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(54) **FORMWORK PANEL ELEMENT AND FORMWORK SYSTEM**

(71) Applicant: **PERI SE**, Weissenhorn (DE)

(72) Inventors: **Werner Schneider**, Erbach (DE); **Guenther Stauderausch**, Kirchhaslach (DE)

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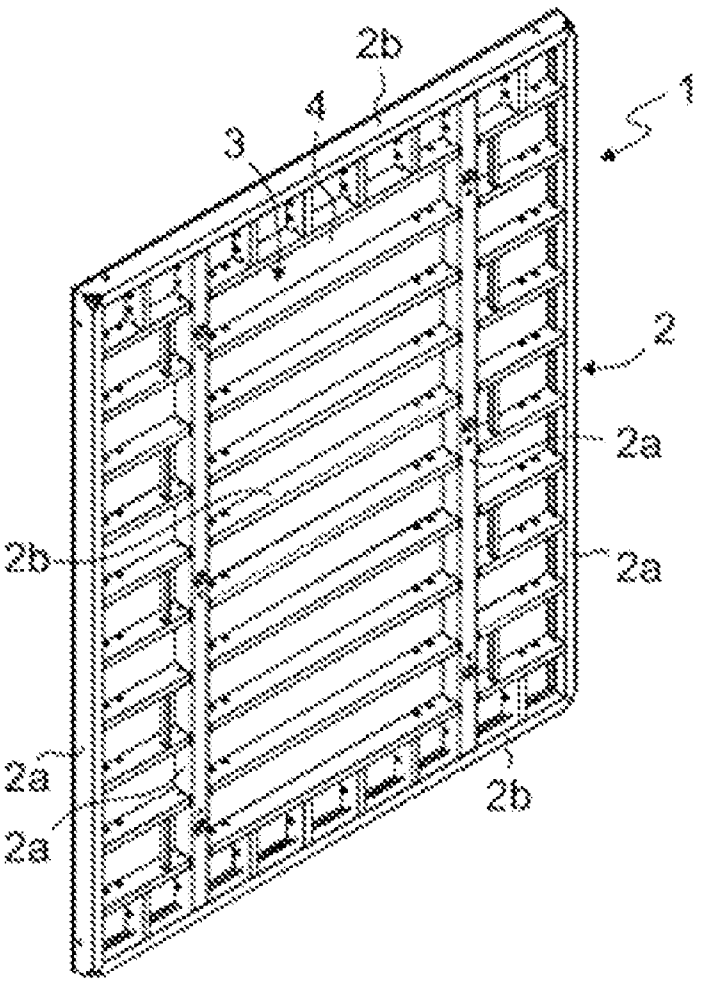
(57) **ABSTRACT**

The invention relates to a formwork panel element for shuttering a curable building material, having a frame (**2**) and having a multilayer formwork skin (**3**) fastened to the frame (**2**). The formwork skin (**3**) has a support panel (**4**) and a rigid wear panel (**5**). The support panel (**4**) is fastened to the frame (**2**). The wear panel (**5**) is releasably fixed to the support panel (**4**). A front side (**5***a*) of the wear panel (**5**) facing away from the support panel (**4**) is designed as a surface in contact with the building material. The support panel (**4**) is fastened to the frame (**2**) so that it is resistant to tensile stress and shearing, in such a way that the support panel (**4**) supports the frame (**2**) statically, the support panel (**4**) being connected to the frame (**2**) in a non-releasable manner, or in a manner allowing release under certain conditions.



