

Shuttering element with edge protection and method for the manufacture thereof

5 The invention relates to shuttering element, in particular a shuttering panel or formwork sheet according to the preamble of patent claim 1 and a method for the manufacture of a shuttering element according to the preamble of patent claim 12.

10 In order to enlarge the working life of shuttering panels or shuttering elements in general made of wood and/or wood material, they have, for quite a long time now, been provided with an edge protection made of plastics, which is essentially designed to reduce damages at the edges of the shuttering elements due to a higher mechanical resistance to wear of the edge protection made of plastics compared to the main body of wood and/or wood material and to largely impede the entry of moisture into the main body made of wood and/or wood material via the edge portions. The edge portions of such shuttering elements are, in particular during
15 the assembly or disassembly after shuttering, in particular at the edges, exposed to high mechanical stress and damages arising therefrom have a negative effect on the quality of the concrete structures built with these shuttering elements because protrusions or bulges at the finished concrete surface can be caused if the edges at the joints between two shuttering elements are damaged and said protrusions or bulges have to be removed laboriously and expensively after disassembly of shuttering. It is therefore an essential criterion for the working life
20 of such shuttering elements that the edges are undamaged.

25 The edge protection of plastics should furthermore prevent an entry of moisture via the edge faces of a shuttering element, because the absorbance and release of moisture can cause a swelling or shrinkage of the main body made of wood and/or wood material. Due to the fact that this can also have a negative effect on the surface quality of the produced concrete component and furthermore impairs the mechanical capacity of the shuttering elements due to degradation processes with respect to wood as a natural material in particular the processes of rotting are strongly accelerated, which causes that the working life of a shuttering element is
30 also disadvantageously shortened.

For realizing such an edge protection at a shuttering element, it is for example known from DE 2 305797 A1 to fix an edge covering layer made of plastics to the narrow faces at the edge-

es of a shuttering plate of wood along the edges of the plates. The edge covering layers have in this case a middle bar, which protrudes in a perpendicular way and engages into a groove at the edge of the shuttering plates and on the face where the edge covering layers bear against the wooden core of the shuttering plate, the edge covering layers are glued to the wooden core. In order to protect the wooden core against moisture, at least one side of the surface of the wooden core is provided with a planar covering layer of plastics and in order to prevent the moisture from getting into the wooden core, the at least one covering layer is glued or welded to the adjoining edge covering layers in the area of its joints at its outer edges.

From the DE 196 11 413, a method for attaching an edge protection to a formwork sheet, where a base plate of wood, wood composite or a wood-like material is, after being cut, at least partially cast with a plastics, preferably polyurethane, along the edge faces and in particular in the corner areas, is known. An embodiment of the edge protection described as being advantageous is, to embody the latter of a homogenous material around the entire plate and without interruptions or additional reinforcements at the corners, however, such an embodiment of a homogenously extending edge protection with formwork sheets of different formats requires complex devices.

WO 2008/095897 A1 also discloses the production of an edge protection or a sealing edge by using a method of injection molding, where an edge protection is attached to the frontal edge faces of a main body of wood coated with a waterproof covering layers. In order to achieve a fix mechanical mounting between the edge protection and the main body as well as a waterproof connection between edge protection and covering layer, complex machining processes at the main body are required.

The DE 92 15 477 U1 describes a plate for concrete shuttering with a corner protection and at each corner of a plate forming panel, a connection contour is formed at, to which a rubber-elastic end piece completing the panel is added, which is made of a soft casing and of an adhesive and soft foam, which fills the soft casing up to the connection contour.

The EP 1 921 223 A2 discloses a rectangular shuttering element, the shorter transverse edges of which are provided with a stiffening member, which can be made of plastics and is fixed to a groove at the transverse edge of the shuttering element by means of sandwich molding with

a second plastics. By this sandwich molding, also recesses at the corners of the shuttering element can be filled with plastics, which represent the corners of the finished shuttering element.

5 The EP 2 055 864 A2 describes a shuttering plate with a holding groove that extends continuously along the plate edge and a reinforcement edge of plastics is arranged in the holding groove, with the outer surface of said reinforcement edge facing away from holding groove being flush with the plate edge. In one embodiment, the edge protection has a surface covering, which can also be formed of plastics, additionally to the reinforcement edge.

10

The DE 26 18 366 A1 discloses a shuttering panel with a revolving edge protection made of an elastic soft material, which is fixed to the panel representing the shuttering area. In order to be protected against impacts, more elastic material can such be arranged in the corners, that the edge protection in the region of the corners has a larger cross section.

15

The DE 196 11 413 A1 shows a shuttering panel with an edge protection of plastics, which completely covers the main body at its edge face in at least one region of the corner. In this case the edge faces of the base plate in the corner section are backwardly offset relative to the rectangular corner of the whole shuttering panel.

20

From the DE 23 05 797 A1, a shuttering plate with a covering layer of plastics is known, which has an edge covering layer of plastics at the narrow faces at the edges along the plate edges.

25

The objective of the invention is to provide a shuttering element with an edge protection as well as a method for the manufacture thereof, where a high mechanical strength of the edge protection and a good protective effect against the entry of moisture into the shuttering element is achieved in spite of economical manufacturing methods.

30

The objective of the invention is provided by a shuttering element with the features of the characterizing part of patent claim 1 as well as a method having the characterizing measures of patent claim 12. Due to the fact that at least at a second sub-face of the edge face of the main body and/or at an outer face of the first protective edge portion, a second protective edge portion made of a second plastics material is arranged by means of an injection molding and

the second protective edge portion adjoins a contact face at a first protective edge portion in a durable mechanically loadable and waterproof way, manufacturing methods that are advantageous for the respective protective edge portions can be chosen and characteristics of the protective edge adjusted to the respective appearing stresses can be achieved by the choice of the plastics material and the joints do not represent weak spots with respect to mechanical strength and protection against moisture due to the permanent connection at the contact faces between the first and the second protective edge portion. Due to the fact that the manufacturing of the edge protection of plastics material in the individual protective edge portions can be chosen to be respectively optimal, such an embodiment or such a manufacturing method is particularly applicable with respect to providing shuttering elements also having complicated edge faces with an edge protection having a high protective effect in an economical way. In particular, the entire edge face of a shuttering element can thus be provided with an edge protection and no distinct weak spots at the contact faces with respect to the protective effect result. The design of the main body of wood and/or wood material is not described in detail herein, because sufficiently applicable embodiments and manufacturing methods are known from prior art, but at this stage, the usage of solid wooden boards, 3-ply sheets, glued laminated timber, plywood, oriented strand boards, particle boards, hardboards, medium-density fiberboards, wood-plastic composite panels, boards of wood-plastic composite, boards of all materials previously mentioned with thermoplastic or thermosetting coatings and suchlike should be mentioned as examples for advantageous embodiments of a main body. The embodiment of the shuttering element, which is particularly advantageous to produce, is that the second protective edge portion extends over a corner of the main body or a corner of the main body covered by the first protective edge portion or an portion of a rounded or a chamfered directional change of the edge face or of the first protective edge portion, because in particular the corner portions or transition portions of the edge face are exposed to high mechanical stresses during the later usage of the shuttering element and the second protective edge portion can be embodied especially according to said requirements. Furthermore, an attachment of a continuous first protective edge portion is easier if the edges or the directional change portions are rounded or chamfered, than it is in the case of sharp corners of the main body.

The embodiment according to the invention is particularly advantageous to use with 3-ply sheets, because in every part of the edge face, at least parts of the main body are cut in per-

pendicular direction to the wood fiber and these areas of so-called cross-grained wood have to be protected against influences of moisture due to their high capacity to absorb water.

