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Innovation, Science and Economic Development Canada
Canadian Intellectual Property Office

CA 3228157 A1 2023/02/09

(21) 3 228 157

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) **Date de dépôt PCT/PCT Filing Date:** 2022/08/04
(87) **Date publication PCT/PCT Publication Date:** 2023/02/09
(85) **Entrée phase nationale/National Entry:** 2024/02/02
(86) **N° demande PCT/PCT Application No.:** EP 2022/071945
(87) **N° publication PCT/PCT Publication No.:** 2023/012274
(30) **Priorité/Priority:** 2021/08/05 (DE10 2021 120 441.0)

(51) **Cl.Int./Int.Cl.** ***E04G 17/04*** (2006.01), ***E04G 1/15*** (2006.01), ***E04G 17/00*** (2006.01), ***E04G 17/14*** (2006.01), ***E04G 7/30*** (2006.01), ***E04G 7/32*** (2006.01), ***E04G 9/02*** (2006.01)

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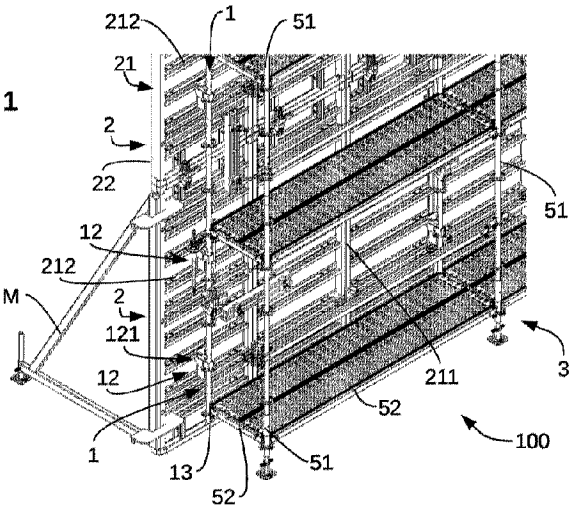
(54) **Titre : SYSTEME DE COFFRAGE D'UN ELEMENT DE PAROI COMPRENANT UN ENSEMBLE CONSTITUE D'UN COFFRAGE ET D'UNE PARTIE TREILLIS**
(54) **Title: FORMWORK SYSTEM FOR A WALL ELEMENT, COMPRISING A COMBINATION OF FORMWORK AND A FRAME SECTION**

Fig. 1



(57) **Abrégé/Abstract:**
The invention relates to a formwork system for a wall element, comprising at least one formwork panel, at least one connection component, and at least one frame section. The connection component comprises at least one frame interface, which is designed to be releasably connected to a frame section, and at least one formwork interface, which is designed to be releasably connected to the formwork panel. The frame interface of the at least one connection component is connected to the frame section, and the formwork interface of the connection component is connected to the at least one formwork panel. When the system is constructed, the frame section supports and positions the formwork panel, and the system can be used in a free-standing manner. The invention additionally relates to a method for producing a wall element using such a system.

Abstract

The invention relates to a formwork system for a wall element, comprising at least one formwork panel, at least one connection component, and at least one frame section, wherein the connection component comprises at least one frame interface, which is designed to be releasably connected to a frame section, and at least one formwork interface, which is designed to be releasably connected to the formwork panel. The at least one connection component is connected here with its frame interface to the frame section, and the connection component is connected with its formwork interface to the at least one formwork panel. When the system is constructed, the frame section supports and positions the formwork panel, and the system can be used in a free-standing manner. The invention additionally relates to a method for producing a wall element using such a system.

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FORMWORK SYSTEM FOR A WALL ELEMENT, COMPRISING A COMBINATION OF FORMWORK AND A FRAME SECTION

[0001] The present application claims the priority of German patent application 10 2021 120 441.0, the content of which is incorporated herein by reference in full.

[0002] The invention relates to a formwork system for a wall element, comprising at least one formwork panel, at least one connection component, and at least one frame section, wherein the connection component comprises at least one frame interface, which is designed to be releasably connected to a frame section, and at least one formwork interface, which is designed to be releasably connected to the formwork panel. The at least one connection component is connected here with its frame interface to the frame section, and the connection component is connected with its formwork interface to the at least one formwork panel. When the system is constructed, the frame section supports and positions the formwork panel, and the system can be used in a free-standing manner. The invention additionally relates to a method for producing a wall element using such a system.

[0003] The invention relates to the field of construction. When building or renovating buildings, building parts are often shaped by casting concrete. The shape of these cast building parts is predetermined by a formwork, wherein the formwork is erected on the construction site before the casting. In particular, ceilings or walls of a building are erected with the aid of circuits. In the production of high walls or wall elements, a frame is required in order to be able to prepare the formwork for the production of the wall element. A frame is required on the one hand in order to connect individual formwork panels to one another to form the overall formwork, for example by attaching formwork locks. Furthermore, two opposite formwork panels have to be connected to one another by anchors before the production of a wall element in order to take up the pressure of the cast concrete material that acts

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outwardly. For this purpose, the formwork panels must be reachable over their entire height for working forces, which usually takes place by a frame or by a working platform. Furthermore, in most cases, prior to the production of the wall element, a reinforcement is attached to an already positioned adjustable formwork or between such an adjustable formwork and a closing formwork which is opposite the adjustable formwork. According to the prior art, frames or working platforms which are provided for attaching formwork locks are arranged on the formwork so that no reinforcement can be attached by these frames or working platforms. The locations at which the reinforcement must be positioned are simply not reachable by these frames or working platforms, which serve to prepare the formwork panels, since they are located on the opposite side of the formwork panel. In practice, this means that a first type of frame is required for operating the formwork and a second type of frame is required for positioning and introducing the reinforcement into the formwork. In addition, a plurality of different types of frames and formwork panels usually exist on the construction site, whereby a connectability of the frames to the formwork panels, in particular for the applications described above, is often not provided. Differences in the grid which exist between the frame systems and the formwork systems usually prove problematic here. Lastly, in many applications after the casting of a wall element with the aid of the formwork, work is still carried out on the wall element after removal of the formwork, for example the filling of anchor holes or also cleaning or coating work. In order to be able to reach the wall element over its entire height, a frame or a working platform is thus again required after the actual casting in order to be able to perform final work. For the production of a wall element with the aid of a formwork, a plurality of different frames or working platforms are thus required, which leads to complicated work processes and a need for a plurality of different frame elements.

