

Coupling device for building facades or windows

The present invention relates to a coupling device for the construction of facades or windows of buildings, comprising at least one longitudinal or transverse support on a building inner side of the facade in the form of a bar-like, statically effective support element and a connection profile to be assembled thereat for the mounting of window or facade parts. Such coupling devices are used in order to connect for example facade elements, in the case of construction by means of post-and-beam construction method, at the building structure of the bars or posts. The invention relates to such coupling devices which allow an assembly, fixing and mounting of facade elements, window parts, window frames or the like at building structures in a secure form. By means of such coupling devices, an assembly of the elements filling the facade at the bars, post elements or support elements forming the statics of the building skin itself, is achieved.

In the prior art, for a post-and-beam construction it is known for example to assemble the facade elements like claddings or window facades to be mounted at the outer side of the building on the bars or posts (transverse or longitudinal supports), by means of metal profiles and fastening elements separate therefrom, like screws or the like. For this, as a rule metal profiles with screw channels or screw holes are mounted at the statically load-bearing bar elements and beams or posts, in post-and-beam construction by means of a plurality of individual screws at individual fastening points distributed along the longitudinal extension. An assembly of such connection profiles is thereby relatively time-consuming and, as well as the extra fastening elements like screws, also requires the providing of corresponding screw holes or screw channels on the building-side load-bearing longitudinal or transverse supports of the building structure. Also, for this form of a coupling, corresponding screw holes have to be present at the generally metal connection profiles.

Not least, in the known such coupling devices, the strength and static resistance is partially also limited. Only at local points are secure connections brought about in each case between the connection profiles serving for the assembly of the facade elements or of the windows and the support elements providing the actual statics, like for example posts and beams. For different kinds of material it is additionally partially difficult here to perform the mounting with screws or nails in a support element consisting, for example, of solid material, without weakening the statics of the structure. By means of the screwing-in of fastening screws into a solid material like wood, it can therefore also come to negative impact on the statics and resistance altogether in relation to loads on the side of the coupling device.

Therefore, as a rule in such coupling devices known up to now, the connection profiles and the support elements are both formed from metal profiles, which are provided with corresponding screw channels or screw holes for the threaded connection to one another. The manufacture of such metal support elements and connection elements is, however, relatively complex. Furthermore, due to the strength requirements, the support elements as a rule have to have a hollow shape or box construction method, in order to achieve the necessary bending stiffness and static strength for the construction of such facade or window structures.

When using support elements made of solid material, for example of a synthetic material or of wood, the disadvantage for solutions up to now is that, through the fastening elements like nails or screws penetrating into the solid material, the mounting is quite time-consuming and it also comes to the local weakening of the bars or beams. For example, nails or screws at a plurality of individual fastening points have to be inserted through holes in the connection profiles into the solid material. Such a system also usually has a reduced overall strength with respect to the bending stiffness and resistance in relation to a separating of facade elements. An example for such a conventional coupling device with support elements made of solid material is described in DE 20 2006 008 297 U1, wherein here a substructure of wood is provided with a metal connection profile at the outside, which is fastened inclined laterally from a middle axis by means of nails inserted at an angle to the longitudinal axis of the device. In this construction, as in the other conventional such coupling devices, the assembly is quite time-consuming due to the plurality of individual nails, and only a reduced statically effective strength is obtained by means of the connection of the parts. Also, only at individual local points are actual fastenings of the facade elements or facade windows given here.

With this in mind, it is the object of the present invention to provide a coupling device for the construction of facades or windows at longitudinal or transverse supports of buildings, which provides an improved and easier assembly possibility, even for support elements made of solid material without impairment of the strength and statics. Additionally, the coupling device is to achieve an optimum overall resistance to loads encountered at facades, like bending forces, pull-off forces and torsion for such facade elements or windows. This object is solved by means of a coupling device having the features of claim 1. Advantageous embodiments and developments of the invention are the subject matter of the dependent claims.

According to the invention, a coupling device for the construction of facades or windows of buildings is proposed, comprising at least one longitudinal or transverse support on a

building inner side of the facade in the form of a bar-like support element which is statically effective – that is, absorbing forces of the facade – and a connection profile which can be attached thereto preferably on an outer side of the building and which has one or more fastening portions for an assembly of windows, facade parts, wall elements of the building, or the like, wherein the coupling device is characterized in that the support element is made of a non-metal solid material and has at least one recess or groove provided with undercuts, corresponding to a form-fit part of the connection profile, which form-fit part has a holding portion and the shape of which is at least partially complementary, for a statically effective form-fit connection to the connection profile. The coupling device according to the invention is therefore characterized by a support element made of solid material, which is fixedly connected by means of a form-fit connection with undercuts and a correspondingly-shaped protruding holding portion to the connection profile and furthermore is continuously reinforcing in the longitudinal extension. The groove, provided with undercuts, in the support element is preferably provided in a longitudinal extension thereof along the whole length thereof.