5 A high bonding capacity between edge protection and 3-ply sheets as well as high mechanical strength of the edge protection during usage is achieved, if the plastics of the first protective edge portion and the plastics of the second protective edge portion is essentially made of elastic plastics, in particular thermoplastic polyurethane (TPU). In this case, the two plastics materials do not have to be identical, but they shall establish a good adhesive composite with respect to one another at their contact faces and the mechanically permanent connection is
10 amongst others effected by Van der Waals forces as well as interdiffusion between the macromolecules of the first plastics material and the macromolecules of the second plastics material. Between the plastics material of the first protective edge portion and the plastics material of the second protective edge portion, a mechanical anchoring, for example by undercuts or apertures in the first protective edge portion, can additionally be effected, that can be effective
15 in addition to the adhesive composite. The connection between the first protective edge portion and the second protective edge portion can be furthermore improved by pretreating the contact face at the first protective edge portion by means of adhesive agents or primers. In particular using similar plastics material with respect to the first protective edge portion and the second protective edge portion ensures a good and permanent connection.

20 An advantageous embodiment of the shuttering element is furthermore that at least sections of the second protective edge portion along the edge face have a constant thickness perpendicular to the edge face, because in such sections having a constant thickness, the edge face at the main body represents a parallel curve with respect to the finished protective edge and the
25 main body can thus easily be prepared for the attachment of the second protective edge portion. It is furthermore thereby achieved that as few changes as possible regarding the mechanical characteristics are present within the second protective edge portion, what should be the aim regarding the entire circumference of the shuttering element.

30 The mechanical anchoring of the second protective edge portion to the first protective edge portion and, if applicable, also to the main body is particularly encouraged by the fact that a contact surface of the second protective edge portion with the first protective edge portion and, if applicable, also with the main body, at least corresponds to in a third of the entire cir-

cumferential surface of the second protective edge portion. The entire circumferential surface thereby corresponds to the entire surface of the second protective edge portion, considered to be a solid model, less the sub-faces situated in the plate surfaces of the shuttering element.

The entire surface can also equated with the interior surface of the mold cavity for the injecting of the second protective edge portion. Thus, the risk of a removing caused by mechanical stress can be reduced.

An advantageous embodiment of the shuttering element that can also be combined with other variants of embodiment is that the end sections of the first protective edge portion form the contact faces or the joints or the frontal surfaces, where later a second protective edge portion follows, are arranged at rectilinear sections of the edge face. These end sections are thus not connected to the edge face of the main body in a curved state and the risk of an undesired removal of the end sections from the edge face due to interior tension is avoided. This is particularly of advantage if a larger time lag is between the attachment of the first protective edge portion and the second protective edge portion. After the injecting of the second protective edge portion, the danger of a removal is insignificant, due to the end sections being fixed to the main body by the second protective edge portion.

At one directional change portion of the main body or the first protective edge portion, in particular a corner, the thickness of the second protective edge portion can preferably be between 5 times and 15 times as much as the thickness of the first protective edge portion, measured along an angle bisector of two edge faces following the directional change portions, with the result that in particular the corners of the main body that are exposed to high mechanical stress are optimally protected against damages by the protective edge according to the invention.

In the region of the contact face, the thickness of the second protective edge portion, measured perpendicularly to its outer surface, can be between one and three times as much as the thickness of the first protective edge portion and preferably with similar mechanical characteristics of the plastics material of the first protective edge portion and the plastics material of the second protective edge portion, preferably a approximately identical thickness of the two protective edge portions at the contact face is chosen in order to effect as few changes as pos-

sible of the mechanical characteristics of the finished protective edge in the region of the contact face.

5 In the event of different mechanical characteristics between the plastics material of the first protective edge portion and the plastics material of the second protective edge portion, the mechanical characteristics, in contrast, of the second protective edge portion can be adjusted to mechanical characteristics of the first protective edge portion by varying its thickness or mechanical characteristics different from these of the first protective edge portion can be achieved in the second protective edge portion, as there is for example an increased flexibility
10 but also a lower flexibility in the event of pressure load.

In order to avoid abrupt changes of the mechanical characteristics within the second protective edge portion, it can be of advantage if the latter has a changeable thickness perpendicular to the edge face at least in sections along the edge face, with the result that, on the one hand,
15 smooth transitions, which are for the manufacturing using an injection molding favorable in terms of flow, are achieved due to smooth changes of the diameter. Due to the fact that the shuttering elements, when used, are frequently pulled over a corner, it is advantageous, if the protective edge of a shuttering element has as few mechanical unsteadinesses as possible, i.e. it has the most even possible flexibility or elasticity, because a protective edge having a rapidly changing flexibility is exposed to an extremely high stress in the region of this mechanical unsteadiness when it is pulled over an edge, which could cause a tearing of the protective
20 edge. It is therefore advantageous, if the first protective edge portion and the second protective edge portion have at least approximately the identical stiffness in the region of the contact face, when they are stressed perpendicularly to the edge face of the main body or the surface of the protective edge and the stiffness is defined as a ratio of the tensile modulus of the respective plastics material to the thickness of the respective plastics material perpendicular to the edge face.
25

30 A particular efficient manufacturing of a shuttering element according to the invention is possible, if the first protective edge portion and/or the second protective edge portion are connected with respect to the entire surface and butt-jointed to the edge face of the main body, because in this case, the pre-sizing of the main body can be performed by means of very simple tools, as there is for example a saw blade or a jointing cutter or a chipper. In particular by

using a double end tenor, two edge faces parallel to each other can be manufactured at the main body in one step, and an additional degree of freedom regarding the design of the edge face can exist by adjustable axes of the milling units that are arranged in the double end tenor perpendicular to the feed motion. In this variant of embodiment of the edge face, the placement of additional grooves by means of complex tools can be omitted and by using high-strength adhesive joints, a connection that is sufficiently strong in terms of mechanic between the first protective edge portion and the main body can be nevertheless achieved. At this stage, the usage of PUR hot melt adhesives should be mentioned as an example for such a high-strength adhesive methods, which have efficiently been used for a long while in the field of the edge banding and which show reliable results and allow mechanically highly-loadable connections and have a high resistance also with respect to environmental impacts, in particular moisture.

The blunt re-sizing of the edge face is in the simplest way effected perpendicular to the surface of the plate-like main body, but deviating from this, the edge face can however also be orientated diagonally with respect to the plate surface of the shuttering element.

Alternatively, in particular in the region of the second protective edge portion, the edge face can have at least one recess or a profiling extending along the edge face of the main body, with the result that between the second protective edge portion, which is attached by means of an injection molding after the attachment of the first protective edge portions, a larger surface of the edge face, which is available for moistening the second protective edge portion with molten plastics, and thus a higher mechanical adhesion at the main body is achieved. Applicable recesses in the main body can thereby be formed of slots or bore holes, which can be produced by means of simple tools or probably even in a continuous process; a profiling at the wall face of the main body can also be simply attached in a continuous process by means of tools known from prior art.

After the recesses or grooves are applied to the edge face of the main body, it has to be considered that these, when the second protective edge portion is attached by means of an injection molding and the thereto related surface pressures, can form the basis for gaps possibly to appear with respect to the main body of wood and/or wood material and that thus sharp edges should be omitted to the largest possible extent. The danger that the main body is split during

the injection of the second plastics material is largely avoided with a complete or but pre-sizing of the edge face of the main body.

5 An additional enhancement of the mechanical stability of the connection between the first protective edge portion and the second protective edge portion can be achieved if they have cooperating positive-locking elements in the region of the contact face. At the first protective edge portion, for example, which is e.g. formed of prefabricated edge material of the first plastics, appropriate undercuts at the contact face can be provided during the application, which are filled with the plastics of the second protective edge portion while the second protective edge portion is subsequently applied by means of an injection molding and after the second plastics is solidified, a positive-locking, mechanical connection between the two protective edge portions is established. Due to such undercuts or recesses, the common surface of the contact face is additionally enlarged and thus a larger area for an adhesive effect is available between the first plastics material and second plastics material. With respect to the first protective edge portion being formed from prefabricated roller material, such an undercut or recess can be produced by means of an appropriate punch during the step of cutting.