[0004] The object of the invention is thus to propose solutions with which the production of a wall element can be simplified.

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[0005] This object of the invention is achieved by a formwork system for a wall element, comprising at least one formwork panel, at least one connection component, and at least one frame section,

- wherein the frame section comprises a plurality of vertical posts and a plurality of horizontal bars and the frame section extends in three spatial directions,

- wherein the formwork panel comprises a framework and a formwork skin, wherein the framework has a plurality of longitudinal struts and a plurality of cross struts, wherein the longitudinal struts and the cross struts are arranged substantially perpendicular to one another, and the formwork skin can be releasably fastened to the framework, wherein, in a connected state, the formwork skin rests on at least a portion of the longitudinal struts and the cross struts, wherein at least a part of the longitudinal struts and/or cross struts has an undercut which is oriented in the longitudinal direction of the longitudinal struts and/or cross struts, wherein the undercut is provided for the form-fitting and frictionally engaged connection to the formwork interface of a connection component,

- wherein the connection component comprises at least one frame interface which is provided for releasable connection to the frame section and comprises at least one formwork interface which is provided for releasable connection to the formwork panel, wherein the formwork interface comprises at least one clamping element and the clamping element comprises at least two gripping arms, wherein at least one of the gripping arms is designed to be movable relative to another gripping arm, wherein the distance between the at least two gripping arms is designed to be adjustable,

wherein the at least one connection component is connected with its frame interface to the frame section, wherein the gripping arms of the clamping element engage in the undercut on the framework of the formwork panel at least in regions, as a result of which at least one form-fitting, preferably also a frictionally engaged connection between the formwork interface and the formwork panel is present, wherein this connection can be arbitrarily positioned along the undercut, whereby the relative position between the

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connection component and the formwork panel is designed to be adjustable in a direction parallel to the running direction of the undercut,
wherein, when the system is constructed, the frame section supports and positions the formwork panel and the system can be used in a free-standing manner, in particular without additional support elements.

[0006] The system according to the invention comprises at least one formwork panel, at least one frame section, and at least one connection component which connects the formwork panel to the frame section. A connection, in particular a structurally stable connection, between the formwork panel and the frame section is possible by means of the connection component. By means of the connection component, the formwork panel and the frame section can be connected to one another in a simple manner, wherein the connection and also the separation of this connection can be carried out easily and quickly. A system according to the invention usually comprises a plurality of formwork panels and can also comprise more than one frame section. For connection, a plurality of connection components are usually provided, which are arranged at different positions between the formwork panel or the formwork panels and the frame section.

[0007] The frame section of the system according to the invention is formed by a frame section according to the prior art and comprises a plurality of vertical posts which are substantially vertically oriented in the constructed state and a plurality of horizontal bars oriented substantially horizontally in the constructed state. These elements of the frame section are connected to one another and in the constructed state form a frame section extending in three spatial directions. The frame section can comprise further elements, such as tread surfaces, ladders, railings, and the like. The frame section is preferably constructed in a modular manner, which means that the frame section can be constructed from standard elements in different sizes and shapes. The frame section can, for example, be a so-called system frame.

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[0008] The system according to the invention further comprises at least one formwork panel, with a supporting framework and a formwork skin, which is releasably connected to the framework. The framework is preferably constructed in a grid-like manner, wherein a plurality of longitudinal struts which are oriented substantially vertically in the constructed state and a plurality of cross struts which are substantially horizontally oriented in the assembled state form this framework. The longitudinal struts and the cross struts are oriented at right angles to one another. The formwork skin is fastened to the framework and rests at least on a part of the longitudinal struts and cross struts. As a result of this contact, during the production of a wall element, forces which act on the formwork skin from the concrete material are diverted into the supporting framework of the formwork panel. At least a part of the longitudinal struts and/or of the cross struts has an undercut. An undercut is to be understood here as a region which is set back relative to adjacent regions. If a counter element is connected to the framework of the formwork panel in such a way that it engages in the undercut in regions, a form fit is created by which the counter element is connected to the framework. The undercut is provided to enter into a form-fitting and frictionally engaged connection with a formwork interface of a connection component, which will be described later. The undercut extends in the longitudinal direction of the longitudinal struts and/or cross struts. For example, the undercut can be formed by a groove which is set back relative to the remaining surface of the longitudinal struts and/or cross struts and which extends along these struts. This extension of the undercut in the longitudinal direction ensures that a connection component can be continuously fastened to different positions on the framework of the formwork skin. This variability with respect to the position at which a connection component can be connected to the framework has the effect that formwork panels and frame sections with different grids can very easily be connected to one another. Due to the undercut extending in the longitudinal direction, a connection can take place at virtually any position, as a result of which the grid applied between a plurality of formwork panels in the formwork panel or in the

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formwork system does not play a role for the connection to the connection component. Preferred embodiments of the undercut are described later.