By simple displacing-on and plugging-in of the connection profiles into the correspondingly-shaped groove or recess with undercuts, in this way a kind of connection to the coupling device at the support element is obtained which is altogether statically effective for the facade, that is, coupled and reinforced against pull-off forces, longitudinal forces or transverse forces. What is understood by correspondingly- and complementarily-shaped groove and holding portion of the profile here, is a form of the parts adapted at least partly in shape so that a securely fixed connection comes about merely due to the form-fit, without extra fastening parts like nails or screws. The support element can, for example, be a post or beam in a post-and-beam construction of such building facades. The support element can, however, also be a part of a window structure in which the frame joint is connected by means of such a statically reinforcing kind of connection.

What is understood according to the invention by a support element made of solid material in a beam shape, is for example a support element or a combination as frame-shaped support elements constructed of post and beam, which forms / form the actual support structure for the facade elements of a building. The function as support element is hereby generally ensured in that either frame-shaped support elements for window assemblies or in form of transverse and longitudinal supports, - that is, for example, so-called posts and beams – form a grid-like support structure which is mounted at the building outer sides at the shell of the building, and at which by means of the connection profiles according to the invention the corresponding individual parts like windows, facade panels etc. can then be assembled. The

support elements are therefore the static main supports of the facade in the coupling device according to the invention, while only additional elements are mounted by means of the connection profiles. The support elements according to the invention therefore have a generally longer longitudinal extension in relation to the connection profiles to be mounted thereat. The beam-like support elements according to the invention are formed from solid material with a recess or groove provided with undercuts, so that, in spite of mounting-possibility of the connection profiles, they provide a high strength for the static objectives: in particular, so-called post-and-beam constructions of such support elements at facades are subjected to stress in different ways, namely shearing, tensile loads and pressure loads, which act at facades due to wind forces or mounted outer elements (windows, facade panels etc.). On the other hand, the connection profiles provided at the support elements according to the invention in a holding portion for the insertion into the groove or recess, serve above all for the fastening of the facade parts or window elements by means of corresponding grooves or screw channels. The connection profiles are therefore not so much conceived with an overall static function of the facades in mind and are generally only subject to tensile loads and pressure loads. In relation to the prior art, this novel construction of the coupling device according to the invention has the advantage that, here, no unnecessary weakening of the base structure, formed from solid material, of the support elements (for example posts / beams made of wooden bars) results, as for example in the case of a screwing-in or fastening by means of nails as in the prior art according to DE 20 2006 008 297 U1 mentioned above.

By means of the novel coupling device realized in this way, further technical advantages are also obtained with respect to the sealing due to lacking transitions between the inside and outside, so that a so-called migration of vapour is prevented. Relatively thin connection profiles can also be used in this construction, which can be used to advantage in narrow constructional shapes with nevertheless secure mounting, fastening and sealing for example in the case of thin kinds of glass or other elements of such facades. This allows space-saving folding constructions for such facades. The support elements formed from solid material are not weakened and nevertheless have a secure and firm fixing for the connection profiles mounted at least section-wise at the support elements by means of form-fit in form of the grooves provided with undercuts, in which grooves the correspondingly-shaped holding portions, for example in dovetailed shape, can engage.

The coupling device according to the invention formed in this way is mounted without additional fastening means with a highly effective, secure and simple-to-assemble way of connection. The connection profiles engage, quasi by means of the recess or grooves

provided with undercuts, into the solid material of the support element without further unnecessarily weakening the support element locally by means of nails or screws. By means of the form-fit, a novel force-absorbing statically effective connection between connection profiles and support elements according to the invention is manufactured. The individual elements for the construction of the facade or the mounting of windows can also advantageously be manufactured in advance so that, on site at the building site, only the outer facade elements, glass facades, windows or the like still have to be mounted in corresponding screw channels or fastening portions of the connection profiles. Therefore, the result is not only a coupling and connection, improved with regard to statics, of such elements in case of beam parts or longitudinal and transverse supports in the post-and-beam construction method made of solid material, but also considerable time saved in the realization of such building facades.

What is to be understood by a coupling device according to the invention with a recess or groove with undercuts in the support element made of non-metal solid material, is any form of a groove-shaped element or element provided with a recess, in which by insertion of the support element with at least partly complementary counter-shape of a holding portion at the form-fit part, the mounting is performed due to a form fit without additional component parts, that is, a pulling-out of the connection toward the outer side of the building or in lateral direction is effectively avoided. A secure fixing in all directions of the facade elements and window parts is therefore very effectively possible in a relatively simple manner with only two parts, namely the support element formed with a groove with undercuts and the connection profile inserted or displaced therein. By means of the connection between the holding portion of the connection profile in the groove or recess of the support element in form of a form-fit connection, a force-absorbing and, for the facade, statically effective, reinforcing is directly realized by means of the coupling between the parts performed in this way.