20 As already mentioned, it is advantageous if the first protective edge portion and the second protective edge portion have as much similar or equivalent physical, in particular mechanical-technological characteristics as possible and thus the most homogenous possible protective edge is present along the entire circumference of a shuttering element. This can be achieved if the plastics material of the first protective edge portion and the plastics material of the second protective edge portion have at least approximately identical technological characteristics, in particular elasticity, tensile strength, hardness, melting temperature and suchlike.

25 It can alternatively also be possible if the plastics material of the first protective edge portion and the plastics material of the second protective edge portion have considerably different mechanical-technological characteristics with respect to each other. For example in the region of corners of the protective edge, which is formed of the second protective edge portions and which are generally exposed to higher mechanical loads during usage, in this embodiment, a plastics material different from the plastics material of the first protective edge portion, extending over a large part of the longitudinal edges or the transverse edges of a shuttering panel, can be used.

In order to achieve a balanced relationship between high mechanical load capacity and efficient manufacturing of a shuttering element with protective edge it is advantageous if the thickness of the first protective edge portion is between 0.1 times and 0.5 times of the thickness of the main body. The main bodies of shuttering elements frequently have a thickness between 10 mm and 35 mm but in practice, an average thickness of a first protective edge portion of 2 mm to 8 mm has turned out to be advantageous. In case of a first protective edge portion or a second protective edge portion having such a thickness it is ensured that also punctiform, impulsive loads at the edge of such a shuttering element are spread over a larger area by the plastics material of the protective edge and the main body below of wood and/or wood material is exposed to slight mechanical loads, which can therefore be borne without causing damages.

Due to the fact that shuttering elements according to the invention have a very large service life, and represent high-quality equipment, it is furthermore possible to provide a measuring sensor element and/or a RFID transponder element in the region of the protective edge. For example, before the first protective edge portion is attached, an appropriate element can be built into a recess of the main body, or also before the attachment of the second protective edge portion it is in particular possible to cast such an element into the second protective edge portion, because the second protective edge portion is attached by an injection molding. A measuring sensor element can for example be used to measure the temperature in the region of the shuttering. An RFID transponder element is for example applicable for a contactless and/or automatable identification of single shuttering elements, whereby also the usage of such shuttering elements can be tracked over their entire service life or the values of a measuring sensor element can be provided in a contactless readable way.

A particular advantageous embodiment of a shuttering element is that the first protective edge portion is essentially flush with the plate surface and the second protective edge portion has an elevated surface which stands proud in particular by at least 0.5 mm with respect to the plate surface of the main body. The corners, made from the second plastics, of such a shuttering element are consequently a little bit thicker than the main body and the first protective edge portions. At a concrete area, manufacture therewith, in the corner regions of the shuttering element, slightly recessed sections result, which correspond to the elevations, which either

do not affect at the finished surface or can easily be filled by filling. The essential advantage of the elevations is that the corner sections of the shuttering elements do not recede or are not recessed with respect to the plate surface of the main body and thus, no local projections result at the finished concrete surface. This also applies in the event that the thickness of the main body grows during usage due to the influence of moisture and swelling processes or the corner sections, as the most stressed regions of the shuttering element, have a heavier wear than the main body of the first protective edge portions. Another advantage of the elevated portions is that with shuttering elements such embodied, air gaps between plate surfaces facing each other are made during piling, which ease the moisture to be vented off from the main body via the plate surfaces and thus, dammed-up water and the thereby effected negative results reducing the duration of life of the wood or the wood materials of the shuttering element, are reduced. The elevated portion is in this case particularly between 0.5 mm and 2 mm elevated with respect to the plate surface of the shuttering element.

An elevated portion has advantageously an elevated surface, being parallel to the plate surface and extending to the corner of the shuttering element. A wear of the elevated portion due to usage is thus more evenly spread over the larger area and the elevation in the corner sections is thus maintained for a longer period of time even under rough operating conditions. Furthermore, shuttering elements piled on one another lie upon one another more stable.

A ramp-like transition area at the second protective edge portion extending from the level of the plate surface to the elevated surface effects that a soft, gradually increasing transition between the plate surface and the elevated portion is created at the finished concrete surface and that no sharp edges or stairs result. Additionally, problems regarding stripping as well as in terms of handling the shuttering elements, such as for example that the edges of the elevated portions get stuck and suchlike, are avoided.

The method according to the invention for manufacturing a shuttering element with edge protection according to patent claim 12 is characterized by the fact that individual sections of the edge protection are respectively produced using these measures representing an optimal ratio in terms of economy of the manufacturing method and optimal usage properties, in particular high durability of the edge protection.

Once the first protective edge portion is applied, the second protective edge portion is applied by using an in-mold assembly encompassing the main body and a sub-face of the first protective edge portion or two adjacent first protective edge portions in the region of the contact face.

5

The mold cavity for the molten second plastics material to be put into is thus on the one hand limited by the walls of the mold of the in-mold assembly and on the other hand by the exterior face of the first protective edge portion of the edge face of the main body together with the abutting faces and the exterior faces of adjacent first protective edge portions. As a primary shaping process, this method is immune to variations in terms of geometry of the edge faces or the abutting faces of adjacent first protective edge portions and thus, the pre-sorted sub-steps of the sizing as well as the application of the first protective edge portion can be performed with less high requirements in terms of accuracy.

10

15

A high-quality, permanent, particularly mechanically highly loadable and waterproof connection at the contact face is achieved by producing the connection of the second protective edge portion with the first protective edge portion at the contact face by a partial melting process or a welding process, which causes the deep connection between the plastics material of the first protective edge portion and the plastics material of the second protective edge portion. Due to the highest possible temperature of the molten plastics material of the second protective edge portion, also the surface plastics material of the first protective edge portion is melted during the injection process, resulting in the creation of a deep connection. A particularly good connection is achieved if the plastics material of the first protective edge portion and the plastics material of the second protective edge portion are at least similar or even largely identical, i.e. have an equivalent chemical composition.

20

25

Once the injection molding operation has been performed, heat is withdrawn from the plastics material of the second protective edge portion via the in-mold assembly and the remaining shuttering element, with the result that the initially molten plastics material solidifies and the second protective edge portion gets the desired solidness. In order to accelerate the cooling down of the second protective edge portion and thus to reduce the time required to remove the shuttering element, the in-mold assembly can have cooling equipment in the form of cooling channels flown through by liquid.

30

Due to the fact that it is the most cost-efficient way to perform the pre-sizing of the main body in a continuous process, it is advantageous if the first protective edge portion or the first protective edge portions are attached to the edge face of the main body in a continuous process. It is therefore possible to integrate the corresponding devices for the attachment of the first protective edge portion into a double end tenoner but also into a single edge banding machine, where the sizing of the main body is effected. Nevertheless, the plastics material of the first protective edge portion and/or the second protective edge portion can also be applied on an independent machining station, independent from the pre-sizing.

The plastics material for the first protective edge portion can therefore advantageously be present in the form of prefabricated edge material, being applied in the form of strips or roll goods, but this embodiment can also be advantageously combined with other embodiments described.

Irrespective of the way of attachment of the first protective edge portion and the second protective edge portion, the edge face can be subjected to a pre-treatment before application, which can comprise the application of primers or similar adhesive agents in order to improve the adhesive strength of the edge protection.

It is furthermore possible that the contact face at the first protective edge portion and/or the edge face at the second protective edge portion is subjected to a machining process. During this can, in particular also with a continuous process, a machining process with geometrically defined cutters, e.g. sawing or milling, or geometrically undefined cutters, e.g. grinding, can be effected. By means of such an intermediate sizing of the shuttering element before the second protective edge portion is attached, the requirements with respect to accuracy to the preceding attachment of the first protective edge portion can be kept down, whereby the economic efficiency of the entire process can be increased. Due to this additional machining process between the applications of the individual protective edge portions, a certain geometry can be achieved between a second protective edge portion and the contact faces, with the result that a particularly high flexibility and elasticity, but also a high resistivity and high rigidity can be achieved. In order to achieve a clean cutting edge with these machining processes

after the first protective edge portion has been attached, the cutting tools are used in synchronous milling.