[0009] The system according to the invention further comprises at least one connection component having a frame interface and a formwork interface. The formwork interface is provided for connection to the formwork panel, in particular with the framework of the formwork panel. For this purpose, the formwork interface comprises at least one clamping element which in turn comprises at least two gripping arms. These gripping arms are designed to be movable relative to one another. The distance of one gripping arm to the other gripping arm is designed to be variable or adjustable. The gripping arms of the clamping element are provided to engage at least in regions in the undercut in the framework of the formwork panel and thus establish a form-fitting connection between the connection component and the formwork panel. In addition to the gripping arms, the clamping element can have further elements, for example a mechanism for actuating and locking the gripping arms. The connection between the connection component and the framework of the formwork panel is produced by the two gripping arms initially being set such that they can partially grip around a cross strut or a longitudinal strut of the framework. In this state, the gripping arms are pushed partially over the longest strut or the cross struts until a region of the gripping arms is positioned adjacent to one or more undercuts on the cross strut or the longitudinal strut. Subsequently, the distance between the two gripping arms is reduced, wherein these engage at least in regions in the undercut on the framework. This results in the previously described form fit between the connection component and the framework of the formwork panel. Preferably, with this connection, a frictionally engaged connection, in particular a clamping between the gripping arms and the framework, is simultaneously established. Such a frictionally engaged connection has the effect that there is no play between the connection component and the formwork panel and thus a stable, statically and dynamically resilient connection is produced. It is particularly advantageous at this connection that it can be produced at different positions

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in the longitudinal direction of the cross strut or of the longitudinal strut. The connection component can thus be positioned variably relative to the framework of the formwork panel. The undercut favorably extends over the entire free length of the cross struts and the longitudinal struts. A connection to the connection component can thereby take place at almost all locations of the framework of the formwork panel. Such a connection is not possible, or only possible by using an additional component, merely at the points of intersection of the longitudinal struts with the cross struts. The connection between the connection component and the formwork panel via the clamping element is designed such that it can be produced and separated in a simple manner. When the system is constructed, when the connection component connects the formwork panel and the frame section to one another, the system is free-standing. Free-standing means that the system stands stably on the underlying surface and does not fall over. Furthermore, the frame section of the free-standing system can be entered by persons and used for work. The frame section supports the formwork panel, and vice versa. The frame section simultaneously positions the formwork panel, for example within a formwork or a formwork system for producing a wall element. The system is designed here such that it can preferably be used without additional support elements, such as supports. The system according to the invention thus avoids effort for the attachment of additional support elements for the installation and positioning of the formwork panel. The connection of the formwork panel and frame section by the connection component also makes it possible to transport and position the entire system together. For example, the system constructed can be positioned by means of a crane at the location where it is required to produce the wall element. A construction of the system at the location at which the wall element is to arise is thereby dispensed with. It is also possible to remove the system according to the invention after production of the wall element in one piece or in the constructed state or to change it in respect of its alignment and position relative to the wall element produced. For example, the system can be rotated by 180°, whereby the opposite side of the system points toward the wall element produced or to be produced. Even in this rotated

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position, the system can again be used in a free-standing manner for work to be carried out.

[0010] The system according to the invention enables a connection of different types or systems of formwork panel and frame section. In particular the connection, which is continuously adjustable in its position, between the formwork interface of the connection component and the framework of the formwork skin allows a simple and flexible connection. Preferably, a plurality of connection components attached at different positions are provided for connecting a formwork panel to a frame section. The frame interface of the connection component is preferably designed such that it is compatible with a connection interface used within the frame section. The connection component can thus be combined in a simple manner with different types of frame sections via a variation or adaptation of the frame interface. The connection component is simple to construct, whereby a system according to the invention can be provided in a simple and cost-effective manner, which system uses an existing frame section. Thus, existing equipment can advantageously be retrofitted to form a system according to the invention. The frame section can be used for a plurality of tasks, for example for attaching a reinforcement to or in the formwork and for securely filling the concrete material into the formwork. Thus, a system according to the invention saves effort and working time during the production of a wall element, which is effected by the multiple use of a single frame section. The system according to the invention is thus particularly suitable for producing a wall element. In addition, the system according to the invention can of course also be used to produce other building elements, such as pillars or columns.

[0011] In one embodiment of the system, it is provided that the clamping element is designed to be dimensionally complementary to one element of the formwork panel at least in regions. The term “dimensionally complementary” is to be understood here to mean that a region of the clamping element, in particular the tip region of the gripping arms, has a negative shape relative to the undercut on

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the framework of the formwork panel. A secure form-fitting connection between the formwork interface and the formwork panel is thereby effected.

[0012] Furthermore, it is provided that the frame interface is designed to be dimensionally complementary to an interface at the frame section, at least in regions. Here, the term “dimensionally complementary” is to be understood to mean that at least a partial region of the frame interface has a negative shape relative to a partial region at an interface at the frame section. The frame section has interfaces for connecting its components, for example vertical posts and horizontal bars. A partial region of the frame interface of the connection component is preferably designed to be similar or identical in shape and size to an interface which is also used in the frame section. For example, connecting disks can be arranged on a vertical post of the frame section with recesses into which interface elements of a horizontal bar can be introduced in a form-fitting manner. In this case, the frame interface of the connection component can be designed to correspond to the interface on the horizontal bar. In this way, the frame interface can be connected to a vertical post in the same way as a horizontal bar of the frame section. As a result of this embodiment, the connection component can be fastened in a simple manner at different positions on the frame section. Alternatively, the connection component can also be designed such that it forms a component of the frame section simultaneously in functional combination. In this alternative embodiment, the frame interface is also designed to be identical or very similar to an interface used in the frame section and is dimensionally compatible with a corresponding interface in the frame section.

[0013] In an advantageous embodiment, it is provided that a support element is provided which is connected to the formwork interface and the frame interface, in particular wherein the support element is rod-shaped, wherein the formwork interface and the frame interface are arranged at a distance from one another on the support element. In this embodiment, a support element is provided which connects the formwork interface and the frame interface to one

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another. The support element can have different shapes. The support element is preferably rod-shaped and can be formed, for example, by a tube or a tube portion. Due to the distance at which the formwork interface and the frame interface are arranged relative to one another on the support element, the distance between the formwork panel and the frame section can be adapted when the system is in the constructed state. In order to be able to individually adjust the distance between the formwork panel and the frame section, the length of the support element can also be adjustable, for example telescopic. The frame interface and the formwork interface can be rigidly connected to the support element, or can be adjustably connected thereto in terms of their position and alignment.

