

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

Description

5 This invention relates to an attachment device for a glass pane, presenting at least one unifacial voltaic cell with wires conducting the current, at a mounting fixed to a structure with an outside and inside clamping element fixing the glass pane between them, and with a support for the attachment device at the inside clamping element.

10 DE 195 19 527 A reveals a spatial articulated support for an attachment device, 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

15 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.

20 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

25 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.

30 DE 44 00 979 A1 also reveals a spatial articulated support, 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
5 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
10 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 hold 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
15 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
20 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.

The publication DE 296 178 70 U1 describes a solar façade panel also suitable for roof covering and comprising a façade
25 element with integrated photovoltaic solar panel. For current conduction, each façade panel is equipped with contact points connectable to a common line.

The EP 0 417 303 A1 deals with a roof-mountable installation
30 for solar power production, which conception includes an adaptation possibility to process tolerances of the roof or to thermal stress introduced into the roof, especially for bridging the roof ridge. Current drain is not the subject of the application; this is obviously realised by means of a line
35 passing through the roof as usually done with solar cells.

When attaching highly sensible glass panes, for example in connection with silicium panes for photovoltaic power production, the before-mentioned 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.

Another object of the invention is to provide an optimum conduction of electric current for a glazing structure at least partially built with glass panes including voltaic cells.

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 and the current conducting lines pass through the attachment device.

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.

In this case, the attachment device performs a double function, as the current is conducted through the attachment device, no special collector components are required.

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

With regard to one inventive 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.

5 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
10 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.
15 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 additional spatial articulation has been
20 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 oriented against the mounting is curved like a concave lens, whereby a pot-formed
25 union nut, overlapping the coupling bell extension's male thread, displays an inner pot bottom area curved correspondingly opposite to the coupling bell 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
30 positioned, their flat surfaces being in abutment. Once the assembly is completed, the 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
35 of a nut receiving the 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 nut's shaft is dimensioned such to pass with play through a borehole in the union nut's pot-bottom.

5 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
10 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
15 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.

20 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.

25 According to the invention, the wires of at least one voltaic cell conducting the current pass through the attachment device.

Advantageously it is provided for that the attachment device comprises two coupling, preferably screwable, holding discs between which the glass pane is hold, whereby the current
30 conduction can radially enter between the holding discs and axially exit at one holding disc. In order the wires for the current conduction pass without any problem through the glass pane holder, in one inventional embodiment, the holding discs are screwed by means of separate screws preferably arranged
35 in the area of cylindrical extensions. Advantageously the wires

inside the glass pane are made of flat metal strands, which in the area of the holding disc are connected to round wire or standard wire by means of connector assemblies. The current is conducted to the building via the round or standard wires.

5 To prevent the wires in the connector area from oxidation, in the inventional embodiment the aperture is filled in with non-conductive synthetic material, wax or the like and the wires are embedded in this material. Advantageously, the synthetic material is polyurethane.

10 In further execution of the invention, it is conceived that an attachment device with the structural characteristics of claim 1 presents a coupling bell regulating screw and a floating screw that is fastened by the union nut and connectable with the attachment bolt, presenting respectively a through borehole
15 with centring namely for the reception of a flexible tube receiving the line conducting the current.

An insulator is in this case advantageously mounted in a hole-type aperture in the glass pane, where the wires of the voltaic cells are combined with the sheathed flexible cables. The
20 insulator displays two through boreholes for the penetration of screws connecting the glass pane with the clamping element inside the structure, whereby at least two radial slot openings and thereto connected axial guiding channels are provided for the connection of the current carrying lines. According to
25 another inventional characteristic, in the radial slot openings are positioned springy elastic contact pieces having a leg that contacts the voltaic cells' wires. The insulator is fixed by means of clamp screws in the glass pane's hole-type aperture between the clamping element inside the structure and a cone
30 nut.

In another execution example with the structural characteristics of claim 1, the clamping element inside the structure shows an axial opening for the torsion-resistant
35 reception of an insulating cage serving to electrically connect the voltaic cells with the lines of a flexible tubing passing through the clamping element inside the structure.

Hereinafter the invention is explained in more detail on the basis of different embodiment examples. Figures 1 to 13 diagrammatically represent the attachment device's stress-free adaptation, not showing the current conduction. It shows:

5 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.

10 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.

20 The figures 14 to 22 diagrammatically represent the current conduction, not showing the stress-free adaptation of the attachment device.