5 A particularly economic manufacturing of the shuttering elements according to the invention is possible if first protective edge portions are attached in a continuous process to continuous extending edge face portions, in particular longitudinal edges and face edges of a rectangular main body, and are subsequently, the second protective edge portions are attached by means of an injection molding at edge faces between or at first protective edge portions being oriented towards one another at an angle. Thus, a large extent of the circumferential edge protection can be attached by means of the economically favorable continuous process, and this method can also be applied in a very flexible way to very different formats, during the attachment of the second protective edge portion at the corners of the shuttering element by means of appropriate in-mold assemblies, which only have to be adjustable with respect to their thickness, can economically be effected independently from the surface dimensions of the shuttering element and a consistent standard of quality of the connection at the contact faces can be achieved.

20 A particularly advantageous embodiment of a shuttering element or the method for the manufacture thereof, which can also be combined with other embodiments, is that the first protective edge portion is attached, in particular as semi-finished material, to approximately the entire edge face of the main body in a first step. Approximately refers in this context to the fact that at the entire circumference of the main body, only two abutting faces or front faces of the first protective edge portion exist, which are preferably disposed in a corner region of the finished shuttering element. In its corner regions of the finished shuttering element, the main body is preferably provided with a curve or a chamfered edge, with the result that the edge face is recessed with respect to a right angle. This chamfer or curve of the contour of the main body eases the attachment of the first protective edge portion in one piece, in particular the continuous attachment in a continuous process. The abutting faces of the first protective edge portions are advantageously positioned at such a curve or chamfer and the abutting faces facing each other have a distance of up to a few centimeters, preferably less than 20 mm. At the straight sections of the edge face, the outer face of the first protective edge portion already represents the later outer face of the shuttering element, whilst the finished outer face of the

shuttering element in the corner regions is formed by injecting the second protective edge portions.

5 The invention will be described in more detail below with reference to examples of embodiments illustrated in the appended drawings.

The heavily simplified schematics show:

- 10 Fig. 1 a shuttering element in the form of a rectangular shuttering panel with circumferential edge protection;
- Fig. 2 a possible embodiment of a corner region of a shuttering element;
- 15 Fig. 3 another possible embodiment of a corner region of the shuttering element with an adumbrated in-mold assembly;
- Fig. 4 a sectional view through a shuttering element according to line IV-IV in Fig. 1;
- 20 Fig. 5 another possible embodiment of the edge protection in a corner region of the shuttering element;
- Fig. 6 another possible embodiment of the edge protection in a corner region of the shuttering element;
- 25 Fig. 7 a flow chart for the manufacturing process of a shuttering element according to the invention;
- Fig. 8 another embodiment of a shuttering element with edge protection;
- 30 Fig. 9 a sectional view through an edge protection with a particular embodiment of a first protective edge portion;

Fig. 10 a corner region of a shuttering element with an elevated portion in the second protective edge portion in a first embodiment;

Fig. 11 a sectional view through a corner region according to Fig. 10;

Fig. 12 a corner region of a shuttering element with an elevated portion in the second protective edge portion in another embodiment;

Fig. 13 a sectional view through a corner region according to Fig. 12.

Firstly, it should be pointed out that the same parts described in the different embodiments are denoted by the same reference numbers and the same component names and the disclosures made throughout the description can be transposed in terms of meaning to same parts bearing the same reference numbers or same component names. Furthermore, the positions chosen for the purposes of the description, such as top, bottom, side, etc, relate to the drawing specifically being described and can be transposed in terms of meaning to a new position when another position is being described. Individual features or combinations of features from the different embodiments illustrated and described may be construed as independent inventive solutions or solutions proposed by the invention in their own right.

The embodiments illustrated as examples represent possible design variants of the part-feeding system and it should be pointed out at this stage that the invention is not specifically limited to the design variants specifically illustrated, and instead the individual design variants may be used in different combinations with one another and these possible variations lie within the reach of the person skilled in this technical field given the disclosed technical teaching. Accordingly, all conceivable design variants which can be obtained by combining individual details of the design variants described and illustrated are possible and fall within the scope of the invention.

All value range specifications in the objective description should be taken as arbitrary ranges which encompass all subareas lying within these ranges, e.g. the specification 1 to 10 should be understood to encompass the full range starting from the bottom limit 1 and rising to the top limit 10, i.e. all subareas start with a bottom limit of 1 or more and end with a top limit of 10 or less, e.g. 1 to 1.7, or 3.2 to 8.1, or 5.5 to 10.

Fig. 1 shows a shuttering element 1 for the manufacture of components of concrete, in this case e.g. in the form of a shuttering panel 2, comprising a two-dimensional main body 3, the edge of which is provided with an circumferential protective edge 4 of plastics. The main body 3 of the shuttering element 1 is essentially made of wood and/or a wood material, which provides the shuttering element 1 with the rigidity and stability required for the usage, whilst the protective edge 4 essentially serves for largely protecting the edge region of the main body 3 against damages and the influence of moisture.

As a further protection against the influence of moisture to the main body 3, a plate surface 5 or two plate surfaces 5, 6 disposed opposite each other can respectively be provided with a top layer 7, screening the face of the main body 3 of wood or wood material from moisture and e.g. being made of a plastics surface, for example of polypropylene PP, varnish. At the main body 3, there can probably be a circumferential edge face 8, being the result of cutting or sizing, where the protective edge 4 is attached to. The circumferential protective edge 4 is in this case composed of several protective edge portions, and first protective edge portions 10, 10', 10'' and 10''' are disposed at first sub-faces 9, 9', 9'' and 9''' of the edge face and second protective edge portions 12, 12', 12'' and 12''' are disposed at second sub-faces 11, 11', 11'' and 11''' of the edge face 8. The first protective edge portions 10, 10', 10'' and 10''' respectively extend across the bigger part of the longitudinal edges or transverse edges of the main body 3, whilst the second protective edge portions 12, 12', 12'' and 12''' extend across the corner regions of the main body and directly follow contact faces 13 at a respectively adjacent first protective edge portion 10, with the result that a continuous protective edge 4 is created extending across the entire edge face 8. The protective edge 4 can naturally also referred to as edge protection and these two terms have an identical meaning in this context.

At each of the contact faces 13, one respective protective edge portion 11 and a second protective edge portion 12 are connected to each other in a permanent way and on the entire surface, with the result that the protective edge 4, also in the region of the contact surfaces 13, is sufficiently resistant to mechanical stresses and influences of moisture occurring during usage. Due to the used injection molding and the thereby effected deep connection of the second protective edge portion 12 with the first protective edge portion 10, the connection at the contact surface 13 is mechanically highly loadable and waterproof.

The first protective edge portions 10, 10', 10'' and 10''' are made of a first plastics material, having a high resistance to environmental influences, such as moisture, concrete ingredients, chemical substances, increased temperature, solar radiation and UV radiation.

5

When used, the second protective edge portions 12, 12', 12'' and 12''' are exposed to comparable mechanical loads and comparable environmental influences like the first protective edge portions 10 and they are made of a second plastics material, which is at least approximately identical to the first plastics material of the first protective edge portions 10, but they can also
10 be made of a second plastics material having characteristics considerably differing from those of the first plastics material.

The first protective edge portions 10, 10', 10'' and 10''', covering a large part of the longitudinal edges or the transverse edges of the main body 3 in the embodiment shown, are e.g. at-
15 tached to its edge face 8 in a continuous process and can be formed of a semi-finished material of the respective plastics material, for example in the form of prefabricated strip material, or endless roll goods, which is applied to the edge face 8 in an corresponding length. For this application of the first protective edge portions 10, 10', ..., for example all common methods for gluing on can be used, where high-strength and moisture-proof glue systems are used. At
20 this stage, PUR hot melt adhesives should be mentioned as an example for an applicable adhesive method, that are amongst others characterized by the fact that they can set under the influence of heat and/or under the influence of moisture and an excellent adhesive strength of a protective edge 4 at the main body 3 is achieved.