Such a form-fit can be performed by means of a simple displacing into the groove in longitudinal direction of the support element from the connection profile with the holding portion. Other forms of assembly of such form-fit connections with undercuts are also conceivable in the scope of the present invention. The groove or recess with undercuts in the support element can be performed both in the longitudinal direction thereof, for example at a front end or at a front, along the entire length thereof or only section-wise, which groove or recess is then provided in the mounting state at the outer side of the building. Alternatively or additionally, such a recess or groove for the form-fit connection according to the invention with undercuts can also be provided in a transverse direction in relation to the longitudinal direction of the support element and the post or beam.

According to an advantageous embodiment of the invention, the connection profile of the coupling device is provided with at least a support portion flush with and directly abutting at an outer side of the support element. At the outer side or fastening side, which is usually the front side of the support element at the outer side of the building, therefore, a support element is provided directly abutting and extending flush. Such a support portion has the effect that a wider support of the connection profile is given, even outside of the actual fastening line of the form-fit connection in the groove with undercuts. A quasi multi-punctiform support of the connection profile is provided, also laterally of the form-fit connection, preferably on both sides, of in each case the middle holding portion of the connection profile and of the form-fit connection. In this way, a kind of counter-bearing with the form-fit is manufactured, by means of which the coupling device represents a statically highly effective connection which is also even more stable in relation to torsional forces. Not only tensile forces, lateral forces, but also torsions etc. are taken up by both parts together, namely on the one hand the support element formed from solid material and on the other hand the connection profile inserted and fixed therein in form-fit connection. With such a coupling device, therefore, a statically altogether reinforced and highly effective connection means is directly provided, which was not given in this way with the conventional connection methods up to now like screws, nails, or the like.

The support portion or the plurality of support portions of the connection profile, which are provided laterally of the holding portion for the form-fit connection with the support element and the groove thereof, can according to the invention preferably be along substantially the whole width of the support element at the front end, that is, at the outer side of the building. Preferably the support portions of the connection profile, which are provided flush and abutting directly at the support element, extend along at least 70% to 80% of the whole width of the support element itself. With such a relatively wide support, according to the invention good results were able to be achieved for the improved statics of the form-fit connection and coupling device according to the invention.

According to a further advantageous embodiment of the invention, the recess or groove of the form-fit connection has in cross-section a V-shape or a U-shape tapered outward from the support element. The recess or groove, which is realized for the form-fit connection according to the invention in the support element, therefore has a shape widened inward towards the building, which tapers when one looks at the outer side of the building. By means of this shape of a recess or groove, the connection profile in the support element is held securely by the coupling device according to the invention against a pulling-out or separating after the assembly. No additional anchor screws or the like are necessary in order

to hold the facade elements securely at the outer side of the building. Window elements can also be held securely in this way with an additional static reinforcement at the beams of the building, like for example longitudinal or transverse supports in a post-and-beam construction method. The form-fit connection with such a recess or groove with undercuts can also have another shape or form, as long as it has a shape secured against pulling out. Cross-sections are also conceivable which are for example T-shaped, L-shaped, circular in cross-section or other cross-sections of such a recess or groove in the scope of the present invention, which provide a form-fit connection with secure fixing against a pulling-out of the connection profile in the support element.

According to a further advantageous embodiment of the invention, the holding portion of the connection profile for the form-fit connection in the groove or recess of the support element has in cross-section a substantially Y-shape or T-shape with partially complementary lateral portions for the accordingly-shaped abutting at an inner side of the undercuts of the groove and recess for the form-fit connection. By means of this measure, the holding portion of the connection profile, which can consist for example of an extruded or extrusion-molded aluminium material or other material, therefore has a counter-shape which is only partially complementary for the form-fit connection and which then ensures the secure firm fixing of the connection profile at the support element by means of the corresponding wall portions in the dimension and in the abutting in the recess or groove. In this way, the connection profile can be realized with less material and therefore lighter. Also, for example further elements in the holding portion of the connection profile can be integrated, like for example screw channels at a front end or lateral end. Further, with such a Y- or T-shape, the forces in case of a load on the form-fit connection can also be specifically diverted into the coupling device. With the at least partial abutting of the arms of the T-profile or Y-profile, a secure fixing can be manufactured also in this way in form-fit, without a form of a holding portion made of solid material in the connection profile being necessary. By means of a Y-shape or T-shape in cross section of the holding portion at the form-fit connection of the connection profile, a relatively low engagement into the solid material of the support element is also obtained. By means of the relatively thin shape of the form-fit connection, only formed by means of a simple middle ridge, by means of such a holding portion the solid materials of the support element are only quite slightly impaired with the incorporating or the recessing of the groove. Therefore, a relatively narrow groove can be provided at undercuts which are present on the inner side at least in the outlet, by means of which an improved form-fit of the coupling device is manufactured with nevertheless highly effective and statically effective reinforcement and connection.