Figure 14: a lateral view of an inventional attachment device.

Figure 15: a top view of the exterior holding disc of the attachment fitting.

25 Figure 16: a sectional view taken along line A-A of figure 15.

Figure 17: a sectional view taken along line B-B of figure 16.

Figure 18: a lateral view of a cover.

30

Figure 19: an axial sectional view of an attachment bolt.

Figure 20: a sectional view analogous to figure 16 according to another intentional embodiment.

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Figure 21: a sectional view taken along line B-B according to figure 20.

Figure 22: a top view of the intentional glass pane.

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The figures 23 to 46 illustrate one embodiment of the stress-free attachment device's adaptation while using the essential components of the embodiment according to figure 1 with a passage for the current conducting wires through the attachment device.

Figure 23: a vertical sectional perspective view of the attachment device.

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Figure 24: a vertical sectional view represented offset by 90° with regard to figure 23.

Figure 25: a vertical sectional view according to figure 23.

Figure 26: an enlarged top view on the insulator.

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Figure 27: a sectional view taken along line A-A according to figure 26.

Figure 28: a perspective view of the insulator.

Figure 29: an enlarged detailed representation of the current drain.

Figure 30: an enlarged top view of the contact piece.

25

Figure 31: a lateral view of the contact piece.

Figure 32: a perspective view of the contact piece.

Figure 33: a top view of the insulator according to figure 26.

30

Figure 34: a sectional view taken along line A-A according to figure 33.

Figure 35: a perspective view of the insulator with connected shrinkdown tubing.

Figure 36: a perspective vertical sectional view of the insulator with connected shrinkdown tubing.

5 The figures 37 to 53 represent another embodiment of the attachment device's stress-free adaptation while using the essential components of the embodiment example according to figure 1 with another execution of a passage for the current conducting wires through the attachment device.

10 Figure 37: a vertical sectional view of the attachment device in perspective representation.

Figure 38: a vertical sectional view according to figure 37.

15 Figure 39: a top view of the clamping element inside the structure.

Figure 40: a sectional view taken along line A-A according to figure 39.

Figure 41: a perspective representation of the clamping element inside the structure.

20 Figure 42: a top view of the cage.

Figure 43: a sectional view taken along line A-A according to figure 42.

Figure 44: a perspective view of the cage.

25 Figure 45: a top view of the cage with connected shrinkdown tubing.

Figures 46 + 47: two views of the cage construction unit.

Figure 48: a perspective representation of the cage with shrinkdown tubing.

30 Figure 49: a perspective representation of the clamp screw.

Figures 50 + 51: two views of the contact piece.

Figure 52: a perspective representation of the contact piece.

Figure 53: a detail of the current passage.

5 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
10 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
15 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
20 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 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
25 purpose, the lens 27 is equipped with a complement surface 29. The coupling bell's 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 lenses 34 and 35 can be arranged
30 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, whereas the second lens 35 forms an
35 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 the union nut 31.

5 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 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
10 area 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
15 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, which is able to compensate building tolerances.
20

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
25 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
30 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.

35 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.

5 The axial opening is slot-type executed as to torsion-resistingly place a fork-like section of the insulating cage in the slot aperture. Another annular section of the insulation cage is hold in an hole-type opening of the glass pane and presents grooves oriented towards the wires of the voltaic cells in which grooves are positioned - preferably spring loaded - contact pieces connected with the wires of a flexible tubing.

10 The insulating cage is fastened between a clamp screw that fixes the glass pane and the clamping element inside the structure, whereby an insulating ring is provided between the clamp screw and the contact pieces respectively the wires of the voltaic cells. The flexible tubing stretches, as already
15 described, through the clamping element inside the structure and through the floating nut, whereby, preferably in the area of the mounting fixed to the structure, another stiffening spatial articulation is conceived through which passes the flexible tubing.

20 According to the invention, glass panes 101 are generally mounted on framework as glazed façades to a building front wall.

The glass pane 101, according to the invention in the embodiment shown, includes two individual panes 102, 103
25 glued together comprising between them several voltaic cells 104. The voltaic cells 104 are equipped with wires respectively connected to wires, through which the current from the voltaic cells 104 is conducted. In the embodiment example, the wires are made from flat metal strands 105.