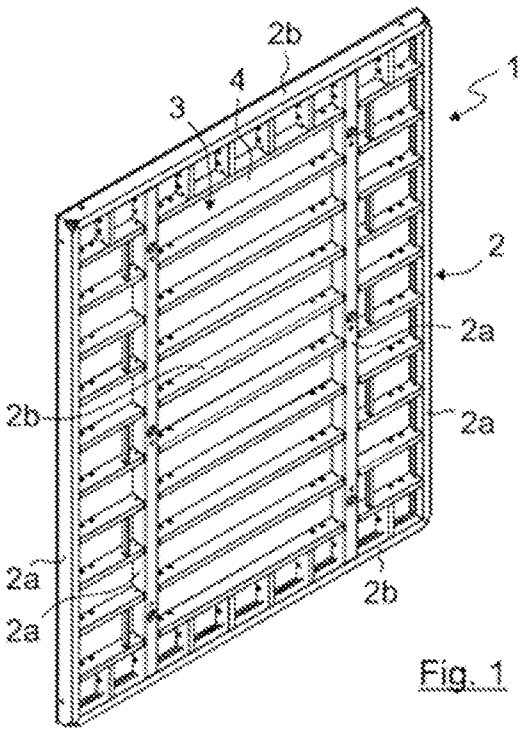


Fig. 1

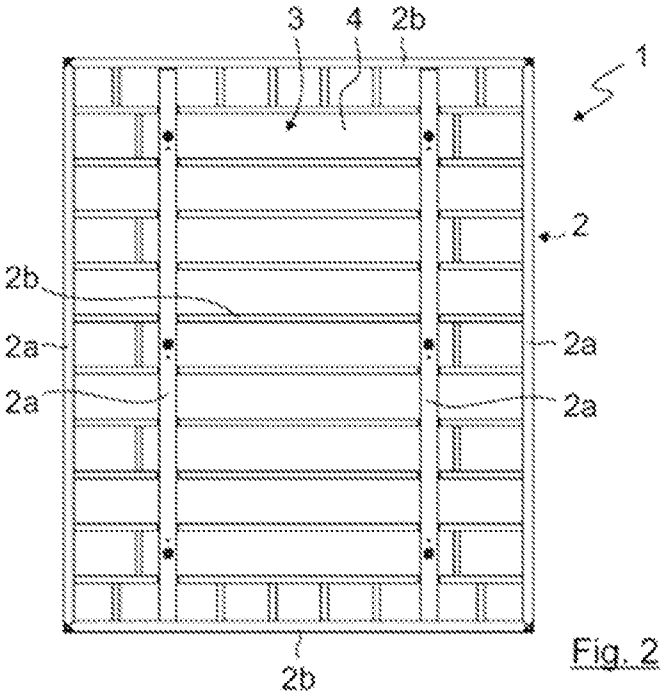


Fig. 2

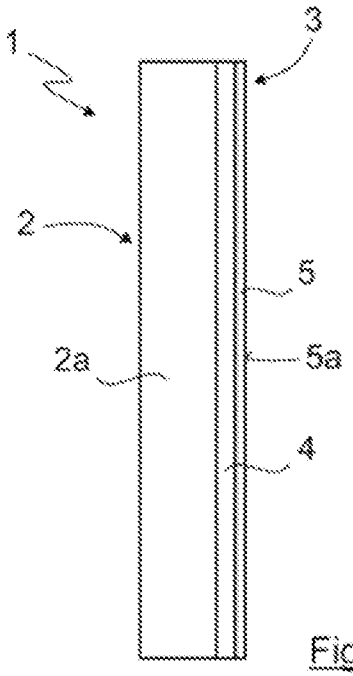


Fig. 3

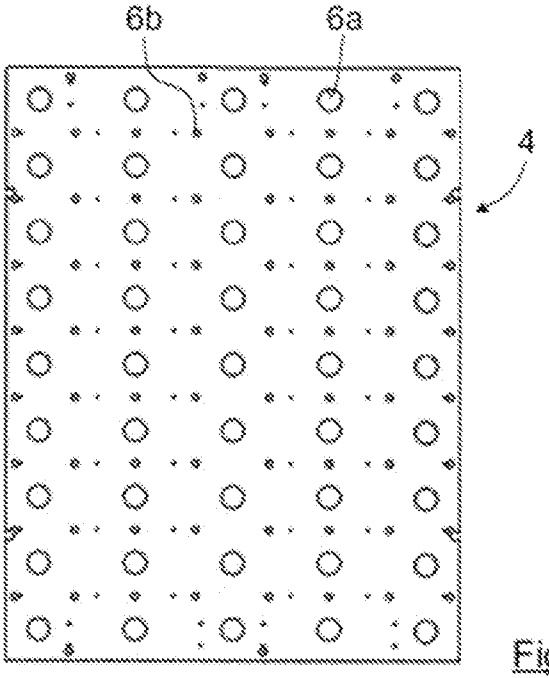


Fig. 4

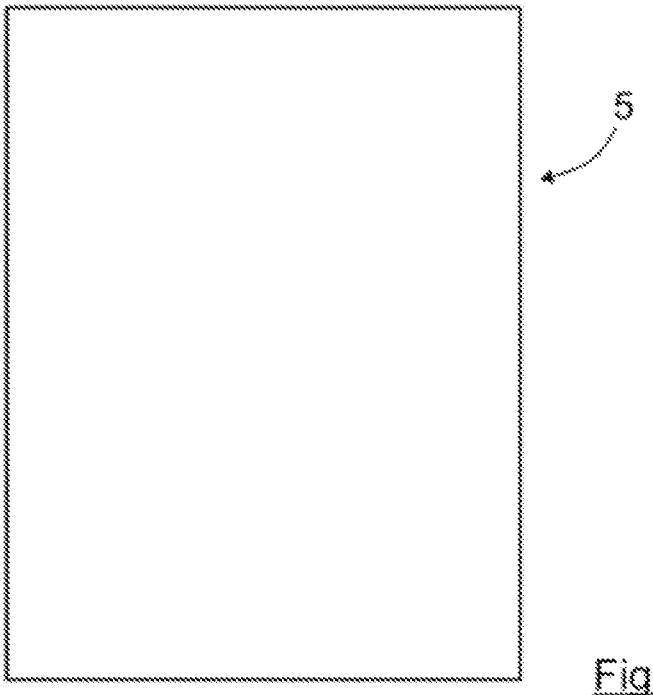


Fig. 5

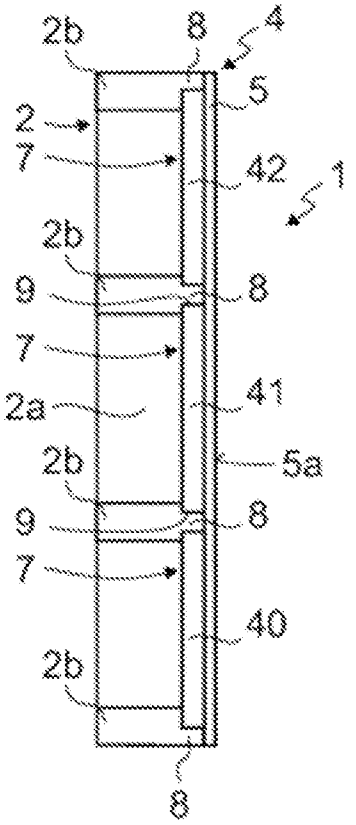


Fig. 6

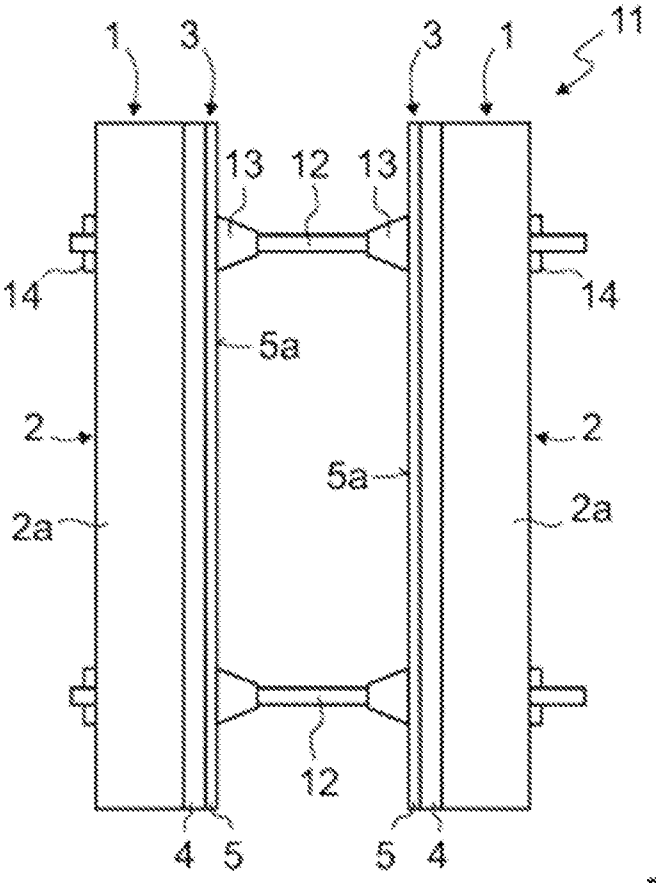


Fig. 7

FORMWORK PANEL ELEMENT AND FORMWORK SYSTEM

[0001] The invention relates to a formwork panel element for shuttering a curable building material, having a frame and a having a multilayer formwork skin fastened to the frame, according to the preamble of claim **1**.

[0002] The invention also relates to a formwork system according to claim **12**.

[0003] Formwork panel elements are used as parts of formwork systems, in particular for the production of concrete components. The formwork panel elements are arranged in such a way that they form a mold into which a curable building material, usually a flowing concrete, is poured to produce a concrete component—for example, a wall element. After the concrete has cured, the formwork panel elements are usually removed.

[0004] The formwork panel elements have a frame to which the formwork skin is attached.

[0005] On the one hand, the frame of the formwork panel elements should be stable, to enable transferring loads which arise when the formwork system is filled with curable concrete. On the other hand, the frame should be sufficiently rigid to ensure high dimensional accuracy and to avoid unwanted deformation.

[0006] The structure of a surface of the concrete component facing the formwork skin, hereinafter also referred to as the "visible surface", is determined by the formwork skin fastened to the frame. A front side of the formwork faces the concrete which will be poured in—that is, the front side of the formwork skin forms the surface in contact with the concrete—while the reverse side of the formwork is fastened to the frame.

[0007] Damage to the front side of the formwork skin facing the concrete—which can result, for example, from transport or handling of the formwork panel element on the construction site—is reflected accordingly on the visible surface of the concrete component to be produced from the concrete. Damage to the formwork skin must therefore be repaired, which is done, for example, by filling small areas of damage, or, for larger areas of damage, by utilizing repair pads. As a result, however, the surface of the formwork skin is structured, which is undesirable when producing concrete components.