According to a further advantageous embodiment of the invention, the support element, which is present at the inner side of the building as base holding element in form of a longitudinal or transverse support, is formed at least partly from a solid material of wood or of synthetic material. In case of a realization of the bar-shaped support element made of wood, for example a real wood can be used as wood beam, a plywood made of MDF or chipboard or a laminated timber beam with a plurality of layers of individual boards glued together. The construction made of wood has the advantage that, by means of relatively simple milling or a CNC-milling, a groove with undercuts for the form-fit connection for displacing-in of the connection profile with its holding portion, is made possible. Also, a wood material has advantages with respect to the CO₂-balance of the building. A merely punctual fastening of the connection profile at a wood beam as support element by means of screws or nails also leads to undesirable weakening effects: due to the tensile load of the screws, which have to be mounted symmetric to the construction axis at the support element, stresses in the wood material come about, which arise in the case of moisture-dependent shrinking and swelling of such natural materials. As a result, stress cracks are unavoidably provoked in the case of the coupling devices realized in this way in the prior art. In contrast to this, the central, longitudinally displaceable and form-fitting force transition according to the invention by means of the form-fit connection on for example the middle axis, that is, the construction axis of the support element, results on the other hand in such stresses being able to be dispersed without distortion inside the wood material of the support element. By means of this, increased strength values of such coupling devices are provided in cooperation between the form-fit of the two elements. Alternatively to wood materials, a support element can also be manufactured from solid material in synthetic materials. In the case of synthetic materials, there is an advantage that for example by means of extruding or injection molding a final shape of the support element with the groove with undercuts is easily realizable.

According to a further advantageous embodiment of the invention, the groove in the support element is manufactured by machining, in particular milling out, CNC-milling, or by molding, in particular extrusion molding or mold casting. In this way, the support elements can be manufactured in advance with relatively small manufacturing complexity in pre-given lengths or as cut-to-size goods, and therefore with reduced costs, and then provided in the intended length for the respective case of application. The incorporating of grooves in wood beams can be easily manufactured in different shapes with conventional milling machines or CNC machines, also with the required undercuts for the form-fit connection with the holding portion of the connection profile. The manufacture by means of extrusion molding or mold casting in the area of synthetic material profiles is likewise a relatively cost-effective method. The form-fit connection, then manufactured by means of the displacing-in of the connection

profile, of the coupling device according to the invention, then provides in the connection of the two elements not only the necessary stiffness, strength and static security in relation to torsions, damage or a separating, but also a direct fixing of both parts.

According to a further advantageous embodiment of the invention, the connection profile is provided with a screw channel as fastening portion for the facade element(s) or window part(s). With such a screw channel, the outside mounting of the window parts, facade elements, like for example glass facades or other facade panels, can then be directly performed at the connection profile. Such a screw channel extends preferably along the whole length of the connection profile and therefore allows the mounting at variable places, without specific bores for the mounting of fastening screws etc. being necessary. A screw channel according to the invention according to this aspect can extend from the building and be opened toward the outside, or also laterally for an assembly of elements provided from the sides. That is, the screw channels can be oriented both in a longitudinal direction of the longitudinal side of the support element, and also in a direction transverse thereto. Combinations thereof are likewise possible in the scope of the invention and partially make good sense. This increases the variability of the possibility of the fastening of facade elements or window parts.

According to a further advantageous embodiment of the invention, the connection profile has a hollow profile portion as fastening portion for the facade element or window part. The assembly of further elements at the outer side of the building facade is then performed by means of corresponding coupling with this fastening portion formed as a hollow profile. Such a hollow profile portion can have a substantially rectangular shape and be provided with corresponding holes, grooves or recess for a fastening of screws or other fastening means.

According to a further advantageous embodiment of the invention, the connection profile has, on the side facing away from the support element, structures or mountings for sealings or other connecting parts. While the connection profile according to the invention generally has a structure as uniform and as plane as possible at the inner side of its support portions toward the front end of the support element, which structure is flush with, and uniform at, the support element for the improved support and receiving of forces for the static reinforcing, therefore according to this aspect, at the outer side of the connection profile, namely at the side which faces away from the support element, corresponding structures are then present, like projections, lugs, undercuts, shoulders etc., which can easily be integrated together with corresponding further elements like sealings, claddings, heat insulation elements etc. Therefore, further functions can be realized in the connection profile of the coupling device,

which serve for the ongoing assembly and facilitation of the connection of other elements without additional fastening means.

According to a further advantageous embodiment of the invention, the connection profile consists of an extruded metal material, in particular aluminium or an aluminium alloy, or of extruded synthetic material. The coupling device according to the invention is therefore realized relatively light and nevertheless with high strength and stiffness for a static support and reinforcing of the facades. The connection profile has the sufficient stiffness also in relation to lateral deformations and torsion, while the support element positioned therebehind is also realized from a non-metal material or from solid material. With such an extruded metal material for the connection profile, one has the possibility of realizing different connection contours like grooves, L-shapes or the like and the corresponding widening shape of the fastening portion (of the connection profile) for the groove at the support element, without complex machinings on site being necessary.