30 The glass pane 101 comes with several hole-type apertures 106 in which area the attachment device 107 is positioned. The attachment device 107 includes an interior holding disc 108 oriented towards the glass pane and an opposite exterior holding disc 109. In the embodiment example, three separate
35 bolts 110 screw the holding discs 108, 109 together. The bolts

110 are hold in female threads 111 in the holding disc 108 and extend through holes in the holding disc 109.

Both holding discs 108, 109 are provided with cylindrical extensions 113, 114 which extend into the glass pane's 101 aperture 106 and in which area the bolts 110 are arranged.

Separate washers 115, for example made from rubber or plastic material, are inserted between the glass pane 101 and the holding discs 108, 109.

The exterior holding disc 109 has got an opening 117 in its center. The opening 117 is equipped with a female thread into which engages a counter-thread of a bolt-type projection 118 conformed to the cover cap 116.

During the installation of the glass pane 101, both holding discs 108, 109 are fixed and mounted together with the glass pane 101 by means of an attachment bolt 120 to framework or the like. Subsequently, the couplings 125 connect metal strands 105 and cables 124, which together with the wires form the current conduction. The couplings 125 are preferably executed as plug connectors. Nevertheless it may also be a welded connection.

In the embodiment example according to figure 16, there is an interior holding disc 108 that is oriented towards the structure and provided with an oblong hole through which extends the attachment bolt 120. The attachment bolt 120 shows a head piece 121 leaning on a holding face 122 of the holding disc 108 and retaining the latter in clamping manner. A hexagon socket 127 or the like is formed in the head piece 121 by which the attachment bolt 120 is screwed. With regard to the attachment bolt 120, the holding disc 108 is displaceable over the oblong hole's 119 length, thus compensating assembly tolerances.

The attachment bolt 120 is conceived as hollow cylinder and with an axial continuous opening 123, through which extend the cables 124 connected inside the aperture 106 via couplings 125 to the wires 105 and which built together with

the latter the wires conducting the current from the voltaic cells 104.

5 In the execution example according to figure 20 an attachment bolt 120 is screwed into a female thread 126 in the holding disc 108. The attachment bolt 120 in this embodiment displays at the rear end a hexagon socket 127 or the like, allowing to engage a hexagon socket screw key.

10 To avoid oxidation of the wires built by metal strands and the cables 124 conducting the current in the area of the couplings 125, the apertures 106 are preferably filled in with a material of low electrical conductivity, for example wax or a synthetic material, like polyurethane.

15 The wires conducting the current radially enter the attachment fittings 107 between the holding discs 108, 109 and axially exit through the interior holding disc 108 and the attachment bolt 120. For this reason, there are no optical unpleasant connections; furthermore the connectors are protected against damage.

20 In the embodiment example according to figures 23 to 36, an attachment device 201 clamping a glass pane 202 exhibits a coupling bell regulating screw 203 provided with a through borehole 206 with centring. In the same way, a floating screw 205 presents a through borehole 206. The coupling bell regulating screw fastens, likewise described in figure 1, a clamping element 214 inside the structure with a coupling bell 222. The through borehole 206 with centring is penetrated for example by a shrinkdown tubing 208 or insulating tube, which in focal plan in the upper part (cf. figure 25) connects to an insulator 210. The wires 207 passing through the shrinkdown tubing 208 lead as far as into the insulator 210 and are at this place connected via clips 219 at the contact pieces 218 to the wires 211 of the voltaic cells 212. The insulator 210 is arranged in a hole-type aperture 209 in the glass pane 202, fastened by means of clamp screws 215 extending through the through boreholes 213 in the insulator 210 and into the 35

clamping element 214 inside the structure, and is positioned between the clamping element 214 and a cone nut 221. The insulator 210 itself displays radial slot openings 216 and axial guiding channels 217, whereby contact pieces 218 are arranged in the radial slot openings 216 which pieces' legs 220 touch and thus contact the wires 211 of the voltaic cells 212.

In the execution example according to figures 37 to 53, an attachment device 301 clamping a glass pane 314 presents a clamping element 302 inside the structure, which is executed with an axial opening 303 into which a clamp screw 315 centrally engages by means of a thread 318. The axial opening has got a slot-type form and serves to torsion-resistingly receive a fork-like section 310 of the insulating cage 307, which is positioned with its annular section 309 that protrudes over the clamping element 302 to the exterior, in an aperture 308 of the glass pane 314. The insulating cage has got grooves 312 oriented towards the wires 311 of the voltaic cells 304 in which grooves - preferably spring loaded - are positioned annular contact pieces 313 establishing the electric contact between the wires 311 of the voltaic cells 304 and the wires 305 of the shrinkdown tubing 306. An insulating ring 316 is intended between the clamp screw 315 and the contact pieces 313 respectively the wires 311 of the voltaic cells 304. Via a tenon-like extension 317 of the insulating cage 307, the shrinkdown tubing 306 is detachably linked to the latter.