[0008] Formwork panel elements made of wood are known from the prior art. These have the disadvantage that they swell up due to the ingress of moisture. With heavy use, the protective impregnation layer is destroyed, and the surface frays. Furthermore, nails that are hammered into the formwork element during use damage the veneer layer or the protective impregnation layer, such that water can penetrate at these points.

[0009] Formwork panel elements made of plastic are also known from the prior art. Although these do not swell when damaged by the ingress of water, they have to be repaired manually and at great expense, just like wooden panels, if they have been damaged during use, particularly on the surface of the formwork skin facing the concrete.

[0010] A generic formwork panel element is known from DE 101 14 161 A1. The generic formwork panel element has a frame and a multilayer formwork skin fastened to the frame. It is provided that the surface of the formwork skin that contacts or faces the concrete is formed by a formwork film. DE 101 14 161 A1 is based on the idea of avoiding time-consuming repair and improvement work on the formwork skin for reuse by replacing a scratched or otherwise damaged surface of the formwork skin with a new formwork film. According to DE 101 14 161 A1, in order to reuse the formwork panel element, the surface of the formwork skin facing the concrete is coated with a new formwork film. The formwork panel element known from DE 101 14 161 A1 is said to have a formwork skin with a formwork film, which can be detached from the support system and replaced without destroying it. The formwork film is intended to form the actual contact surface with the concrete, and is responsible for the surface structure and the surface quality of the concrete.

[0011] However, the use of a formwork film that is detached from the formwork skin after wear and replaced by a new formwork film is not optimal, due to the coating process required for this.

[0012] Another disadvantage of using formwork films is that the formwork film can warp and become unusable as a result.

[0013] In the case of formwork panel elements, it is generally desirable if they have the highest possible static load capacity. In this regard, too, it is important to improve the formwork panel elements known from the prior art.

[0014] The present invention is therefore based on the object of improving the formwork panel elements known from the prior art for shuttering a curable building material, in particular to enable repairs to be made in the event of damage to the surface of the formwork skin facing the building material, and to improve the static load-bearing capacity of the formwork panel element as far as possible.