According to a further advantageous embodiment of the invention, the at least one support element is part of a frame or grid structure with in particular post-and-beam construction method. The support element forming the statics for the building is therefore part of a construction of transverse and longitudinal supports made of solid material, which are used for example in form of a post-and-beam construction method for such facades. Alternatively, the support element can be part of a frame element with beam-shaped transverse and longitudinal supports, which is used here to manufacture the supporting structure made of solid material, for example wood, in an opening of a building in particular at the outer side of the facade of the building, wherein the connection profiles then mounted at the outer side of the support element can be mounted either also only partly or only in one direction, for example, in vertical direction of the support elements. Alternatively, also longer connection profiles can be used, and connection profiles can also be mounted both at the transverse and at the longitudinal supports at such a post-and-beam construction. The advantages of the invention according to this aspect are that the actual substructure of the support elements forms a statically very secure and stable construction made of solid material, which is also not unnecessarily weakened by specific configurations or methods of mounting like screws, nails or the like. The inherent material stiffness of the beams is therefore almost completely used and the forces acting at the building facade like pressure forces, tensile forces, wind forces etc. are securely intercepted. With the fast and simple-to-mount assembly of the connection profiles assembled thereat, additionally an efficient configuration is provided, which can be easily varied on site. With the shape of the form-fit connection, displaced in undercuts or grooves, of connection profiles according to the invention, in this

way further diverse variants of the assembly can be realized with nevertheless secure connection of the elements which are statically necessary and necessary for the fixing and assembly of windows or the like at building facades.

According to a further advantageous embodiment of the invention, the support element is a frame with vertical and horizontal beam elements joined together. In this way, the support elements made of solid material do not only have a high inherent stiffness in themselves, but also altogether a high strength as frame construction for an assembly of windows, for example, by means of the displaced-in connection profiles.

The connection profile according to the invention, which primarily serves for the receiving of facade elements like for example glasses or windows, is therefore optimally adapted to these objectives and functions. The connection, fastening and sealing of the window elements or glasses can be performed here, while the support element made of solid material positioned therebehind provides the main object of the static strength, wherein both together have a particularly increased strength due to the form-fit connection according to the invention. In the connection profile of the coupling device according to the invention, the seal-receiving grooves are provided. Together with such grooves, abutting sealings inserted therein can manufacture an impermeability between the inner area of the building and the outer side of the facade. This abutting sealing, by way of example for glasses as glass facade elements, is generally penetrated in conventional such solutions of coupling devices in the prior art with facade screws, in order to fasten the insertion elements at the connection profile. Hereby, in the conventional solutions, openings are caused in the water-guiding fold plane of the facade structure. These can have as a result that water vapour, which arises in the fold, advances as far as the support material of the support element which is formed for example from solid wood, as openings for the fastening screws have in turn to be present in the connection profile. In the solution according to the invention, this is not necessary anymore in this way due to the screw-on grooves or screw channels. In case of a wood as material of the support element, this can later lead to considerable problems, namely to rot and therefore to malfunction of the coupling device of the facade altogether. In the invention, therefore, the described openings are not provided and not necessary, which leads further to advantages with respect to the endurance strength, service life and protection against penetrating moisture.

Further features, aspects and advantages of the invention are described below in more detail with respect to a plurality of exemplary embodiments in connection with the attached drawings, in which:

- Fig. 1 shows a cross-sectional view of a first embodiment of a coupling device according to the invention of a facade construction with a wood post-and-beam facade and connection profile mounted thereon with the coupling device;
- Fig. 2 shows a cross-sectional view of a second embodiment of a coupling device according to the invention, in use for a window construction of a frame window with static reinforcing of the middle post;
- Fig. 3 shows a third embodiment of a coupling device according to the invention for a window construction with a window band and static reinforcing at the frame joint of the window; and
- Fig. 4 shows a perspective partial view of an embodiment of a coupling device according to the invention by way of example of a post-and-beam facade construction with support elements made of solid material and connection profiles, displaced therein, for facade elements or window elements.

Fig. 1 shows in a cross-sectional view a first embodiment of a coupling device 10 according to the invention by way of an example for a facade construction, in which a facade element 12, represented here as glass facade with triple glazing, is assembled at a support element 1 in form of a beam-shaped longitudinal support located at the building inner side of the facade. The coupling device 10 serves not only the mounting of facades elements 12, but also the static reinforcing by means of the coupling between the support element 1 and a connection profile 3 at which, via a screw channel 23, the facade element 12 is assembled by means of screws 9 and a counterpart 11 for the fastening of the facade element 12. The support element 1 in this example of Fig. 1 is a wood beam of a post-and-beam construction, as used for facades of buildings.