[0014] It is preferably provided that the support element has a longitudinal axis and the formwork interface and the frame interface are arranged at a distance from one another along the longitudinal axis, and wherein the longitudinal axis is oriented substantially parallel to the surface of the formwork skin or substantially perpendicular to the surface of the formwork skin. In this embodiment, the support element has a longitudinal axis which runs between the formwork interface and the frame interface. Preferably, the connection component is oriented relative to the formwork panel such that the longitudinal axis runs substantially parallel to the surface of the formwork skin or substantially perpendicular to the surface of the formwork skin. However, the longitudinal axis can also be oriented relative to the surface of the formwork skin at a different angle.

[0015] In one embodiment, it is provided that the support element comprises a vertical post which is designed substantially identically to a vertical post of the frame section, wherein at least one formwork interface is fastened to the vertical post, and the frame interface is designed to be substantially identical to an interface which has the vertical post of the frame section, in particular wherein a plurality of frame interfaces at a distance from one another are arranged on the support element comprising the vertical post. In this

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embodiment, the support element comprises a vertical post or is formed by a vertical post. The support element can thus be integrated directly into the frame section. In contrast to the other elements of the frame section, however, the support element has at least one formwork interface which is connected to the formwork skin. The advantage of this embodiment is that at least one vertical post, which must additionally be provided in other embodiments, is formed by the connection component in this alternative embodiment. In this way, the required number of parts for the system and in particular for the frame section is reduced. A plurality of frame interfaces for connection to other components of the frame section are preferably provided on the vertical post which forms the support element. This corresponds to known vertical posts of a frame section which usually likewise have a plurality of interfaces for connection to other components of a frame section. However, the vertical post which forms the support element can be designed differently, in regions, from another vertical post. For example, additional fastening surfaces or fastening elements can be provided for attaching one or more formwork interfaces.

[0016] Advantageously, it is provided that a compensating element is provided which is arranged between the support element and the frame interface, wherein the compensating element has a linear bearing by means of which the frame interface and the support element can be displaced relative to the support element at least in regions in a direction parallel to the longitudinal axis of the support element. In this embodiment, a compensating element is provided which enables a displacement between the frame interface and the support element and thus also a displacement between the frame interface and the formwork interface. For this purpose, the compensating element has a linear bearing which guides a linear movement in a direction parallel to the longitudinal axis of the support element. This displaceability between the frame interface at the formwork interface further increases the flexibility in the connection between the formwork skin and the frame section. Due to the displaceability, the distance between the two interfaces can be continuously adjusted, whereby tolerance differences or also grid differences between the

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frame section and the formwork panel can be compensated. In addition, the compensating element also enables the compensation of height differences in the underlying surface of the system. If, for example, the underlying surface below the formwork panel is higher than the underlying surface below the frame section, this height difference can be continuously compensated by the compensating element, without adaptation work being required on the system.

[0017] Furthermore, it is provided that the distance between the frame interface and the formwork interface, in particular in a direction perpendicular to the longitudinal axis of the support element, is greater than or equal to the thickness of the formwork panel. The distance between the frame interface and the formwork interface defines the distance between the formwork panel and the frame section. The distance between the two interfaces is preferably greater than the thickness of the formwork panel in a direction perpendicular to the surface of the formwork skin. However, this distance can also be smaller. Furthermore, the distance can also be selected to be significantly greater, for example the distance between the frame interface and the formwork interface, in particular in a direction perpendicular to the longitudinal axis of the support element, can also be greater than three times the thickness of the formwork panel, or greater than five times the thickness of the formwork panel.

[0018] In a further embodiment, it is provided that two frame interfaces and two formwork interfaces are provided, which are each arranged at a distance from one another on a common support element. In this embodiment, two frame interfaces and two formwork interfaces are each arranged on a support element. In this embodiment, the length along the longitudinal direction of the support element is greater than in the embodiments described above. In this embodiment, the longitudinal direction of the support element is arranged parallel to a vertical post of the frame section in the system. The length of the support element is at least 1 m. Two frame interfaces, which will be or are connected to interfaces at the frame section, are arranged on the support element pointing in a first direction. Two formwork interfaces, which will be or

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are connected to the framework of the formwork panel, are likewise arranged on an opposite second side. Such a connection component enables a connection via two points to the formwork panel and to the frame section. The connection component is thus more stable and better able to support a load. Furthermore, the number of components required to construct a system is reduced by such a connection component, whereby the logistics on the construction site can be simplified and the construction time of the system can be reduced.

[0019] It is provided in a skillful manner that the clamping element of the two formwork interfaces, which are arranged on a common support element, has an unlocking mechanism which can be actuated by a simple linear or rotational movement, wherein the form fit between the formwork interface and the formwork panel can be canceled by actuating the unlocking mechanism. In this embodiment, the clamping element has an unlocking mechanism which is quickly and easily actuated by hand. The formwork interface of the connection component can thereby be separated quickly and easily from the formwork panel. This is advantageous if the formwork panel is to be separated from the frame section during the production of a wall element in the disassembled state of the system. Due to the unlocking mechanism, such a separation is quickly and easily carried out. The unlocking mechanism can be actuated by a simple movement, which can be linear, rotational or a simple combination of both types of movement. For example, the unlocking mechanism can have a rod-shaped lever which is actuated in a linear movement or a rotational movement and in so doing releases the form-fitting connection between the formwork interface and the formwork panel. In order to prevent accidental actuation of the unlocking mechanism, a securing mechanism can be provided which initially has to be deactivated before the unlocking mechanism is actuated. Such an unlocking mechanism is preferably used in a connection component which has two or more formwork interfaces. Such a connection component is described in the preceding embodiment. It can be provided here that a common unlocking mechanism is provided for a plurality of formwork

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interfaces or each formwork interface has its own unlocking mechanism, wherein the unlocking mechanisms are coupled to one another. In this way, a plurality of formwork interfaces can be simultaneously separated from the formwork panel by a single actuating process. The required time for separating the formwork panel and frame section is thereby further reduced. It is, of course, also possible to provide an unlocking mechanism in embodiments of a connection component which only has a formwork interface.