25 The second protective edge portions 12, 12', 12'' and 12''' being disposed in the corner regions of the main body 3, are applied to the main body 3 and the first protective edge portions 10, 10' by means of an injection molding and respectively extend between two first protective edge portions 10. For the injection molding to be performed, an in-mold assembly is disposed at the main body 3 with the first protective edge portions 10 already being arranged thereto so
30 that a mold cavity applicable for the manufacturing of the second protective edge portions 12 is created, which is on the one hand limited by elements of molded parts of the in-mold assembly itself and on the other hand by a second sub-face 11 at the edge face 8 as well as front faces of the adjacent, first protective edge portions 10. Other details of embodiment of this

injection molding will be explained in more detail on the basis of a further example of embodiment.

In the exemplary embodiment according to Fig. 1, the shuttering element is made of a rectangular shuttering panel 2, but naturally, shapes of the shuttering element 1 differing from the shape of a rectangle come into account, in particular differing corner angles but also curved sections of the edge face 8 of the main body 3, and a first protective edge portion 10 as well as a second protective edge portion 12 can be disposed at curved sections of the edge face 8.

Thus, using known methods e.g., edge materials can also be applied to rounded, sectional circular edge areas. The second protective edge portions 12 are preferably provided at sub-faces 11 of the edge section 8, where the edge face 8 changes its direction. The sub-faces thus extend across a directional change portion 14, which in the example of the shuttering panel 2 shown corresponds to one respective corner 15 of the main body 3.

Fig. 2 shows a section of a shuttering element 1, namely in a directional change portion 14 in the form of a corner 15, which approximately corresponds to the lower right corner in Fig. 1. This being the case, a first protective edge portion 10 is disposed at the edge face 8 of the main body 3 at the longitudinal edge and another, first protective edge portion 10' is disposed at the transverse edge and a second protective edge portion 12, encompassing the main body 3 in the region of the corner 15 and quasi closing the gap between the two first protective edge portions 10 and 10' extends in between. The permanent connection between the first protective edge portions 10 and 10' and the second protective edge portion 12 is adumbrated by short lines at the contact faces 13 here.

In Fig. 2, it is furthermore adumbrated that a thickness 16' of the second protective edge portion 12 can be approximately equal to the thickness 17 of the first protective edge portion 10' – in Fig. 2, the arm pointing upwards of the angle-shaped second protective edge portion 12, corresponding to the shorter transverse edge of the rectangle shuttering element 1 – or that a thickness 16 of the second protective edge portion 12 can be larger than a thickness 17 of the first protective edge portion 10 – as shown in Fig. 2 at the horizontal arm of the protective edge portion 12, corresponding to the longer longitudinal edge of the rectangle shuttering element in Fig. 1. This exemplary shown variant of the thickness 16 of the second protective edge portion 12 can be used to give it similar mechanical characteristics in the event of a load

approximately perpendicular to the protective edge 4, for example in order to compensate different degrees of hardness or elasticity between the plastics material of the first protective edge portion 10 and the plastics material of the second protective edge portion 12. It is thus recommended to use similar a same thickness 16' of the second protective edge portion 12 and the thickness 17 of the first protective edge portion 10', if both plastics materials have the approximately same elasticity, whilst e.g. a lower elasticity of a plastics material of the second protective edge portion 12 can be compensated with respect to the plastics material of the first protective edge portion 10 by choosing the for the second protective edge portion thickness larger 16 than the thickness 17 for the first protective edge portion 10, provided that both plastics materials have a higher elasticity than the main body 3 of wood and/or wood material, what can generally be assumed.

Fig. 2 furthermore shows that the edge face 8 can be machined after the first protective edge portion 10 has been applied and that similarly, the frontal surfaces of the first protective edge portion 10 forming the contact faces 13 can be prepared for being connected with the second protective edge portion 12. The limiting curve of the edge face 8 shown in Fig. 2 results e.g. from the fact that after the first protective edge portion 10 has been applied, into the passage, a milling tool is being attached which rotates with an axis of rotation oriented perpendicularly to the main body plane and is fed in immersion direction 18 perpendicular to the longitudinal edge of the shuttering element 1. The main body 3 is then further machined in a constant extent by moving the milling tool parallel to the longitudinal edge and at the end of the main body 3, another feed motion 19 perpendicular to the longitudinal direction is performed, effecting a curved runout zone 20 of the edge face 8 of the main body.

It is thereby of advantage if the arms of the angle-shaped, second protective edge portion 12 extend from the corner 15 of the finished shuttering element 1 across a multiple of the thickness 16 along the edge face 18, with the result that additional to the connection with the first protective edge portions 10, 10' at the contact faces 13, a large contact face between the second protective edge portion 12 and the main body 3 is achieved and thus, a high mechanical load capacity in terms of shearing procedures or peeling procedures is achieved. A sufficiently large adhesive surface between the second protective edge portion 12 and the main body 3, a joining surface 21 of the second protective edge portion 12 with the first protective

edge portion 10 and, if applicable, also with the main body 3 corresponds at least to a third of the total circumferential surface of the second protective edge portion 12.

The second protective edge portion 12 shown in Fig. 2 furthermore has, at least in sections, an approximately constant thickness 16, with the result that also in these sections largely constant, mechanical characteristics can be deemed to be the basis.

As an example for an alternative embodiment of a shuttering element 1, Fig. 3 shows a section of a corner 15 of a shuttering panel 2, where the curved edge face 8 of the main body 3 in the corner region and the two straight edges following thereto – for example the longitudinal edge and the transverse edge of a rectangular main body 3 is engaged by a first, continuous protective edge portion 10, and the corner 15 of the finished shuttering element 1 is formed of a second protective edge portion 12, which pointed at an outer surface 22 of the first protective edge portion 10. The outer face 22 of the first protective edge portion 10 can additionally be subject to a processing, to increase the durability of the connection. For example by machining the corner region provided with the first protective edge portion 10, the contact face 13 can be increased, with the result that additionally, a mechanical anchoring between the first protective edge portion 10 and the second protective edge portion 12 can be effected. If applicable, an additional anchoring of the second protective edge portion 12 in the main body 3 can be achieved by a boring going into the main body 3.

The contour of the edge face 8 is in this exemplary embodiment rounded in the form of a quadrant in the region that will be a corner 15 later, but in a modification, it can also be given a more rounded contour by means of an edge-gated chamfer or by two straight cuts, adumbrated by dash-dotted lines, compared to a rectangular trimmed main body 3 at the corner 15, with the result that the latter has a corner angle being larger than 90°, i.e. for example 135°. Compared to the rounded embodiment or the exemplary embodiment in Fig. 2, where the contour of the edge face 8 is machined by means of a cylindrical milling tool, a contour of the edge face 8 in the region of the outer corner being composed from straight sections can be produced by means of two or more straight saw cuts.

A rounding of chamfering in the region of the corner is advantageous for the application of the first protective edge portion 10, because if plastics material in the form of semi-finished

material is used, it has a certain inherent rigidity and by avoiding sharp edges of the edge face 8 in directional change portions 14, the application, in particular the circumferential gluing of the first protective edge portion 10 in one single stroke is substantially easier and the bonding at the main body 3 is better.

5

In the embodiment according to Fig. 3 or with a chamfering in the corner region, the second protective edge portion 12 has a changeable thickness 16, which also causes different mechanical characteristics at different places of the second protective edge portion 12. Due to the fact that no sudden changes of the thickness 16 of the second protective edge portion 12 is provided, the risk of impact loads when a shuttering element 1 of this kind is drawn or pushed over an edge of another item does not exist. The continuous changing of the thickness shown can, as well as the gentle transitions shown in Fig. 2, cause favorable flow conditions in terms of injection molding when the second plastics material is injected.