[0015] The present invention is also based on the object of improving the formwork systems known from the prior art, in particular of simplifying their repair and of improving the static load-bearing capacity as far as possible.

[0016] This object with respect to the formwork panel element is solved by the features of claim **1**.

[0017] With regard to the formwork system, this object is achieved by the features of claim **12**.

[0018] Insofar as the specific term "concrete" is used below in the context of the description of the invention, instead of the general term "building material", it should also be understood as a disclosure of the general term "building material".

[0019] The formwork panel element according to the invention for shuttering a curable building material has a frame and has a multilayer formwork skin fastened to the frame. According to the invention, the formwork skin has a support panel and a rigid wear panel. The support panel is fixed to the frame, and the wear panel is releasably secured to the support panel. A front side of the wear panel facing away from the support panel is designed as a surface in contact with the building material. The support panel is fastened to the frame in such a way that it is resistant to tensile stress and shearing, such that the support panel supports the frame statically, the support panel being connected to the frame in a non-releasable manner, or in a manner allowing release under certain conditions.

[0020] Due to the fact that the formwork skin according to the invention has a support panel and a rigid wear panel, there are a plurality of advantages. On the one hand, the inventor has recognized that a rigid wear panel can be detached from the support panel in a particularly simple and advantageous manner.

[0021] The rigid wear panel thus forms a wear lining that can be changed when necessary.

[0022] The wear panel, the front side of which faces the curing building material, and thus influences the structure of the surface—that is, the visible surface—of the building material, in particular concrete, can be replaced quickly and easily if the wear panel is damaged. This measure can be carried out in particular in the event that the front side of the wear panel facing the building material is damaged. Replacing the rigid wear panel is easier than coating the formwork skin with a new formwork film. Furthermore, a rigid wear panel is more robust than a formwork film, which is particularly advantageous in daily use on the construction site.

[0023] The feature that the wear panel is releasably fixed to the support panel preferably also includes a connection allowing release under certain conditions—that is, if only the auxiliary joining parts have to be destroyed in order to release the wear panel from the support panel.

[0024] The frame of the formwork panel element is preferably made of metal, in particular iron or steel.

[0025] Because the invention provides for the support panel of the formwork skin to be fastened to the frame with tensile and shear strength, such that the support panel supports the frame statically, the static load capacity of the entire formwork panel element is improved.

[0026] A non-releasable connection of the support panel to the frame has proven to be particularly suitable. The support panel can thus support the frame statically in a particularly advantageous manner. Conditional releasability of the support panel from the frame can also be suitable in this case. Conditional releasability exists, for example, when only the auxiliary joining parts have to be destroyed, and not the support panel or the frame, in order to release the parts from one another. This includes, for example, knocking off the rivets in a riveted joint.

[0027] The support panel is preferably fixed to the frame or permanently installed in the frame, such that the support panel supports the frame statically. The formwork skin has not been included in previous calculations of the static load-bearing capacity of a formwork panel element. Because the formwork skin has a support panel and a rigid wear panel, it is now possible to attach the support panel to the frame permanently, with tensile and shear strength, such that the support panel supports the frame statically, and can therefore be included in the calculation of the static load-bearing capacity.

[0028] It is preferably provided that the support panel is designed in such a way that it remains connected to the frame or remains part of the formwork panel element over the calculated service life of the formwork panel element.

[0029] It can be provided within the scope of the invention that the support panel itself has a multilayer structure, with the layers of the support panel preferably being glued, adhered, or otherwise connected to one another in a materially bonded and/or non-positive and/or positive manner.

[0030] However, it is particularly suitable if the support panel is designed as a single piece.

[0031] Furthermore, it is particularly suitable if the rigid wear panel is also designed as a single piece.

[0032] The support panel is preferably designed to prevent deflection of the rigid wear panel. The support panel is preferably rigid. The support panel is preferably designed to be weatherproof. Furthermore, the support panel is preferably designed so that it can be nailed. The support panel preferably has a high pull-out resistance for the nails. The support panel is preferably designed and/or treated in such a way that it is resistant to the usual formwork agents.

[0033] According to the invention, it can be provided that the support panel is 30% to 80%, preferably 40% to 80%, more preferably 40% to 70%, particularly preferably 50% to 70%, and very particularly preferably 50% to 60% of the thickness of the formwork skin.

[0034] The aforementioned values have proven to be particularly suitable, in particular so that the support panel supports the frame statically, and deflection of the wear panel is reliably prevented.

[0035] It is advantageous if the support panel has a thickness of 6 to 14 mm, preferably 7 to 13 mm, more preferably 8 to 12 mm, particularly preferably 8 to 11 mm, and very particularly preferably 8 to 10 mm—in particular, 9 mm.

[0036] The aforementioned values have proven to be particularly suitable for forming the support panel.

[0037] The aforementioned values are suitable in particular in connection with the aforementioned percentage values which the support panel can have in relation to the thickness of the formwork skin.

[0038] According to the invention, it can also be provided that the support panel is connected to the frame in a non-positive manner and/or in a materially-bonded manner, and/or in a positive manner.

[0039] According to the invention, it can be provided that the support panel is glued and/or welded and/or soldered and/or riveted and/or screwed and/or nailed to the frame. Furthermore, the frame can also have projections, for example a peripheral projecting edge, such that the support panel can be inserted into the peripheral edge of the frame in a positive manner. The peripheral edge can also have recesses or interruptions.