[0020] In a further embodiment, it is provided that the direction of movement of at least one of the gripping arms of the clamping element is oriented substantially parallel to the connection direction of the frame interface and/or substantially parallel to the surface of the formwork skin. The distance between the two gripping arms of the clamping element is adjustable, wherein at least one of the gripping arms is designed to be movable. In one embodiment, at least one of these gripping arms is movable in one direction, which in the disassembled state of the system runs substantially parallel to the surface of the formwork skin. In this way, by the movement of the gripping arm, an at least partial gripping of a longitudinal strut or a cross strut of the framework of the formwork panel can be performed. The direction of movement of the gripping arm is to be understood here as meaning the direction along which the distance between the two gripping arms is designed to be adjustable. The clamping element can also be designed such that both gripping arms are designed to be movable. The direction of movement of the gripping arm preferably runs parallel to a connection direction of the frame interface. This connection direction is the direction in which the frame interface is moved for establishing or releasing a connection to the frame section. In this case, the connection direction can be oriented parallel to a vertical post of the frame section, i.e., when the system is constructed, substantially vertically. In this case, the direction of movement of the gripping arm is also substantially vertical, whereby a gripping of the clamping element around a cross strut of the formwork panel is made possible.

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[0021] In an alternative embodiment, it is provided that the direction of movement of at least one of the gripping arms of the clamping element is oriented substantially perpendicular to the connection direction of the frame interface and/or perpendicular to the surface of the formwork skin. In this embodiment, the direction of movement of a gripping arm is oriented perpendicular to the direction of movement in the embodiment described above. The direction of movement of at least one of the gripping arms runs here perpendicular to the surface of the formwork skin. This makes it possible for the clamping element to grip around an edge region of the framework of the formwork panel. This makes it possible for the connection component to be arranged at the edge of the formwork panel, whereby, for example, the arrangement of a second formwork panel between the formwork panel and the frame section is made possible. When the system is constructed, the direction of movement preferably runs in the horizontal direction. The direction of movement is thus oriented substantially perpendicular to a connection direction of the frame interface, which preferably runs in the vertical direction.

[0022] It is provided in a skillful manner that the length of the support element is designed to be adjustable. In this embodiment, the distance between the frame section and the formwork panel can be varied by an adjustability of the support element. This is advantageous in particular if objects having different thicknesses, for example wall elements to be produced, are to be arranged between the frame section and the formwork panel. For this purpose, the support element can be designed to be telescopic. The support element can furthermore have at least one locking device with which a set length of the support element can be fixed in a stable manner.

[0023] In an advantageous embodiment, it is provided that the undercut on the framework of the formwork panel is designed as a groove which is oriented in the longitudinal direction of the longitudinal struts and/or cross struts, wherein the groove has a U-shaped, rectangular or curved cross-section. The undercut can be designed as a groove which is introduced into the longitudinal struts

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and/or cross struts and which extends, at least in regions, along these struts. Preferably, the longitudinal struts and the cross struts have a rectangular cross-section, wherein the formwork skin rests on a side surface of this rectangular cross-section. The undercut is preferably arranged on a side surface which is adjacent to the side surface on which the formwork skin rests. Two undercuts can also be arranged on a cross strut or longitudinal strut and are preferably arranged on two opposite side surfaces of the struts. In cross-section, such an undercut designed as a groove can have a U-shaped, rectangular, polygonal or semicircular shape. In general, a wide variety of shapes are suitable for the cross-section of the groove, as long as these cross-sections generate an undercut relative to the adjacent regions on the cross strut or the longitudinal strut.

[0024] In a further embodiment, it is provided that at least two connection components are provided and each connection component has at least two formwork interfaces, and the formwork panel has a plurality of cross struts with an undercut arranged thereon at least in regions, wherein the distance between the at least two formwork interfaces on the connection component corresponds to an integer multiple of the distance between two adjacent cross struts of the formwork panel. In this embodiment, the grids of the formwork panel and of the connection component are coordinated with one another, so that a flexible usability of the components of the system is made possible. Each connection component has two formwork interfaces which are arranged at a distance from one another on a support element. The distance between the two formwork interfaces on the support element corresponds here to an integer multiple of the distance between two cross struts of the formwork panel. The distance between two adjacent cross struts of the formwork panel is smaller than the distance between the two formwork interfaces on the connection component. Due to this choice of dimensions, the connection component can be connected to different cross struts of the formwork panel at different positions. When the system is constructed, the connection component can thus be arranged in a vertical direction at different heights relative to the formwork panel. Such a variability of

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the connection position between the connection component and the formwork panel is then particularly useful if a plurality of formwork panels are used in combination as formwork for a wall element. In the regions of the combined formwork in which two formwork panels meet, an attachment of the formwork interface may not be possible. In this case, the connection to the connection component can be offset from the locations at which two formwork panels meet. A connection of a frame section to a formwork panel by the connection component is thus also possible if the overall size or overall shape of the formwork and/or of the frame section is varied.

[0025] Advantageously, it is provided that the formwork panel and the frame section are oriented parallel to one another, wherein the distance between the formwork panel and the frame section is determined by the connection component. Such a parallel arrangement of formwork panel and frame section is particularly advantageous in the production of a wall element, since the formwork or the wall element is always at a constant distance from the frame. Of course, it is also possible, however, to arrange formwork panel and frame section at a different angle to one another, for example if the wall element to be produced has an irregular or angular shape.