15 With dashed lines, Fig. 3 adumbrates an in-mold assembly 23, with which the second protective edge portion 12 can be applied to the corner region of a main body 3 already provided with a first protective edge portion 10. The in-mold assembly 23 thereto has a recess for molded part 24, which, together with the edge face 8 as well as the outer face 22 of the already applied first protective edge portion 10 borders a mold cavity 25 that corresponds to the later, second protective edge portion 12. For this purpose, at least one feed channel 26 is disposed within the in-mold assembly 23, via which the molten plastics material can be fed to the mold cavity 25. The feed channel 26 or the system of feed channels flows into at least one gate 27, probably also in several gates 27 in the mold cavity 25, and the gate(s) are positioned in a favorable way in terms of injection molding. In order to accelerate the setting of the molten plastics material of the second protective edge portion 12 and thus to shorten the required production time, preferably one cooling system is additionally disposed, to support the fast cooling of the second protective edge portion 12 after having been injected.

30 With respect to Fig. 3, a modification of the embodiment of the corners is also possible, where the first protective edge portion 10 has a joint 28 in the corner region, which is closed when the second protective edge portion 12 is being injected. At least one joint 28 of this kind inevitably results from the application of several first protective edge portions 10 or also of only one integrally circulating first protective edge portion 10 at the edge face 8 of the main

body 3, however, this is positioned in such an advantageous way that it is disposed in a corner region and is thus covered and closed by a second protective edge portion 12. The distance between the two frontal surfaces 29 to first protective edge portions 10 is thus bypassed, similar to the embodiment according to Fig. 1 or 2, and the frontal surfaces 29 are facing each other and have only a slight distance between each other.

In sections, Fig. 4 shows a sectional view through a shuttering element 1 according to line IV – IV in Fig. 1 in the region of a second protective edge portion 12 or in the region of a first protective edge portion 10. The edge face 8 of the main body 3 can in this case, as shown in solid lines, extend straight between the surfaces 30 of the shuttering element 1 but it can also be contoured, and the profiling is exemplarily shown by a groove 31 adumbrated with dashed lines in Fig. 4. The advantage of a butt, straight edge face 8 bases on the simple manufacture of the edge face 8, whereas an enlargement of the contact face between the first protective edge portion 10 or the second protective edge portion 12 and the main body 3 can be achieved by a profiling of the edge face 8. This enlargement of the contact face can effect a better anchoring with the main body 3 for the first protective edge portion 10, preferably being applied by means of a bonding techniques, as well as for the second protective edge portion 12, which is attached by means of an injection molding. This being the case, the additional anchoring of the first protective edge portion 10 can be effected by harpoon-like extensions of the profile engaging the groove 31.

Fig. 4 furthermore shows that the surfaces 30 of the shuttering element 1 can be formed of covering layers 32, which are connected to the main body 3 face to face. These covering layers 32 cause a protection of the main body 3, which can be made of wood and/or wood material and/or wood-plastics composite, against mechanical influences as well as against the influence of moisture or other, chemical substances, which can get in contact with the shuttering element 1. Together with the protective edge 4 being formed of the first protective edge portion 10 and the second protective edge portion 12, the covering layers 32 form a protective barrier against loads influencing from the outside, mechanical loads, influence of moisture and, if applicable, the influence of chemical substance for the main body 3. The covering layers 32 e.g. are made of plastics boards or coatings, for example of polypropylene PP or other thermoplastic or thermosetting, enhanced or unenhanced plastics and are glued or glued laminated to the main body 3 particularly over the entire surface. The edge face 8 of the main

body 3 can alternatively or additionally to a profiling have one or more recesses 33, by means of which an additional anchoring in the main body 3 for a second protective edge portion 12, applied by means of an injection molding, can be effected.

5 The thickness 17 of the first protective edge portion 10 is between 0.1 times and 0.5 times of the thickness of the main body 3. The main bodies 3 of the shuttering elements 1 frequently have a thickness between 15 mm and 35 mm, with the result that an average thickness of the first protective edge portion 10 between 2mm and 8mm has turned out to be advantageous in practice.

10

Fig. 5 shows another possible embodiment of a shuttering element 1 in a corner region 15, to the straight edges of the main body 3 of which, first protective edge portions 10 are attached, which are connected in the corner region 15 by means of a second protective edge portion 12. In this exemplary embodiment, the contour of the edge face 8 is produced by means of an end mill 34, the rotation axis 35 of which is oriented perpendicular to the surface 30 of the shuttering element 1. This being the case, the dashed line adumbrates the path of the rotation axis 35 relative to the main body 3. In this exemplary embodiment, the second protective edge portion 15 is embodied in a symmetrical way with respect to the corner 15, and this symmetrical embodiment of a corner can represent a simple solution, also for other variants of embodiment of a shuttering element 1.

20

Fig. 6 shows another exemplary embodiment of a shuttering element, the main body 3 of which is pre-trimmed in a rectangular way and the edge face 8 is modified with respect to a rectangle to the extent that once the first protective edge portion 10 is attached, slots 36 are inserted into the main body 3, e.g. by means of saw blades, which can effect an additional anchoring of the second protective edge portion 12 with the main body 3. In the exemplary embodiment, the slots 36 run approximately parallel to an angle bisector 37 of the corner 15. When said slots 36 are produced, the frontal surfaces of the previously applied first protective edge portions 10 can be machined at the same time, with the result that also the later contact faces 13 are being manufactured. Due to the diagonal embodiment of the slots 36, the contact faces between the first protective edge portion 10 and the second protective edge portion 12 in the region of the contact faces 13 are enlarged with respect to a transversely oriented slot and

25

30

thus also an improved mechanical connection at the contact faces 13 between protective edge portions 10, 12 adjoining each other can be effected.

Heavily simplified and schematically, Fig. 7 shows the method for the manufacture of a shuttering element 1 according to the invention, where a main body 3 probably covered by covering layers 32 runs through the following procedural steps in a continuous process:

- Sizing 38 of the longitudinal edges by means of a double end tenoner
- Edge banding 39 of the first protective edge portions 10 at the longitudinal edges of the main body 3
- 10 • Sizing 40 of the transverse edges of the main body 3 during the throughput, e.g. on a double end tenoner
- Edge banding 41 of the first protective edge portions 10 at the transverse edges of the main body 3
- Sizing 42 of the main body 3 for attachment of the second protective edge portion 12
- 15 • Injecting 43 of the second protective edge portions at the corner regions of the main body 3

In Fig. 8, another, if applicable individual embodiment of the shuttering element 1 is shown, and the same components are also denoted by the same reference numbers or component names as they are used in the preceding Figs. 1 to 7. Regarding components provided with reference number, which are not described in detail at this stage, it is referred to the corresponding description of the components provided with the same reference numbers in other exemplary embodiments.

25 Fig. 8 shows a shuttering element 1 in the form of a rectangle shuttering panel 2 with a main body 3 of wood and/or wood materials and/or wood-plastics composite and a circulating protective edge 4. The protective edge 4 is such manufactured that after an edge face 8 has been manufactured by pre-sizing the main body 3, a first protective edge portion 10 is glued or glued laminated to the edge face 8 of the latter and the edge face 8 extends over the entire
30 circumference of the edge face 8 in one piece, except from one joint 28. With its rectangular basic design, the main body 3 has four directional change portions 14 or corner regions, where the edge face 8 is provided with chamfers 44. These chamfers 44 or alternatively, the round-

ings described on the basis of Fig. 3 serve for guiding the first protective edge portion 10 around the corner sections simpler and without sharp bucklings. In the following, the corners 15 of the shuttering element 1 are such manufactured that second protective edge portions 12 are attached in the corner regions or the directional change portions 14 of the outer surface of the first protective edge portion 10 by means of an injection molding, and the sharp-edged and rectangular corners 15 of the finished shuttering element 1 are embodied by the injected plastics material of the second protective edge portion 12. Between the first protective edge portion 10 and the second protective edge portion 12, a permanent connection is manufactured by the injecting at the contact faces 13.