[0040] It has proven particularly suitable to connect the support panel to the frame by riveting—that is, riveting the support panel to the frame.

[0041] It is advantageous if the support panel is designed as a metal panel, a plastic panel, a panel made of a fiber composite material, a wooden panel, or a composite panel.

[0042] Provision can also be made for the support panel to be made from a plastic composite construction, for example, a sandwich panel consisting of polypropylene and aluminum or glass fiber, preferably without wood or wooden parts. Such a support panel can be nailed and repaired like a wooden board.

[0043] In particular, it can be provided that the support panel is designed as a plastic panel made of polyethylene or polypropylene.

[0044] It can also be provided within the scope of the invention that expanded metal is inserted, preferably welded, into the support panel. The insertion or welding of expanded metal can further increase the load-bearing capacity of the support panel, as a result of which the frame is further supported statically.

[0045] In principle, the rigid wear panel can also be designed as a metal panel, a plastic panel, a panel made of a fiber composite material, a wooden panel, or a composite panel. In particular, it can be advantageous to form the rigid wear panel out of wood or plastic.

[0046] The support panel should preferably be designed in such a way that it can be nailed with little tearing damage, in particular on the reverse side of the support panel facing away from the rigid wear panel.

[0047] According to the invention, it can also be provided that the support panel has openings for detaching, and/or bore holes for fastening, the wear panel.

[0048] It has proven to be advantageous if the support panel has openings for detaching the wear panel. The openings can be designed as maintenance openings through which the rigid wear panel can preferably be pressed out. It is also advantageous if the support panel has bore holes for fastening the wear panel. The bore holes can be provided, for example, for screwing and/or riveting through the wear panel. Provision can preferably be made for the wear panel to be screwed or riveted on from the reverse side of the support panel.

[0049] The reverse side of the support panel facing away from the wear panel is preferably designed in such a way that it can be easily cleaned with a high-pressure cleaner.

[0050] Furthermore, it can be advantageous if the reverse side of the support panel is designed to be light-resistant—that is, it does not change upon the application of light. The reverse side of the panel is preferably designed in such a way that, according to DIN 53952, which is no longer valid, it has at least a light fastness rating of 5 (good), preferably a light fastness rating of 6 (very good).

[0051] The support panel is preferably designed in such a way that, if the struts or the transverse frame parts have a spacing of 300 mm and a width of 40 mm, the deflection of the support panel is at most 1.5 mm.

[0052] In an alternative embodiment of the invention, it can also be provided that the support panel is subdivided into a plurality of support panel segments, each of which covers corresponding segments of the frame.

[0053] The subdivision of the support panel into a plurality of support panel segments, each of which covers corresponding segments of the frame, has proven to be advantageous for specific applications. The support panel segments can be manufactured inexpensively and fixed within the corresponding segments so that they are resistant to tensile stress and shearing, such that each of the support panel segments support the frame statically. Provision can also be made for the support panel segments to be inserted in a positive manner into the respective corresponding segments of the frame. The position fit can preferably be made in such a way that the positive fit prevents movement of the support panel segments within the plane of the support panel segments.

[0054] It is advantageous if the frame, on its front side facing the support panel, has projections protruding in the direction of the support panel, which bound the segments, the support panel segments being inserted into the segments in such a way that each of the support panel segments has an edge resting on at least one of the projections, and at least one edge region of the reverse side of the support panel segment facing the frame, said edge region being adjacent to the edge, rests against a surface of the front side of the frame which is adjacent to the projection.

[0055] The aforementioned configuration has proven to be particularly suitable for fixing the support panel segments in a positive manner. In this case, a non-positive and/or materially bonded connection is preferably also provided. Provision can be made for the support panel segments to be glued and/or welded and/or soldered and/or riveted and/or screwed and/or nailed to the frame as an alternative or in addition to the positive fit.

[0056] According to the invention, it can also be provided that the wear panel is nailed and/or screwed and/or riveted and/or releasably glued to the support panel.

[0057] The aforementioned options for connecting the wear panel to the support panel have proven to be particularly suitable. The wear panel is preferably nailed and/or screwed and/or riveted to the support panel from behind—that is, from the reverse side.

[0058] According to the invention, it can be provided that the wear panel has a thickness of 4 to 11 mm, preferably 5 to 10 mm, more preferably 6 to 10 mm, particularly preferably 7 to 10 mm, in particular 8 mm.

[0059] The aforementioned values have proven to be particularly suitable, so that the wear panel is rigid and robust. The aforementioned values have proven to be particularly suitable, in particular in connection with the values specified with regard to the support panel.

[0060] It is also particularly suitable if the wear panel is at least 20% as thick as the formwork skin. Furthermore, it is particularly suitable if the wear panel has at most 50% of the thickness of the formwork skin. Preferably, the support panel has a thickness greater than the thickness of the wear panel. This means that, based on the values of the support panel named as preferred values, the wear panel preferably has a lesser thickness, preferably such that the wear panel has a thickness of at least 4 mm. However, the thickness of the wear panel is preferably at least 1 mm less than the thickness of the support panel.

[0061] The support panel is preferably designed in such a way that it assumes the load-bearing function in relation to the concrete pressure in full or at least 70%, preferably at least 80%, particularly preferably at least 90%, in particular at least 95%. Since in this configuration, the wear panel only has to absorb a small amount of, or no, concrete pressure, it can be made thinner, preferably much thinner, compared to the support panel, which reduces the cost of the wear panel and thus also the repair costs.