[0026] Furthermore, it is provided that the connection component forms a vertical post of the frame section in functional combination, and the frame interface is formed by at least one interface which corresponds to a connection interface within the frame section in terms of shape and size. In this embodiment, the connection component can be integrated into the frame section like a vertical post and assumes a load-bearing function in the frame section. The connection component is, at least in regions, identical to a vertical post, as is also inserted within the frame section. In this way, the connection component simultaneously forms an element of the frame section in functional combination, as a result of which a vertical post is saved in the frame section. This reduces the required number of components or parts for the system. In this embodiment, the frame interface corresponds to an interface which also

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has a vertical post in the frame section. The length and the grid in which connection interfaces are arranged on the connection component also correspond to the dimensions which a vertical post has in the frame section.

[0027] In one embodiment, it is provided that the clamping element has an unlocking mechanism which is in operative connection with the movable gripping arm, wherein the unlocking mechanism can be actuated by hand or with a simple hand tool and generates a relative movement of the movable gripping arm in relation to a further gripping arm. This embodiment is based on the embodiment described above, in which the connection component forms a vertical post of the frame section in a functional combination. An unlocking mechanism is arranged on this vertical post and serves to actuate the clamping element of the connection component. By actuating this unlocking mechanism, the connection component can be connected to the formwork panel or separated from it quickly and easily. The unlocking mechanism is preferably designed here in such a way that a connection of the formwork panel and the frame section can be carried out simply when the formwork panel with the formwork skin is placed on the underlying surface or ground. As a result, the frame section can also be constructed in a horizontal state, which brings advantages with regard to occupational safety.

[0028] Furthermore, it is advantageously provided that the clamping element comprises a pin element and a tensioning element, wherein the pin element is introduced form-fittingly into a recess, in particular into a bore, in one of the longitudinal struts or the cross struts of the formwork panel, and the tensioning element is designed to be movable relative to the pin element, and the tensioning element rests against one of the longitudinal struts or the cross struts at least in regions, wherein a tensioning mechanism is provided which generates the relative movement between the pin element and the tensioning element, and wherein the tensioning mechanism generates a form fit and a frictional engagement between the connection component and the framework of the formwork panel. In this embodiment, the undercut is formed on the framework of the formwork panel by

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a recess or a groove in a cross strut or a longitudinal strut. A pin element is provided on the clamping element and is introduced form-fittingly into the recess on the framework during the connection. In some regions, the pin element has a negative shape relative to the recess and forms a movable gripping arm of the clamping element. In this embodiment, the second gripping arm is formed by a tensioning element which, when connected to the framework, rests against a longitudinal strut or a cross strut and partially encloses it. A tensioning mechanism, which generates a relative movement between the two elements or gripping arms, is arranged between the pin element and the tensioning element. By actuating the tensioning mechanism, the distance between the pin element and the tensioning element is reduced, whereby a force flow and a form fit are produced between the frame interface and the framework of the formwork panel.

[0029] In a skillful manner, it is provided that the frame interface, which is arranged at a distance from the formwork interface on a support element, is designed as a connection clamp, wherein the connection clip is fastened by way of frictional engagement to a vertical post of the frame section. In this embodiment, the frame interface is designed as a connection clip which is connected by way of frictional and form-fitting engagement to a vertical post of the frame section. This connection point can be positioned almost arbitrarily on the vertical post. In this embodiment, the frame interface is thus not identical to an interface which is used to connect components within the frame section. The connection clip encloses a vertical post in the circumferential direction and is clamped to the desired connection position, for example with the aid of a screw connection. A frame interface designed as a connection clamp has the advantage that it can be used particularly flexibly with respect to the relative position between the connection component and the frame section. Thus, in this embodiment, compensation of tolerances or of different heights of the underlying surface under the formwork panel and the frame section between the connection component and the frame section is also possible.

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[0030] In an alternative embodiment, it is provided that the formwork interface is formed by a compensating rail and the frame interface by means of a clamping clip, wherein the compensating rail is introduced into the undercut in the framework of the formwork panel with a first partial region which forms a gripping arm, wherein the second gripping arm is formed by a securing pin which can be inserted into the first partial region, and the compensating rail has a second partial region which is designed as a rail with a constant cross-section and the clamping clip has a connection region which is designed to be dimensionally complementary to the compensating rail at least in part, and the clamping clip furthermore has a bar element which can be inserted into the connection region and in the connected state the connection region and the bar element together completely enclose the compensating rail, wherein the clamping clip is designed to be displaceable in a manner parallel to the longitudinal direction of the compensating rail and the clamping clip furthermore has a connection clip which is arranged adjacently to the connection region, wherein the connection clip is fastened by way of frictional engagement to a vertical post of the frame section. In this embodiment, the formwork interface is designed as a compensating rail. A formwork interface designed in this way comprises a first partial region which is introduced in a form-fitting manner into an undercut in the framework and which forms a first gripping arm. In this embodiment, the undercut penetrates a longitudinal strut or a cross strut in the framework and the first partial region is introduced into the undercut in such a way that it penetrates the entire longitudinal strut or cross strut. In this embodiment, a securing pin which can be introduced into the first partial region is provided as the second gripping arm. During the connection, the first partial region is guided through the undercut in the framework and then the securing pin is introduced into the part which protrudes beyond the longitudinal strut or the cross strut. In this way, the formwork interface is connected to the framework of the formwork panel in a form-fitting manner. Adjacent to the first partial region, the compensating rail has a second partial region which is designed as a rail with a constant cross-section. This rail then serves for connection to the frame interface, which is designed as a