At the joint 28 – in Fig. 8 shown in the bottom right – the distance being present between the beginning and the end of the first protective edge portion 10 closed by the second protective edge portion and the contact face 13 also extends to the frontal surface 29 of the first protective edge portion 10. The manufacturing method of this embodiment of a shuttering element 1 can be similar to the method described on the basis of Fig. 7, and the sizing of the corner regions, in this case the manufacture of the chamfers 44 is effected directly after the longitudinal edges have been trimmed 38 and after the transverse edges have been trimmed 40. The application of the first protective edge portion 12 by edge banding 39 and 41 can be combined to one single circulating edge banding process, if applicable. The subsequent injecting of the second protective edge portions 12 in the corner regions completes the shuttering element 1.

Thus, Fig. 8 is an exemplary embodiment, where three corners 15 of the shuttering element 1 the respective second protective edge portion 12 is only connected to the outer faces 22 of the first protective edge portion 10 via the contact faces 13 and at the corner 15 having the joint 28 of the second protective edge portion 12, the second protective edge portion 12 is additionally to the contact face 13 disposed at the outer face 22 and the frontal surfaces 29 of the first protective edge portion 10 also connected to the edge face 8 of the main body 3.

According to the exemplary embodiments according to Figs. 1, 2, 5, 6, 7 and 8, the frontal surfaces 29, being formed from the end sections of the first protective edge portion 10 and which form the joints 28, are disposed in the straight sections of the edge face 8, with the result that the end sections are not subject to a curvature, which could probably effect an peeling off of the first protective edge portion from the main body due to bending stress.

A further embodiment of a shuttering element 1, in Fig. 9 shown in a sectional view, can be that the first protective edge portion 10 is not made of a homogenous plastics material, but, in the direction thickness of the shuttering element, is combined of at least three sections 45a, 45b, 45c, and these sections 45a, 45b, 45c can be made of different plastics materials, which also can have different mechanical properties each. The sections 45a, 45b, 45c can be connected to each other by adhesive bonds, it is nevertheless advantageous to manufacture the plastics material for the first protective edge portion 10 by a so-called coextrusion method, which, in a extrusion process, connects different plastics materials to an integral extruded profile, being used for the first protective edge portion 10 as a semi-finished product. An advantageous embodiment of such a first protective edge portion 10 is achieved if the outer sections 45a and 45c are made of a material having a high resistance to wear and tear and also high toughness, e.g. thermoplastic polyurethane (TPU) and if the section 45b lying in between is made of another material – preferably also TPU – having a higher elasticity and can quasi act as an expansion part which can expand in the event that the main body 3 changes its thickness due to influence of moisture and the two outer sections 45a and 45b remain flush with the plate surfaces 5, 6 of the main body 3 because they can follow the change of the thickness of the main body 3 due to the relatively elastic section 45b, and the danger that the glue joint peels off due to high shear stress does not exist.

The local higher elasticity of such a protective edge portion 10 comprising several sections can alternatively or in addition to the above described measures achieved by the measure that the thickness 16 of the protective edge 4 is not constant in the direction of the shuttering element but has a local reduction of cross-section, for example in the form of a grooving, recess, flute or suchlike extending in circumferential direction of the edge face, with the result that the plastics provided with elastic properties locally allows a larger deformation and the protective edge portion 10 can bear modifications of the thickness of the main body 3 without sustaining damages.

Another feature of embodiment of a shuttering element 1 that can be combined with above described embodiments is shown in partial view in Fig. 10 as well as in a sectional view according to XI – XI in Fig. 11. This being the case, the second protective edge portion 12 is injected to a directional change portion 14 in the form of a rectangular corner 15 directly at

the edge face 8 and is via contact faces 13 connected to the first protective edge portions 10 edges following the corner 15. In this case, the edge face 8 is rounded at the corner, with the result that the second protective edge portion 12 made of a second plastic material has a larger material thickness and protects the regions of the corner 15 of the main body 3 against pushes.

5 As shown in Fig. 11, in the regions of the corner 15 at both sides of the plate, the second protective edge portion 12 has an elevated portion 46, which stands proud with respect to the plate surface 5 or 6, with the result that a thereto corresponding deepening is produced in the finished concrete surface. The thickness of the shuttering element 1 is thus somewhat larger in the region of the corner 15 than in the region of the main body 3, and the elevation 47 of such an elevated portion 46 with respect to the plate surface 5 can be approximately between
10 0.5mm and 2mm. The shuttering element 1 preferably has identical elevated portions 46 on both surfaces 5, 6, with the result that such a shuttering element 1 can be used from both sides, it is derogating from the above also possible to embody the elevated portions 46 only on one plate surface 5 or 6.

15 In the exemplary embodiment shown, the elevated portion 46 is embodied in such a way, that it has an elevated surface running parallel to the plate surface 5, 6 and extending to the corner 15. This being the case, the elevated surface 48 has the shape of an equilateral rectangular triangle, which is symmetrical with respect to the angle bisector 37. In the event that the corners 15 of several shuttering elements 1 of one shuttering are adjacent to one another, the re-
20 spective elevated surface 48 complement one another to be a larger, planar total elevation, forming a thereto corresponding deepening in the finished concrete surface.

25 The second protective edge portion 12 can additionally have a ramp-like transition area 49 extending from the level of the plate surface 5 or 6 to the elevated surface 48, with the result that a gradually rising transition from the plate surface 5, 6 to the elevated surface 48 is created.

30 The essential advantage of such elevated portions 46 is that in the event of a swelling of the main body 3 probably occurring while a shuttering element 1 is being used, even if the thickness of the main body increases, it does not project above the elevated portion 46 and thus no elevation at the finished concrete surface results in the region of the corner 15 of such a shuttering element 1. The resulting small deepening at the finished concrete surface can be elimi-

nated little effort, for example by filling, if necessary, whilst elevations at the finished concrete surface are problematic and have to be eliminated with great effort, for example by grinding.

5 The transition area 49, forming a gently rising connection between the plate surface 5, 6 and the elevated surface 48 has an angle of inclination of preferably less than 30° , in particular less than 20° . As a result, also gentle and gradually rising or extending transitions at the finished concrete surface are made and it is largely avoided for the elevated portion 46 to get stuck at the edges.

10 In the Figs. 12 and 13, another, if applicable individual embodiment of the shuttering element 1 is shown, and the same components are also denoted by the same reference numbers or component names as they are used in the preceding Figs. 11 and 11. In order to avoid unnecessary repetitions, it is referred to the detailed descriptions in the preceding Figs. 10 and 11.

15 As shown in the partial view according to Fig. 12 and in Fig. 13 shown by a sectional view according to line XIII – XIII in Fig. 12, the second protective edge portion 12 of this embodiment is attached to the outer face 22 of the first protective edge portion 10 and thereto connected over the entire common contact face 13, i.e. similar to the embodiment in Fig. 3. The first protective edge portion 10 thereby also extends across the directional change portion
20 14 or the region of the corner 15 and is flush with the plate surfaces 5 and 6. The injected second protective edge portion 12 has in this case also the elevated portions 46 described on the basis of Figs. 10 and 11, in particular with elevated surfaces 48 and transition areas 49.

25 The shape of the elevated portions 46 or the elevated surfaces 48 can naturally differ from the figurative shapes shown, e.g. if the transition area 49 does not pass into the following plate surface 5 or the elevated surface 48 in a sharp-edged way and rounded transitions can be embodied as well. The top view of the elevated surface 48 can e.g. have a curved edge and thus an elevated surface having the shape of a quadrant can result.

30 When the shuttering element 1 is manufactured by injecting the second protective edge portions 12 forming the corners 15 of the finished shuttering elements 1, for the embodiment having elevated portions, an in-mold assembly 23 is used, the forming areas of which are adjustable in the direction of the thickness of the plate, with the result that the deforming in the direction of the plate surface is allowed.