[0062] The invention also relates to a formwork panel system according to claim **12**, which has at least two formwork panel elements and a plurality of anchor rods in order to brace the formwork panel elements at a distance from one another.

[0063] As a rule, the two ends of an anchor rod have a threading onto which screw nuts are screwed as anchor fixations. The central region of an anchor rod, which concrete may contact during concreting, preferably either has a smooth surface or is encased by a sleeve or a sheath with a smooth surface. The effective length of the anchor rod, and thus the strength (thickness) of the concrete component to be concreted, e.g., a wall, is determined by the anchor fixations.

[0064] Features that have been described in connection with the formwork panel element according to the invention can of course also be advantageously implemented for the formwork system according to the invention—and vice versa. Furthermore, advantages that have already been mentioned in connection with the formwork panel element according to the invention can also be understood in relation to the formwork system—and vice versa.

[0065] In addition, it should be pointed out that terms such as "comprising," "having," or "with" do not exclude any other features or steps. Furthermore, terms such as "one" or "the" which refer to a single number of steps or features do not exclude a plurality of features or steps—and vice versa.

[0066] Embodiments of the invention are described in more detail below with reference to the drawing.

[0067] The figures each show preferred embodiments in which individual features of the present invention are shown in combination with one another. Features of an embodiment can also be implemented separately from the other features of the same embodiment, and can accordingly be easily combined with features of other embodiments by a person skilled in the art to form further useful combinations and subcombinations.

[0068] In the figures, functionally identical elements are provided with the same reference symbols.

[0069] The figures show the following:

[0070] FIG. **1** is a perspective view of a reverse side of a formwork panel element according to the invention;

[0071] FIG. **2** is a plan view of a reverse side of a formwork panel element according to the invention;

[0072] FIG. **3** is a schematic side view of a formwork panel element according to the invention;

[0073] FIG. **4** is a schematic plan view of a reverse side of a support panel;

[0074] FIG. **5** is a schematic plan view of a reverse side of a wear panel;

[0075] FIG. **6** is a schematic longitudinal section through a formwork panel element in an embodiment in which a support panel is formed by a plurality of support panel segments; and

[0076] FIG. **7** is a schematic representation of a side view of a formwork system which has at least two formwork panel elements and a plurality of anchor rods in order to brace the formwork panel elements at a distance from one another.

[0077] Formwork systems and formwork panel elements, and methods for shuttering a curable building material, are well known from the general prior art, for which reference is made to DE 10 2018 203 764 A1, by way of example. Therefore, only the features relevant to the invention will be discussed in more detail below.

[0078] FIGS. **1** and **2** show a formwork panel element **1** for shuttering a curable building material. In the embodiment example, the building material is preferably concrete. However, the invention is not limited to this. The embodiment example is to be understood in such a way that instead of concrete, another curable building material can also be used for the formwork.

[0079] The formwork panel element **1** shown in FIG. **1** and FIG. **2** has a frame **2** and a multilayer formwork skin **3** fastened to the frame **2**. The frame **2** has a plurality of longitudinal frame parts **2***a* and a plurality of transverse frame parts **2***b*. The outer contours of the frame **2** are each formed in this case by two longitudinal frame parts **2***a*, namely a left and a right longitudinal frame part **2***a*, and two transverse frame parts **2***b*, namely an upper and a lower transverse frame part **2***b*, between which further longitudinal frame parts **2***a* and transverse frame parts **2***b* can be formed. Such a design of the frame **2** is particularly advantageous, but the invention and the embodiment examples are not limited to this.

[0080] As can be seen from FIGS. **3**, **6** and **7**, the formwork skin **3** has a support panel **4** and a rigid wear panel **5**. The support panel **4** is fixed to the frame **2**. In the embodiment example, it is provided that the support panel **4** is connected to the frame **2** in a non-releasable manner, or in a manner allowing release under certain conditions.

[0081] The front side **5***a* of the wear panel **5** facing away from the support panel **4** is designed as the surface in contact with the building material. The front side **5***a* of the wear panel **5** can optionally be designed in such a way that a desired structure is reproduced on the visible side of the concrete structure to be created, for example a wall.

[0082] In the embodiment example, it is provided that the support panel **4** is connected to the frame **2** in such a way that the support panel **4** is connected to the frame **2** over the intended service life thereof, or forms a unit with the frame **2**, and generally does not have to be detached.

[0083] In the embodiment example, it can be provided that the support panel **4** is connected to the frame **2** in a non-positive manner and/or in a materially-bonded manner, and/or in a positive manner.

[0084] The support panel **4** is fastened to the frame **2** in such a way that it is resistant to tensile stress and shearing, in such a way that the support panel **4** supports the frame **2** statically. For this purpose, the support panel **3** can be glued and/or welded and/or soldered and/or riveted and/or screwed and/or nailed to the frame **2** in a manner that is not shown in detail.

[0085] In the embodiment example, the support panel **2** is designed in such a way that it absorbs the concrete pressure completely or for the most part, such that the wear panel **5** can be made inexpensively.

[0086] Various materials are available for forming the support panel **4**, wherein materials that can absorb the concrete pressure and have only a small amount of deflection are particularly suitable. Furthermore, the material used for the support panel **4** should be weatherproof.

[0087] In the embodiment example, it can be provided that the support panel **4** is designed as a metal panel, as a plastic panel, as a panel made of a fiber composite material, as a wooden panel or as a composite panel. The support panel **4** can in particular also be designed as a foamed plastic panel.

