loose lens 34 adjoins with its
convex surface the extension's 21 fore-part 30,
20 whereas the second lens 35 forms an integrated
part of a nut 36 receiving the attachment bolt 11
and its convex surface leans on the pot-bottom
39. The nut 36 is provided with a shaft 37
extending with play 40 through a borehole 38 in
25 the union nut 31.

Figure 1 illustrates the situation that, when
screwing the union nut 31 on the coupling bell 10
by means of an exterior thread 20 in the area of
the extension 21, a generally with 12 specified
30 spatial articulation built by both lenses 34 and
35 can be stiffened. The nut 36 (cf. figures 10
and 11) has got a pocket borehole 51 with a
female thread 50 into which the attachment bolt
11 can be screwed, whereby wrench areas 52 area
35 included on the exterior envelope of the nut 36.

Figure 1 shows furthermore that in this embodiment, a distance sleeve 49 is annexed to the nut 36, which sleeve itself leans on a nut 43 fastening the mounting 3. Between the nut 43 and a counter nut 44 are provided lenses 46 and 47 abutting against complement locating faces 48 of the nut 43 respectively the counter nut 44. The lenses' 46 and 47 flat surfaces 45 directly adjoin the mounting 3. As an attachment bolt 11 extends with play 42 through a mounting's 3 borehole 41, here again is realised a spatial articulation specified with 13, by which building tolerances can be compensated.

Figure 2 illustrates the possible inclination of the glass pane 2 with regard to the mounting 3, with correspondingly adjusted spatial articulations 12 and 13 and correspondingly angled in the area of the coupling bell regulating screw's 18 shaft 25 on the one hand with regard to the coupling bell 10 and on the other hand with regard to the union nut 31. It is visible that a coupling bell's 10 displacement with regard to a permanently elastic spring member 7 has taken place. That means, here a non-stiffening spatial articulation has been realised. The permanently elastic spring member's 7 position is unchanged with regard to the clamping element 5 due to leaning on the projections 53.

The embodiment example according to figure 3 corresponds in its essential components to the embodiment example according to figure 1, whereby in contrast to figure 1 the outside clamping element 4 is executed as countersunk screw.

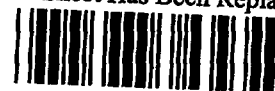
The above described attachment device is thus suitable to maintain the glass panes' 2 elasticity, as it does not impede their freedom of motion and thus neutralises forces. The
5 inventional attachment device means adaptation to the structural facts and thus not rigidity of the material glass, which forcibly leads to its destruction, as it is the case in the summoned state of the art.

10 For any application of punctiform suspended glass panes, whether inside or outside, whether with or without voltaic cells, the attachment device is suitable for stress-free assembly and also for stress-free permanent operation.

References:

- 1 attachment device
- 2 glass pane
- 3 mounting fixed at the structure
- 5 4 clamping element
- 5 clamping element
- 6 envelope surface
- 7 permanently elastic spring member
- 8 complement surface
- 10 9 inner envelope
- 10 coupling bell
- 11 attachment bolt
- 12 spatial articulation
- 13 spatial articulation
- 15 14 envelope surface
- 15 female thread
- 16 through borehole
- 17 clamp screw
- 18 coupling bell regulating screw
- 20 19 permanently elastic cushion
- 20 exterior thread
- 21 cylindrical extension
- 22 bottom
- 23 flange
- 25 24 screw head
- 25 shaft
- 26 play
- 27 lens
- 28 locating face
- 30 29 complement surface
- 30 fore-part
- 31 union nut
- 32 internal pot bottom area
- 33 flat surface
- 35 34 lens

	35	lens
	36	nut
	37	shaft
	38	borehole
5	39	pot bottom
	40	play
	41	borehole
	42	play
	43	nut
10	44	counter nut
	45	flat surface
	46	lens
	47	lens
	48	complement locating face
15	49	distance sleeve
	50	female thread
	51	pocket borehole
	52	wrench areas
	53	projection