The support element 1 realized here as wood beam is provided with a form-fit connection 5 according to the invention for the assembly and mounting of the connection profile 2, which in this embodiment comprises a groove 7 which is substantially V-shaped in cross-section. The connection profile 2 is provided with an at least area-wise form-fit connection 4, formed correspondingly V-shaped, whose holding portion 21 is connected in a form-fitting manner to the support element 1 made of solid material, by simple displacing and plugging into the groove 7. The support element 1 realized here as wood beam made of solid material, is for example part of a post-and-beam facade and correspondingly has longitudinal supports and

transverse supports at the inner side of the building. The facade elements 12 mounted outside the building on the outer side thereof, are either glass facade parts as shown in Fig. 1, or facade parts of another configuration.

By means of the coupling device 10 according to the invention, through the form-fit connection 5 a secure fixing and at the same time statically effective coupling is provided for the improved absorbing of forces and mounting of the facade elements 12 at the outer side of the building. The coupling device 10 does not require any additional fastening elements as for conventional such constructions, as by means of the form-fit connection 5 itself and the simple displacing of the form-fit part 4 with the holding portion 21 into the groove 7 directly, a secure connection and additional reinforcing is achieved for the improvement of the statics of the whole facade of the building.

The support element 1 can as shown be realized from a multilayer solid wood made of glued boards as wood beam or also made from solid wood or MDF-beams. Other materials for the support element 1 made of synthetic material or the like are likewise possible in the scope of the invention, as long as they can receive a static main support load and can be provided with a corresponding groove 7 with undercuts 6 or alternatively a preformed recess for, for example, synthetic material beams. The connection profile 2, on the other hand, is realized in this embodiment as an extruded aluminium profile. It can however also be manufactured from other metal materials or also from synthetic material.

The connection profile 2 in the embodiment of Fig. 1 has a substantially crosswise cross-sectional shape with the thin, vertical holding portion 21 in a kind of Y-shape protruding toward the support element 1, for displacing into the groove 7 of the form-fit connection 5. At the outer side, which is the front end of the support element 1, the connection profile 2 in this example here has lateral support portions 21, which are formed such that they abut uniformly at and flush with the front end of the support element 1 for supporting the form-fit connection 5. For the actual assembly of the facade element 12, the connection profile 2 is here further provided with a middle screw channel 23. In the screw channel 23, the fastening screws can be screwed in for the assembly of the counterpart 11 for the facade fastening of the facade element 12 or other assembly parts. Additionally, between the facade element 12 and the connection profile 2 and the support element 1, sealings 8 are also provided, which serve for the sealing of the facade element 12 at the outer side of the building.

By means of the coupling device 10 according to the invention realized in this way, an assembly system is provided which is highly effective because it is directly further statically

reinforced by means of the coupling, besides this, is easy to assemble, and which can be used effectively in particular also for wood beam constructions for support elements 1 at facades. Due to the form-fit connection 5 and the direct integration of the connection profile 2 into the groove 7 or recess, statically effective reinforcements are therefore realized, also due to the kind of the connection between the parts 1, 2. The support elements 1 are not damaged or structurally weakened by the screws or the like which were necessary in the prior art up to now, and furthermore no additional fastening means are necessary for the assembly. The coupling device 10 according to the invention therefore has a very high strength and connection stiffness and a secure fastening of the facade elements 12, for such facade elements 12 or window elements 13 of buildings. An unintended separating of facade elements 12 is securely avoided in all situations as, here, throughout the entire length of the form-fit connection 5 and not only punctually, a secure fixing is manufactured by means of the two parts which receive forces, namely the support element 1 and the connection profile 2, in cooperation with mechanically synergetic effects.

In the second embodiment, which is represented in a cross-sectional view in Fig. 2, the coupling device 10 likewise has as a base on the inner side of the building a support element 1 realized as a wood beam made of solid wood, which beam is realized in the middle at the front end (outer side of the building) with a groove 7 which has a V-shaped cross-section and undercuts 6, like in the above first embodiment. This groove 7 with the undercuts 6 serves for the form-fit connection 5 according to the invention: a form-fit part 4 of the connection profile 2 with a holding portion 21, which here has a substantially Y-shaped cross-sectional shape, is inserted by simple displacing into the groove 7 in longitudinal direction of the support element 1. The holding portion 21 is provided with lateral portions which are complementary, that is, formed correspondingly at least section-wise as to their shape, at the same angle and with the same dimension as the undercuts 6 of the groove 7, so that a secure form-fit connection 5 between the connection profile 2 and the support element 1, then realized after a plugging together or displacing-in of the parts, is direct.

Unlike the first embodiment (Fig. 1), in the second embodiment according to Fig. 2 the coupling device 10 is not provided for the assembly of a facade element 12, but serves for the assembly and additionally at the same time reinforcing of a window 13. For this, a middle post 14 of the construction of the window 13 is fixed at the connection profile 2, namely the support portions 22 of the form-fit part 4 of the connection profile 2. The assembly of the window 13 at the facade of the building is thereby relatively simple and does not require any additional fastening means like screws or nails. Further, a statically effective kind of connection with the coupling device 10 is provided by the form-fit connection 5. The strength

and stiffness of the connection of the window 13 at the building is thereby improved as, both with the connection profile 2 and by means of the support element 1 also realized here as a wood beam, a joint static reinforcing of this area of the facade at the window 13 is obtained. The other aspects and features according to the second embodiment are similar to those of the first embodiment in Fig. 1, so that here reference can be made to the above description provided with the corresponding reference signs.