[0088] In the embodiment example, it can be provided in a manner not shown in detail that expanded metal is introduced, preferably welded, into the support panel **4** in order to increase the load-bearing capacity of the support panel **4**.

[0089] In the embodiment example, the wear panel **5** is preferably made of plastic, wood or a composite material, in particular a fiber composite material.

[0090] The support panel **4** is formed as a single piece in the embodiment example.

[0091] However, it is also possible to design the support panel **4** in a plurality of layers, for example two or three layers, which means that the support panel **4** is formed from a plurality of panels placed on top of one another, which then form the overall thickness of the support panel **4**. In the case of a multilayer design of the support panel **4**, provision can be made, for example, for the individual panels to be glued, adhered or riveted to one another.

[0092] In the embodiment example, it is provided that the thickness of the support panel **4** is 30% to 80%, preferably 40% to 80%, more preferably 40% to 70%, particularly preferably 50% to 70% and very particularly preferably 50% to 60% of the thickness of the formwork skin **3**.

[0093] In the embodiment example, it is also provided that the support panel **4** has a thickness of 6 to 14 mm, preferably 7 to 13 mm, more preferably 8 to 12 mm, particularly preferably 8 to 11 mm and very particularly preferably 8 to 10 mm, in particular 9 mm.

[0094] It has proven to be advantageous if the support panel **4** has a thickness that is greater than the thickness of the wear panel **5**, such that the support panel **4** prevents the rigid wear panel **5** from bending. However, it is also possible, for example, for the support panel **4** and the wear panel **5** to have an identical thickness, in particular such that the support panel **4** has a thickness of 9 mm and the wear panel **5** also has a thickness of 9 mm.

[0095] In the embodiment example, the wear panel **5** has a thickness of 4 to 11 mm, preferably 5 to 10 mm, more preferably 6 to 10 mm, particularly preferably 7 to 10 mm, in particular 8 mm.

[0096] In the embodiment example, it is provided that the thickness of the formwork skin **3**, which is composed of the support panel **4** and the wear panel **5**, is between 10 and 25 mm, preferably between 12 and 23 mm, more preferably between 14 and 22 mm, particularly preferably between 15 and 21 mm, in particular between 16 and 20 mm.

[0097] In the embodiment example, provision is made for the wear panel **5** to be releasably fixed to the support panel **4**. For this purpose, the wear panel **5** can preferably be nailed and/or screwed and/or riveted and/or releasably glued to the support panel **4**.

[0098] A detachable adhesive is preferably provided for gluing the wear panel **5** to the support panel **4**.

[0099] The support panel **4** has openings **6***a* for this detachment, in particular for pressing out the wear panel **5**. Furthermore, the support panel **4** in the embodiment example has bore holes **6***b* for fastening the wear panel **5**, preferably in order to screw into the wear panel **5** from behind, or rivet through it. The openings **6***a* for the detachment and the bore holes **6***b* for fastening the wear panel **5** are shown in FIG. **4** by way of example.

[0100] The support panel **4**, in particular the reverse side of the support panel **4**, as shown in FIG. **4**, is preferably designed to be light-resistant. The reverse side of the support panel **4** is preferably designed in such a way that it is suitable for applying an advertising print, and the back can be cleaned with a high-pressure cleaner without the support panel **4** being damaged.

[0101] FIG. **5** schematically shows the reverse side of the wear panel **5**. The wear panel **5** preferably has the same height and the same width as the support panel **4**. The wear panel **5** can have bore holes in a manner not shown in order to facilitate screwing or riveting to the support panel **4**.

[0102] A specific embodiment of the support panel **4** is shown in FIG. **6**. It is provided in this case that the support panel **4** is divided into a plurality of support panel segments **40**, **41**, **42**, which each cover corresponding segments **7** of the frame **2**. Three support panel segments **40**, **41**, **42** are shown in FIG. **6**, but as little as two support panel segments, or more than three support panel segments, can also be provided.

[0103] In the embodiment example according to FIG. **6**, it is provided that the frame **2** has, on its front side facing the support panel **4**, projections **8** protruding in the direction of the support panel **4**, which bound the segments **7** of the frame **2**, the support panel segments **40**, **41**, **42** being inserted into the segments **7** in such a way that each of the support panel segments **40**, **41**, **42** has an edge **9** which rests on at least one of the projections **8**, and at least one edge region of the reverse side of the support panel segment **40**, **41**, **42** which faces the frame **2**, said edge region being adjacent to the edge **9**, rests against a surface of the front side of the frame **2** which is adjacent to the projection **8**. This is shown schematically in FIG. **6**.

[0104] The frame **2** with the projections **8** is thus designed in such a way that a movement of the support panel segments **40**, **41**, **42** in the plane of the support panel segments **40**, **41**, **42** is limited by the projections **8**, wherein the frame **2**—or the form of the projections **8**—forms a shoulder on which the support panel segments **40**, **41**, **42** can rest on an edge area of their reverse side, such that a concrete pressure acting orthogonally to the plane of the support panel segments **40**, **41**, **42** can be directed from the reverse side of the support panel segments **40**, **41**, **42** into the shoulder and/or the frame **2**.

[0105] FIG. **6** shows a longitudinal section through a formwork panel element **1**—that is to say, a section through the formwork panel element **1** from the upper transverse frame part **2***b* to the lower transverse frame part **2***b*. The support panel segments **40**, **41**, **42** are thus arranged one above the other. In principle, however, provision can also be made for the support panel segments **40**, **41**, **42** to be arranged side by side—that is, the support panel segments **40**, **41**, **42** are not arranged horizontally one above the other, but vertically next to one another. In principle, it is also possible for the support panel segments **40**, **41**, **42** to be arranged both laterally next to one another and one above the other, such that the support panel segments **40**, **41**, **42** are arranged similarly to a chess board, and each cover segments **7** of the frame **2**.