5 The above described exemplary embodiments refer to possible variants of embodiment of a method for public provision of protected electronic documents and are not intended to limit the scope of the invention to these illustrated variants of embodiments provided herein but that there are also various combinations among the variants of the embodiments themselves and variations regarding the present invention should be executed by a person skilled in the art. All and every imaginable variants of the embodiment, arising from combining single details of the variant of embodiment illustrated and described are subject to scope of protection.

10 As a matter of form, it is finally also noted that in order to facilitate an enhanced understanding of the design of the shuttering element 1 and its component parts, these are illustrated in part not to scale and/or enlarged and/or reduced in size.

15 The fundamental function of the independent inventive solutions can be taken from the description.

20 Particularly, the individual features illustrated in the embodiments shown in the Figs. 1; 2; 3; 4; 5; 6; 7; 8; 9; 10, 11; 12; 13 may be construed as independent solutions proposed by the invention in their own right. The associated objectives and solutions proposed by the invention may be found in the detailed descriptions of the drawings.

List of Reference Numerals

5	1	Shuttering element		
	2	Shuttering panel		
	3	Main body	41	Edge banding
	4	Protective edge	42	Sizing
	5	Plate surface	43	Injecting – Injection molding
10			44	Chamfer
	6	Plate surface	45	Section
	7	Top layer		
	8	Edge face	46	Elevated portion
	9	Sub-face	47	Elevation
15	10	First protective edge portion	48	Elevated surface
			49	Transition area
	11	Sub-face	50	Angle of inclination
	12	Second protective edge portion		
	13	Contact face		
20	14	Directional change portion		
	15	Corner		
	16	Thickness		
	17	Thickness		
25	18	Immersion direction		
	19	Feed motion		
	20	Runout zone		
	21	Joining surface		
30	22	Outer face		
	23	In-mold assembly		
	24	Recess for molded part		
	25	Mold cavity		
35	26	Feed channel		
	27	Gate		
	28	Joint		
	29	Frontal surface		
	30	Surface		
40				
	31	Groove		
	32	Covering layer		
	33	Recess		
	34	End mill		
45	35	Rotation axis		
	36	Slot		
	37	Angle bisector		
	38	Sizing		
50	39	Edge banding		
	40	Sizing		

Claims

1. Shuttering element (1) with a protective edge (4), in particular a shuttering panel (2), comprising a two-dimensional main body (3) made of wood and/or wood material and/or wood-plastics composite and defined by an edge face (8), a first protective edge portion (10) made of a first plastics material or a combination of a plurality of first plastics materials and arranged on first sub-face (9), at least corresponding to the entire edge face (8) of the main body (3), of the edge face (8), a second protective edge portion (12) made of a second plastics material by means of an injection molding process being mounted on at least one second sub-face (11) of the edge face (8) of the main body (3) and/or an outer face (22) of the first edge protection portion (10) and at a contact face (13), the second edge protection portion (12) is attached to the first edge protection portion (10) and at the contact face (13), the second edge protection portion (12) is permanently connected to the first protective edge portion (10), characterized in that the second protective edge portion (12) extends over a directional change portion (14), in particular a corner (15), of the edge portion (8) of the main body (3) or over a directional change portion (14) of the outer face (22) of the first protective edge portion (10).
2. Shuttering element (1) according to claim 1, characterized in that the plastics material or the plastics materials of the first protective edge portion (10) and the plastics material of the second protective edge portion (12) are essentially made of a permanently elastic plastics, in particular of thermoplastic polyurethane.
3. Shuttering element (1) according to claim 1 or 2, characterized in that the second protective edge portion (12) at least in sections provides a constant thickness (16) perpendicular to the respective edge face (8) or outer face (22).
4. Shuttering element (1) according to one of the preceding claims, characterized in that the end sections of the first protective edge portion (10) that form the frontal surfaces (29) are arranged at straight sections of the edge face (8).
5. Shuttering element (1) according to one of the preceding claims, characterized in that at a directional change portion (14) of the main body (3) or of the first protective edge

portion (10), in particular a corner (15), the thickness (16) of the second protective edge portion (12) measured along the angle bisector of two edge faces (8) following the directional change portion (14) is between 5 times and 15 times the thickness (17) of the first protective edge portion (10).

5

6. Shuttering element (1) according to one of the preceding claims, characterized in that the first protective edge portion (10) is connected to the edge face (8) of the main body (3) in a butt way and over the entire surface and the second protective edge portion (12) is connected to the edge face (8) of the main body (3) and/or the outer face (22) of the first protective edge portion (10) in a butt way over the entire surface.

10

7. Shuttering element (1) according to one of the preceding claims, characterized in that the edge face (8) or the outer face (22) below the second protective edge portion (12) has at least one recess (33), in particular in the form of a slot or a boring, in the main body (3) and/or the first protective edge portion (10) or a profiling, in particular a groove (31), extending along the edge face (8) of the main body (3) and/or the outer face (22) of the first protective edge portion (10).

15

8. Shuttering element (1) according to one of the preceding claims, characterized in that the first protective edge portion (10), in direction of the thickness of the main body (3) is composed of at least sections (45a, 45b, 45c) and the two sections (45a, 45c) being nearest to the plate surfaces (5, 6) are made of a plastics material having at least approximately identical mechanical properties and the at least one section (45) being in between has a higher elasticity compared to the sections (45a, 45c).

20

25

9. Shuttering element (1) according to one of the preceding claims, characterized in that the first protective edge portion (10) is essentially flush with the plate surface (5, 6) and the second protective edge portion (12) has an elevated portion (46), which is raised with respect to the plate surface (5, 6) of the main body (3), in particular by at least 0.5 mm.

30

10. Shuttering element (1) according to claim 9, characterized in that the elevated portion (46) has an elevated surface (48), which is parallel to the plate surface (5, 6) and extends to a

corner (15) of the shuttering element (1).

5 11. Shuttering element (1) according to claim 10, characterized in that the elevated portion (46) has a transition area (49), which extends in ramp-like way from the level of the plate surface (5, 6) to the elevated surface (48).

10 12. Method for the manufacture of a shuttering element (1) with a protective edge (4), in particular a shuttering panel (2), comprising sizing of a two-dimensional main body (3) of wood or wood material for manufacturing an edge face (8), attaching a first protective edge portion (10) made of a first plastics material to a first sub-face (9) at least approximately corresponding to the entire edge face (8) of the main body (3), of the edge face (8) by means of a bonding techniques or an injection procedure, and following attaching a second protective edge portion (12) made of a second plastics material to a second sub-face (11) of the edge face (8) and/or to an outer face (22) of the first protective edge portion (10), and the second
15 protective edge portion (12) is at a contact face (13) directly connected to the first protective edge portion (10) by means of an injection molding process by using an in-mold assembly (23) encompassing the main body (3) and a section of the first protective edge portion (10), and by the attachment of the second protective edge portion (12) at the contact face (13), a permanent connection between the first protective edge portion (10) and the second protective
20 edge portion (12) is established, characterized in that the second is attached via a directional change portion (14), in particular a corner (15), of the edge face (8) of the main body (3) or a directional change portion (14) of the outer face (22) of the first protective edge portion (10).

25 13. Method according to claim 12, characterized in that the connection of the second protective edge portion (10) to the first protective edge portion (10) at the contact face (13) is made by a partial melting process or a welding process.

14. Method according to claim 12 or 13, characterized in that the first protective edge portion (10) is attached as prefabricated edge material.

30 15. Method according to one of the claims 12 to 14, characterized in that before the second protective edge portion (12) is attached, the contact face (13) at the first protective edge portion (10) and/or the edge face (8) of the main body (3) is subject to a machining, in par-

ticular in a continuous process.

16. Method according to one of the claims 12 to 15, characterized in that at the edge face (8) of a main body (3), a continuous first protective edge portion (10) or a plurality of first
5 protective edge portions (10, 10', 10'', 10''', ...) are attached and subsequently, at directional change portions (14) of the outer face (22) of the continuous first protective edge portion (10) or at joints (28) between the first protective edge portions (10, 10', 10'', 10''', ...), the second protective edge portions (12) are attached by means of an injection molding process.

10

15

20