The third embodiment, which is shown in a cross-sectional view in Fig. 3, also refers to a coupling device 10 according to the invention for a window construction for the assembly of a window 13 at an outer side of a building. Here too, a beam formed from solid wood is provided as support element 1, in which at the front end in the middle a V-shaped groove 7 is inserted or worked. The V-shaped groove 7 and the form-fit part 4 adapted in shape and dimension can form a dovetail connection as a form-fit connection 5 according to the invention. Instead of the V-shaped groove 7, also other shapes of grooves 7 or recesses can be used, as long as it has undercuts 6 in such a shape that a form-fit connection 5 with the holding portion 21 of the connection profile 2 is achieved which is secured against coming out and lateral tilting movements. Here, the connection profile 2 is provided with fastening portions 3 for the assembly of the window frame 15 of a window 13, which are oriented in shape transverse to the longitudinal direction or longitudinal axis of the coupling device 10, that is, parallel to the surface of the window 13. In this embodiment of Fig. 3, the connection profile 2 is also provided with further portions and structures, which serve for a mounting of sealings 8 or construction parts for the assembly of the window 13 and the window frame 15.

In the partial perspective view according to Fig. 4 of the drawings, an embodiment of a coupling device 10 according to the invention is shown in which the support elements 1 of the device 10 form a grid-like post-and-beam construction, which is often used for such facades of buildings. That is, the support elements 1 form not only transverse supports fixedly coupled together, but also longitudinal supports in vertical and horizontal direction, which in each case are provided with the groove-shaped recesses 7 for the assembly of the connection profiles 2 with correspondingly-shaped fastening portions 3, for example in the form of a dovetail connection. The connection profiles 2 can thereby be present merely section-wise at the support elements 1. Alternatively, they can also be mounted along the whole length at the support elements 1, wherein the actual reinforcing and statics is manufactured by means of the connection of the horizontal and vertical support elements 1 (post-and-beam construction) and their inherent stiffness (solid material beams).

As in the above embodiments, the screw channels 23 according to the invention are formed in the connection profiles 2, which screw channels are used for the screwing-in of the

fastening elements for the facade elements 12 or windows 13. Therefore, the actual assembly of the facade elements 12 is not performed at a metal hollow profile formed as a support element 1 as in the prior art, rather it is performed at the connection profiles, which for their part are assembled at the support elements 1 manufacturing the statics by means of, for example, the dovetail connection shown here (V-shaped groove 7 and form-fit part 4 of the form-fit connection 5). In this way, a novel construction is provided of support elements 1 formed from solid material, for example support elements 1 formed from solid wood, which themselves have a compact and highly stable configuration, without their being weakened by screws or nails. A continuous and planar connection of the connection profiles 2 displaced therein is ensured by the particular shape of the form-fit connection 5, for example in dovetail shape, so that altogether a highly secure connection of the elements is ensured: the support elements 1 form the base construction for the manufacture of the static unit at the facade, while the connection profiles 2 assembled thereat by means of the form-fit connection 5 serve only for the assembly and mounting of facade elements 12.

Therefore, the object of strength and mounting is divided in a novel way among the two base elements, namely the support elements 1 and the connection profiles 2: while the support elements 1 serve for the whole static load of the facade, the connection profiles 2 which are mounted therein and for example only partially mounted, function only for the assembly and securing of the facade elements 12, 13. Therefore, a form of a coupling device 10 for such facades is provided which is optimal with respect to the kinds of loads. The attachment construction of the connection profiles 2 is mostly subjected to tensile and pressure forces and received by means of the dovetail kind of form-fit connection 5 of the coupling device 10. The support elements 1 positioned therebehind, on the other hand, serve for the complete strength and statics of the facade itself, wherein they are in each case highly resilient to both tension and pressure and also to shear stress, and therefore form a secure base construction of the facades of such buildings due to the coupling device 10 according to the invention.

Due to the specific shape of the form-fit connection 5 provided with a V-shaped recess or groove 7, which can for example be a kind of dovetail connection, the screw holes or fastenings by means of nails in the material of the solid material of the support elements 1, which were necessary in the prior art up to now, can be omitted. Thereby, on the one hand a local weakening of the material of the support elements 1 is prevented. On the other hand, hereby a so-called vapour migration can be avoided, which can lead to rot or damage of such support elements 1 made of solid material consisting, for example, of wood. Not least, the coupling device 10 according to the invention is easily assembled. By means of simple

displacing-on of the corresponding form-fit connections 5 with the form-fit part 4 and the groove 7 of the beam-like support elements 1, secure couplings can be manufactured. A complex screw connection at a plurality of individual points is not required; also, a continuous and secure mounting in linear form is given, in contrast to the otherwise punctual fixing present in the case of screws or nails.