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clamping clip. Providing the second partial region as a rail with a constant cross-section allows improved flexibility with respect to the relative position between the formwork panel and the frame section. With the aid of this rail with a constant cross-section, the relative position between the formwork interface and the frame interface in the connection component can be varied along the length of this rail. Thus, in this embodiment, not only is variability provided with regard to the attachment of the connection component to the formwork panel and to the frame section, but there is an additional variability or adjustability within the connection component. This embodiment is particularly favorable if the formwork panel has undercuts on its framework only at discrete points. Such formwork panels often exist in the stock of construction companies and should continue to be used in the future. Such formwork panels from older stock can be used very flexibly in a system by a connection component according to this embodiment. The adjustability of the frame interface relative to the formwork interface is furthermore possible by the connection region of the clamping clip which, in this embodiment, forms the frame interface. This connection region is designed to be at least partially dimensionally complementary to the second partial region of the compensating rail. This means that the connection region grips around a partial region of the compensating rail. For the fixed connection of the frame interface to the formwork interface, the clamping point additionally has a bar element which can be introduced into the connection region and, together with the connection region, completely grips around the rail with a constant cross-section in the connected state. The bar element is designed such that a frictionally engaged connection can additionally be established between the clamping point and the compensating rail. During the connection, the connection region is first pushed over the second partial region of the compensating rail. In this state, the connection region is displaceable relative to the compensating rail along the length of the rail with a constant cross-section, whereby the position between the formwork interface and the frame interface can be set. The bar element is then introduced into the connection region, whereby a form fit and a frictional engagement between the components is produced. In this state, the

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connection component is then fixed. As in the embodiment described above, the frame interface is connected to the frame section via a connection clip which, in the connected state, encloses a vertical post of the frame section and is fastened to it in a frictionally engaged manner. As described above, this connection clip is advantageous here, since it can be positioned virtually continuously relative to a vertical post of the frame section. The described embodiment thus has a very high adaptability with respect to the shape and the positioning of the connection component between the formwork panel and the frame section.

[0031] The object of the invention is further achieved by a method for producing a wall element, comprising the steps of

A) setting up an adjustable formwork which comprises at least one formwork panel,

B) constructing a system according to any one of the preceding claims parallel to the adjustable formwork, wherein the frame section points toward the adjustable formwork,

C) fastening a reinforcement to the attached adjustable formwork, wherein the reinforcement is fastened from the frame section,

D) rotating the system until the formwork panel and the adjustable formwork delimit the spatial region in which the wall element is provided, and wherein the reinforcement is arranged between the adjustable formwork and formwork skin, and wherein the frame section is arranged on the side of the formwork panel opposite the adjustable formwork,

E) preparing the formwork for the filling of a liquid material between the adjustable formwork and the closing formwork, wherein in particular anchors are introduced which connect the adjustable formwork and the closing formwork to one another,

F) filling the formwork with a liquid material,

G) curing the material, whereby it forms the wall element together with the reinforcement,

H) removing the adjustable formwork and system.

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[0032] The method according to the invention serves to produce a wall element, for which purpose a system according to one of the embodiments described above is used. The invention thus also relates to the use of a system according to one of the embodiments described above for producing a wall element. The method according to the invention can of course also be used to produce other structural parts, such as columns or pillars. The method is preferably carried out in the described sequence of method steps A) to H). However, it is also possible to carry out the method steps in a different order.

[0033] In a first method step A), an adjustable formwork is constructed which comprises at least one formwork panel. The adjustable formwork can be formed here by a known formwork panel. Preferably, a plurality of formwork panels are combined with one another to form an adjustable formwork. It is also possible to use a system according to the invention as an adjustable formwork.

[0034] In a second method step B), a system according to any one of the embodiments described above is constructed, wherein the surface of the formwork skin of the system is preferably oriented parallel to the surface of the already constructed adjustable formwork. In method step B), the system is positioned such that the frame section points toward the adjustable formwork and faces the formwork panel away from the adjustable formwork.

[0035] In a third method step C), a reinforcement is attached to the adjustable formwork, wherein this work is carried out from the frame section of the system. It is advantageous that the frame section runs parallel to the adjustable formwork and this is thus easy to reach from the frame section everywhere. Since the reinforcement is attached from the frame section of the system, no additional reinforcement frame is required in this method step. After completion of this work, the working persons leave the frame section.

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[0036] In a fourth method step D), the system is rotated in order to use the system as a closing formwork. The system is rotated through 180° about a vertically extending imaginary axis, as long as the surface of the formwork skin of the system points toward the surface of the formwork skin of the adjustable formwork and preferably runs parallel thereto. In this rotated state, the previously placed adjustable formwork and the system which serves as a closing formwork then delimit the spatial region in which the wall element is to be produced and in which the reinforcement is also arranged. In the rotated state, the frame section of the system points away from the adjustable formwork and the spatial region in which the wall element is to be produced. It is advantageous that the system does not have to be supported via additional mechanisms, but that the formwork panel of the system is supported and held in position by the frame section connected thereto. The closing formwork can thus be positioned and fixed by a simple rotation of the system. Such a rotation of the system is preferably carried out using a crane which, after completion of method step C), raises the system, rotates it in the raised state through 180° and subsequently lowers it vertically again.

[0037] In a fifth method step E), the formwork is prepared for filling a liquid material, preferably a concrete material, between the adjustable formwork and the closing formwork. For this purpose, for example, anchors can be attached to or in the formwork and connect the adjustable formwork to the closing formwork and absorb and compensate for outwardly acting compressive forces acting on the formwork when the wall element is cast. In addition, in method step E), if a plurality of formwork panels for the adjustable formwork and the closing formwork are used, formwork locks can be attached to one another for connecting this plurality of formwork panels. This preparation of the formwork takes place from the frame section of the system, from which the formwork can be reached comfortably over its entire height. Since the frame section was already connected to the formwork panel before the rotation, the previously required effort for constructing a working frame or a working platform for preparing the formwork is dispensed with.