The above described attachment device 301 is thus suitable to maintain the glass panes' 2, 314 elasticity, as it does not impede their freedom of motion and thus neutralises forces. The 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. Furthermore the optimum conduction of generated power without requiring separate ductwork is made possible.

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
40	39	pot bottom
	40	play

	41	borehole
	42	play
	43	nut
	44	counter nut
5	45	flat surface
	46	lens
	47	lens
	48	complement locating face
	49	distance sleeve
10	50	female thread
	51	pocket borehole
	52	wrench areas
	53	projection
	101	glass pane
15	102	individual pane
	103	individual pane
	104	voltaic cells
	105	metal strands
	106	hole-type aperture
20	107	attachment device
	108	holding disc
	109	holding disc
	110	bolts
	111	female thread
25	112	borehole
	113	cylindrical extension
	114	cylindrical extension
	115	seal
	116	cover cap
30	117	opening
	118	projection
	119	oblong hole
	120	attachment bolt
	121	head piece
35	122	holding surface
	123	opening
	124	cable
	125	coupling
	126	female thread
40	127	hexagon socket
	201	attachment device

	202	glass pane
	203	coupling bell regulating screw
	204	union nut
	205	floating screw
5	206	through borehole with centering
	207	wire (sheathed flexible cable)
	208	shrinkdown tubing
	209	hole-type aperture
	210	insulator
10	211	wire
	212	voltaic cells
	213	through boreholes
	214	clamping element inside the structure
	215	clamp screw
15	216	radial slot opening
	217	axial guiding channel
	218	contact piece
	219	clips
	220	leg
20	221	cone nut
	222	coupling bell
	301	attachment device
	302	clamping element inside the structure
	303	axial opening
25	304	voltaic cells
	305	wires of the shrinkdown tubing
	306	shrinkdown tubing
	307	insulating cage
	308	aperture
30	309	annular section
	310	fork-like section
	311	wire
	312	grooves
	313	contact pieces
35	314	glass pane
	315	clamp screw
	316	insulation
	317	tenon-like extension
	318	thread



THIS SHEET HAS BEEN
REPLACED

Patent Claims

1. Attachment device for a glass pane, including at least one uniaxial voltaic cell with wires conducting the current, at a mounting fixed to a structure with one outside and one inside clamping element fastening the glass pane between them and a 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, 101, 202, 314), 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 attachment bolt (11) and the mounting (3) respectively one stiffening spatial articulation (12, 13) is realised and that the wires conducting the current pass through the attachment device (1, 107, 201, 301).
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).

5 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).

10 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).

15 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).

20 25 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).

30 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.

35 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.



18. Attachment device according to any of the claims 1 to 17, characterised in that the current conducting wires of at least one voltaic cell (104) extend through the attachment device (107, 201, 301).
- 5 19. Attachment device according to any of the claims 1 to 18, characterised in that the sheet voltaic cell (104) is or several sheet voltaic cells (104) are inserted between two individual panes (102, 103) of the glass pane (101).
- 10 20. Attachment device according to any of the claims 1 to 19, characterised in that the attachment device (107) includes two holding discs (108, 109) that can be coupled preferably screwed, fixing between them the glass pane (101), whereby the wires conducting the
15 current radially enter between the holding discs (108, 109) and axially exit at one of the holding discs (108).
21. Attachment device according to any of the claims 1 to 20, characterised in that each holding disc (108, 109) presents a cylindrical extension (113, 114) stretching
20 out into an aperture (106) of the glass pane (101).
22. Attachment device according to any of the claims 1 to 21, characterised in that the holding discs (108, 109) are screwed by means of separate bolts (110) which are preferably arranged in the area of the cylindrical
25 extension (113, 114).
23. Attachment device according to any of the claims 1 to 22, characterised in that the wires conducting the current present couplings (125) in the area of the holding discs (108, 109).
- 30 24. Attachment device according to claim 23, characterised in that the wires conducting the current from the voltaic cells (104) inside the glass pane (101) are made of flat metal strands (105) which are connected by means of couplings (125) to cables (124), round wires
35 respectively standard wires.