Patent Claims

1. Attachment device for a glass pane at a mounting fixed to a structure with one outside and one inside clamping element fastening the glass pane between them and a spatial articulated support of the attachment device at the inside clamping element, characterised in that the inside clamping element (5), on its envelope surface (6) opposite to the glass pane (2), presents a conical or crowned surface (envelope surface 6) built by a permanently elastic spring member (7) against which surface a coupling bell (10) interior envelope's (9) complement surface (8) is adjustable with adaptable initial tension in a way that between the coupling bell (10) and an attachment bolt (11) and the mounting (3) respectively one stiffening spatial articulation (12, 13) is arranged.
2. Attachment device according to claim 1, characterised in that the inside clamping element (5) presents on its envelope surface (14) opposite to the glass pane (2) a conical or crowned surface (envelope surface 14).
3. Attachment device according to claims 1 and 2, characterised in that the inside clamping element (5) presents a through borehole (16) with centring and female thread (15) for the reception of a clamp screw (17) connecting the clamping elements (4, 5) and a coupling bell regulating screw (18) uniting the





coupling bell (10) with the inside clamping element (5).

4. Attachment device according to claims 1 and 2, characterised in that a permanently elastic cushion (19) is placed between the interior clamping element's (5) conical or crowned surface opposite to the glass pane (2) and the coupling bell's (10) complement surface (8).

5. Attachment device according to any of the claims 1 to 4, characterised in that the coupling bell (10) on its side oriented towards the mounting (3) presents a cylindrical extension (21) with exterior thread (20) between said extension and the coupling bell (10) in the area of the coupling bell's (10) bottom (22) is conformed an inward oriented flange (23) to support the screw head (24) of the coupling bell regulating screw (18).

6. Attachment device according to claim 5, characterised in that a play (26) is designed between the coupling bell regulating screw's flange (23) and a shaft (25).

7. Attachment device according to claims 5 and 6, characterised in that a disc (lens) (27) is arranged between the flange (23) and the coupling bell regulating screw's (18) screw head (24).

8. Attachment device according to claims 5 to 7, characterised in that a locating face (28) of the flange (23) and a complement





surface (29) of the disc (lens) (27) describes a conical or crowned form.

9. Attachment device according to claim 5, characterised in that a fore-part (30) of the coupling bell's (10) extension (21) is oriented towards the mounting (3) and curved concave lens-shaped.

10. Attachment device according to any of the claims 1 to 9, characterised in that a pot-like union nut (31) overlapping the exterior thread (20) of the coupling bell's (10) extension (21), which union nut's inner pot bottom area (32) displays a curvature opposite with regard to the fore-part (30) of the coupling bell's (10) extension (21).

11. Attachment device according to claim 10, characterised in that between the fore-part (30) of the coupling bell's (10) extension (21) and the union nut's (31) pot bottom area (32) are arranged two planoconvex lenses (34, 35) abutting with their flat surfaces (33).

12. Attachment device according to claim 11, characterised in that the planoconvex lens (35) abutting against the union nut's (31) pot bottom area (32) forms one component of a nut (36) receiving the attachment bolt (11).

13. Attachment device according to claim 12, characterised in that a shaft (37) of the nut (36) extends with play through a borehole (38) in the pot bottom (39) of the union nut (31).





1999025 PC

- 17 -

14. Attachment device according to any of the claims 1 to 13, characterised in that the attachment bolt (11) extends with a play (42) through a borehole (41) in the mounting (3) and the mounting (3) is positioned between a nut (43) and a counter nut (44), whereby on the one hand between the nut (43) respectively the counter nut (44) and on the other hand the mounting (3), in each case is provided one planoconvex lens (46, 47) abutting with its flat surface (45) against the mounting and the nut (43) and the counter nut (44) are designed to present a complement locating face (48) with regard to the lens (46, 47).

15. Attachment device according to any of the claims 1 to 14, characterised in that a distance sleeve (49) is arranged between the nut (36) receiving the attachment bolt (11) and the nut (43) retaining the mounting (3).

16. Attachment device according to any of the claims 1 to 15, characterised in that the outside clamping element (4) is designed as clamping disc.

17. Attachment device according to any of the claims 1 to 15, characterised in that the outside clamping element (4) is designed as countersunk screw.



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