[0106] FIG. **7** is a schematic illustration of a formwork system **11** having (at least) two formwork panel elements **1**, and having a plurality of anchor rods **12** in order to brace the formwork panel elements **1** at a distance from one another.

[0107] According to this principle, a plurality of formwork panel elements **1** can be connected to one another in a manner known in principle in such a way that they together form a formwork for shuttering a curable building material, in particular concrete.

[0108] FIG. **7** shows by way of example that the formwork system **11** is formed by two formwork panel elements **1** according to the invention.

[0109] In principle, it can be provided that only a portion of the formwork panel elements **1** is equipped according to the invention. However, it makes sense to design all formwork panel elements **1** according to the invention—that is, in such a way that the formwork skin **3** is formed by a support panel **4** and a wear panel **5**. The anchor rods **12** are only shown schematically in FIG. **7**. As illustrated, it is preferably provided that the anchor rods **12** each have two anchor cones **13**. Furthermore, anchor fixations in the form of nuts **14** are shown in FIG. **7**. Two are screwed onto each of the anchor rods **12** in order to brace the formwork panel elements **1**. This illustration is purely an example.

[0110] For bracing the formwork panel elements **1**, an anchoring technique that can be applied from one or both sides can be used, and spacer tubes or cladding tubes can also be used.

1. A formwork panel element (**1**) for shuttering a curable building material, having a frame (**2**) and having a multilayer formwork skin (**3**) fastened to the frame (**2**),

characterized in that

the formwork skin (**3**) has a support panel (**4**) and a rigid wear panel (**5**), the support panel (**4**) being fastened to the frame (**2**) and the wear panel (**5**) being releasably fixed to the support panel (**4**), wherein a front side (**5***a*)

of the wear panel (**5**) facing away from the support panel (**4**) is designed as a surface in contact with the building material, wherein the support panel (**4**) is fastened to the frame (**2**) in a manner which is resistant to tensile stress and shearing, in such a way that the support panel (**4**) supports the frame (**2**) statically, the support panel (**4**) being connected to the frame (**2**) in a non-releasable manner or in a manner allowing release under certain conditions.

2. The formwork panel element (**1**) according to claim **1**, characterized in that

the thickness of the support panel (**4**) is 30% to 80%, preferably 40% to 80%, more preferably 40% to 70%, particularly preferably 50% to 70%, and very particularly preferably 50% to 60% of the thickness of the formwork skin (**3**).

3. The formwork panel element (**1**) according to claim **1** or **2**,

characterized in that

the support panel (**4**) has a thickness of 6 to 14 mm, preferably 7 to 13 mm, more preferably 8 to 12 mm, particularly preferably 8 to 11 mm, and very particularly preferably 8 to 10 mm, in particular 9 mm.

4. The formwork panel element (**1**) according to any of claims **1** to **3**,

characterized in that

the support panel (**4**) is connected to the frame (**2**) in a non-positive manner and/or in a materially-bonded manner and/or in a positive manner.

5. The formwork panel element (**1**) according to any of claims **1** to **4**,

characterized in that

the support panel (**4**) is glued and/or welded and/or soldered and/or riveted and/or screwed and/or nailed to the frame (**2**).

6. The formwork panel element (**1**) according to any of claims **1** to **5**,

characterized in that the support panel (**4**) is designed as a metal panel, a plastic panel, a panel made of a fiber composite material, a wooden panel, or a composite panel.

7. The formwork panel element (**1**) according to any of claims **1** to **6**,

characterized in that

the support panel (**4**) has openings (**6***a*) for detaching, and/or bore holes (**6***b*) for fastening, the wear panel (**5**).

8. The formwork panel element (**1**) according to any of claims **1** to **7**,

characterized in that

the support panel (**4**) is divided into a plurality of support panel segments (**40**, **41**, **42**) which each cover corresponding segments (**7**) of the frame (**2**).

9. The formwork panel element (**1**) according to claim **8**, characterized in that

the frame (**2**) has, on its front side facing the support panel (**4**), projections (**8**) protruding in the direction of the support panel (**4**), which bound the segments (**7**), wherein the support panel segments (**40**, **41**, **42**) are inserted into the segments (**7**) in such a way that each of the support panel segments (**40**, **41**, **42**) has an edge (**9**) which rests on at least one of the projections (**8**), and at least one edge region of the reverse side of the support panel segment (**40**, **41**, **42**) which faces the frame (**2**), said edge region being adjacent to the edge (**9**), rests against a surface of the front side of the frame (**2**) which is adjacent to the projection (**8**).

10. The formwork panel element (**1**) according to any of claims **1** to **9**,

characterized in that

the wear panel (**5**) is nailed and/or screwed and/or riveted and/or releasably glued to the support panel (**4**).

11. The formwork panel element (**1**) according to any of claims **1** to **10**,

characterized in that

the wear panel (**5**) has a thickness of 4 to 11 mm, preferably 5 to 10 mm, more preferably 6 to 10 mm, particularly preferably 7 to 10 mm, in particular 8 mm.

12. A formwork system (**11**) having at least two formwork panel elements (**1**) according to any of claims **1** to **11**, and having a plurality of anchor rods (**12**) in order to brace the formwork panel elements (**1**) at a distance from one another.

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