25. Attachment device according to claims 23 or 24, characterised in that the couplings (125) are executed as connectors.
- 5 26. Attachment device according to any of the claims 1 to 25, characterised in that one of the holding discs (108) is retained by an attachment bolt (120) executed as hollow cylinder and through which pass the cables (124) of the wires conducting the current from the voltaic cells (104).
- 10 27. Attachment device according to claim 26, characterised in that the attachment bolt (120) holds the holding disc (108) in a clamping manner.
28. Attachment device according to claim 27, characterised in that the attachment bolt (120) extends through an oblong hole (119) of the holding disc (108).
- 15 29. Attachment device according to any of the claims 1 to 28, characterised in that one of the holding discs (109) presents an axial opening (117) covered by a cap (116).
- 20 30. Attachment device according to claim 29, characterised in that the opening (117) is equipped with a female thread into which a bolt-like projection (118) of the cap (116) is screwable.
- 25 31. Attachment device according to any of the claims 1 to 30, characterised in that the aperture (106) is filled in with an insulating synthetic material, wax or the like and the wires are embedded into this material.
32. Attachment device according to claim 31, characterised in that polyurethane is used as synthetic material.
- 30 33. Attachment device according to any of the claims 1 to 32, characterised in that the attachment bolt (120) is designed with a hexagon socket (127).
34. Attachment device according to any of the claims 1 to 33, characterised in that a coupling bell regulating



5 screw (203) and a floating screw (205), that is fastened by a union nut (204) and can be connected to the attachment bolt, presents a through borehole (206) with centring for the reception of a flexible tubing (shrinkdown tubing 208) with a sheathed flexible cable (207) conducting the current.

10 35. Attachment device according to any of the claims 1 to 34, characterised in that an insulator (210) is arranged in a glass pane's (202) hole-type aperture (209) and that the wires (211) of the voltaic cells (212) are connected to the sheathed flexible cables (207) inside the insulator (210).

15 36. Attachment device according to any of the claims 1 to 35, characterised in that the insulator (210) is provided with two through boreholes (213) for the penetration of the clamp screws (215) fastening the glass pane (202) with a clamping element (214) inside the structure.

20 37. Attachment device according to any of the claims 1 to 36, characterised in that the insulator (210) presents at least two radial slot openings (216) and axial guiding channels (217) are connected to the respective radial slot opening (216) for the reception of the electrical wires (207, 211).

25 38. Attachment device according to any of the claims 1 to 37, characterised in that springy elastic current collectors (contact piece 218) are installed in the radial slot openings (216).

30 39. Attachment device according to any of the claims 1 to 38, characterised in that the insulator (210) can be fastened between the clamping element (214) inside the structure and a cone nut (221) fixing the glass pane (202).

35 40. Attachment device according to any of the claims 1 to 39, characterised in that a clamping element (302) inside the structure presents an axial opening (303) for



the torsion resistant reception of an insulating cage (307) serving to establish the electrical connection of voltaic cells (304) with the wires (305) of a flexible tubing (shrinkdown tubing 306) extending through the clamping element (302) inside the structure.

41. Attachment device according to any of the claims 1 to 40, characterised in that the insulating cage (307) consists of an annular section (309) retained in a glass pane's (314) hole-like aperture (308) and of a fork-like section (310) retained in the clamping element (302) inside the structure.

42. Attachment device according to any of the claims 1 to 41, characterised in that grooves (312), open towards the wires (311) of the voltaic cells (304), are arranged in the annular section (309) of the insulating cage (307).

43. Attachment device according to any of the claims 1 to 42, characterised in that contact pieces (313) are arranged in the grooves (312) adjoining the voltaic cell's (304) wires (311) and connecting with the wires (305) of the flexible tubing (shrinkdown tubing 306).

44. Attachment device according to claims 42 and 43, characterised in that the contact pieces (313) are spring loaded against the wires (311) of the voltaic cells (304).

45. Attachment device according to any of the claims 1 to 44, characterised in that the glass pane (314) is fastened between a clamp screw (315) outside the structure and the clamping element (302) inside the structure and an insulating ring (316) is arranged between the clamp screw (315) and the contact pieces (313).

46. Attachment device according to any of the claims 1 to 45, characterised in that the flexible tubing (shrinkdown



tubing 306) clips on a tenon-like extension (317) of the insulating cage's (307) fork-like section (310).