The form-fit connection 5 according to the invention can also have other shapes in its cross-section than the V-shaped groove 7 shown in the Figures with the holding portion 21, which is Y-shaped in cross-section, of the connection profile 2. By way of example, L-shaped or also round grooves 7 and recesses can be provided, in which then correspondingly complementarily-shaped holding portions 21 of connection profiles 2 engage as holding portions provided with compatible counter-shapes. The form-fit connection 5 requires only at least one undercut 6, by means of which the firm connection and mounting of the connection profile 2, secured against coming out, is made possible by means of form-fit connection 5 at support element 1 supporting the main force.

It is also conceivable that grooves 7 or recesses are also provided at least partially in transverse direction of the support elements 1, instead of in the longitudinal direction thereto. Likewise it is possible, according to requirement, also to provide a plurality of form-fit connections 5 adjacent to one another at an individual support element 1, in order thereby to achieve a higher strength and resistance in the static reinforcing by means of the coupling device 10 according to the invention.

Regarding the materials and configurations of the support element 1, all materials made of solid material can be used here, as long as a groove 7 or a recess with undercuts 6 in the material is manufacturable. The manufacture of a groove 7 in the support element 1 can be manufactured by machining or also in the molding in the case of, for example, synthetic material supports. The advantages of the coupling device 10 according to the invention are not only an easier assembly and fewer costs. Also, a complete, coupled and statically effective reinforcing is provided in spite of the attachment construction with the connection profile 2 mounted from the outside. Both transverse forces and longitudinal forces, that is, holding forces against a pulling-out, and also the torsional stiffness, are therefore considerably improved with respect to their receiving and diverting of loads occurring at the facade of the building.

List of reference signs

- | | |
|----|--------------------------------------|
| 1 | Support element |
| 2 | connection profile |
| 21 | holding portion |
| 22 | support portion |
| 23 | screw channel |
| 3 | fastening portion |
| 4 | form-fit part |
| 5 | form-fit connection |
| 6 | undercut |
| 7 | groove and recess |
| 8 | seal |
| 9 | screw |
| 10 | coupling device |
| 11 | counterpart facade fastening element |
| 12 | facade element |
| 13 | window |
| 14 | middle post |
| 15 | window frame |

Claims

1. Coupling device (10) for the construction of facades or windows of buildings, comprising at least one longitudinal or transverse support on a building inner side of the facade in the form of a bar-like, statically effective support element (1) and a connection profile (2) which can be attached thereto preferably on an outer side of the building and which has one or more fastening portions (3) for an assembly of windows, facade parts or wall elements of the building, **characterized in that** the support element (1) is made of a non-metal solid material and has at least one recess or groove (7) provided with undercuts (6), corresponding to a form-fit part (4) shaped at least partially complementary with a holding portion (21) of the connection profile (2) for a statically effective form-fit connection (5) to the connection profile (2).
2. Coupling device (10) according to claim 1, characterized in that the connection profile (2) is provided with at least a support portion (22) abutting directly at and flush with an outer side of the support element (1).
3. Coupling device (10) according to claim 1 or 2, characterized in that the recess or groove (7) has a V-shape or U-shape in cross-section, tapered outward from the support element (1).
4. Coupling device (10) according to one of the preceding claims, characterized in that the holding portion (21) of the connection profile (2) has in cross section a substantially Y-shape or T-shape with partially complementary lateral portions for the form-fitting abutting at an inner side of the groove (7) for the form-fit connection (5).
5. Coupling device (10) according to one of the preceding claims, characterized in that the support element (1) is formed at least partially from a solid material made of wood, in particular real wood, plywood MDF, laminated timber beams or synthetic material.
6. Coupling device (10) according to one of the preceding claims, characterized in that the groove (7) in the support element (1) is manufactured by machining, in particular milling or CNC-milling, or by means of molding, in particular extrusion molding or mold casting.

7. Coupling device (10) according to one of the preceding claims, characterized in that the connection profile (2) is provided with a screw channel (23) as fastening portion (3) for the facade element (12) or window part (13).
8. Coupling device (10) according to one of the preceding claims, characterized in that the connection profile (2) has a hollow profile portion as fastening portion (3) for the facade element (12) or window part (13).
9. Coupling device (10) according to one of the preceding claims, characterized in that connection profile (2) has, on the side facing away from the support element (1), structures or mountings for seals (8) or other connection parts.
10. Coupling device (10) according to one of the preceding claims, characterized in that the connection profile (2) consists of an extruded metal material, in particular aluminium or aluminium alloys, or extruded synthetic material.
11. Coupling device (10) according to one of the preceding claims, characterized in that at least a support element (1) is part of a frame or grid construction with, in particular, post-and-beam construction method.
12. Coupling device (10) according to one of the preceding claims, characterized in that the support element (1) is a frame with vertical and horizontal bar elements which are joined together.