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[0038] In a sixth method step F), a liquid material is introduced into the formwork. This material, preferably a concrete material, then encloses the reinforcement and together therewith forms the wall element. This filling of the formwork can also be performed and monitored from the frame section.

[0039] In a seventh method step G), the liquid material filled into the formwork is given time to cure. After curing of the material, the wall element formed from this material and the reinforcement is itself capable of supporting a load.

[0040] In an eighth method step H), the adjustable formwork and the system which forms the closing formwork are removed. In this case, the system or the adjustable formwork can be removed first, both alternatives are possible. Preferably, after removal of the formwork, the system is rotated through 180° again about a vertically extending axis as long as the frame section again runs parallel to the produced wall element. In this way, the frame section can then be used for further processing of the wall element produced, for example for filling the holes which have been produced by the introduced anchors in the formwork. Such a rotation of the system is significantly less complex than the construction of a further or additional working frame for the post-machining of the wall element produced. Furthermore, it is possible to position the system on the side on which the adjustable formwork was previously arranged. On this opposite side of the wall element, the system is then aligned such that the frame section points toward the wall element. The side on which the adjustable formwork was previously attached can thus also be post-machined from the frame section of the system. The rotation and positioning of the system after removal of the formwork is again preferably carried out with the aid of a crane.

[0041] The method according to the invention has the advantage that the frame section of the system is used for a plurality of method steps and for a plurality of activities during the production of a wall element. In this way, effort for the provision, assembly and disassembly of different frames or frame systems is

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saved. In particular, the attachment of the reinforcement and the subsequent preparation of the formwork for the filling of the material can be performed very quickly one after the other, in which the system is simply rotated by 180°. Furthermore, at the end of the method according to the invention, there is still a connection between the formwork panel and the frame section, whereby the system is inherently stable and capable of supporting a load. It is thus possible in a simple manner to move the system spatially a bit further and to use it directly again for the production of a further wall section or wall element of the building, without the need for assembly and disassembly steps in this case. The method according to the invention thus significantly simplifies and accelerates the production of a wall element.

[0042] In one embodiment of the method, it is provided that in method step B), the system is constructed on the underlying surface as in the application or the system is placed on the underlying surface for construction. Several possibilities result for the construction of the system in method step B). On the one hand, the system can be constructed from bottom to top starting from the ground or underlying surface, which corresponds to the construction sequence which is usually used for a frame section. Alternatively, the system and/or the frame section can also be constructed on the underlying surface at a different location, also away from the position at which the wall element is to be produced. This has the advantage that, during the construction of the frame section, there is no risk of falling for working persons and thus fewer safety precautions have to be taken. Furthermore, the system can be constructed at a location on the construction site which is less frequented than the location at which the structure is created. This relieves the logistics and facilitates the work on the construction site. The frame section mounted horizontally can also be connected to the formwork panel horizontally, and the system can then be positioned, for example by a crane, at the location at which the wall element is to be produced.

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[0043] In a further embodiment of the method, it is provided that in method step B), the system is anchored in the ground or a support is attached to the system and points from the formwork panel into the side opposite the frame section. In this embodiment of the method, the system is additionally fastened to the underlying surface or to the ground. This can be necessary in cases in which the system and in particular the formwork panel is very high or increased loads act on the system, such as high wind loads or a plurality of workers on the frame section. Such an additional fastening can be achieved, for example, by anchoring the system in the ground or underlying surface. The anchoring can be carried out here between the frame section and the underlying surface and/or between the formwork panel of the system and the underlying surface. Alternatively, it is possible to attach a known support to the system. In method step B), such a support points away from the adjustable formwork and away from the frame section of the system. In this way, the support does not hinder the accessibility of the frame section and the attachment of the reinforcement in method step C). Optionally, it is also possible in method step D) after the rotation and positioning of the system to provide an additional fastening of the system, which in turn can take place by anchoring in the underlying surface or by providing a support. However, in method step D), a support is preferably attached to the side of the system on which the frame section is located so as not to hinder the production of the wall element between the adjustable formwork and the closing formwork.

[0044] Features, effects, and advantages disclosed in conjunction with the system also apply as disclosed in conjunction with the methods. The same applies in the reverse direction: features, effects, and advantages which are disclosed in conjunction with the methods also apply in conjunction with the system as disclosed.

[0045] Embodiments of the invention are shown schematically in the figures. In the figures:

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Fig. 1 shows a perspective representation of an embodiment of a system according to the invention,

Fig. 2 shows a side view of a connection component in functional combination with a vertical post,

Fig. 3 shows a sectional view through a cross strut of a formwork panel which belongs to an embodiment of the system according to the invention,

Fig. 4 shows a perspective detailed view of an embodiment of a formwork interface of a connection component,

Fig. 5 shows a perspective detailed view of a further embodiment of a formwork interface of a connection component,

Fig. 6 shows a perspective detailed view of a further embodiment of a formwork interface of a connection component,

Fig. 7 shows a perspective representation of a first state when carrying out a method according to the invention,

Fig. 8 shows a perspective representation of a second state when carrying out a method according to the invention,

Fig. 9 shows a perspective representation of a third state when carrying out a method according to the invention.

[0046] In the figures, like elements are provided with like reference signs. In general, the described properties of an element which are described in relation to one figure also apply to the other figures. Directional specifications as above or below relate to the described figure and are to be transferred analogously to other figures.

[0047] Fig. 1 shows a perspective representation of an embodiment of a system 100 according to the invention. Fig. 1 schematically shows a detail of an embodiment of a system 100 according to the invention. The system 100 comprises a frame section 3 which is shown at the front right. The frame section 3 extends three-dimensionally in three spatial directions and comprises a plurality of vertically oriented vertical posts 51. The frame section 3 further comprises a plurality of horizontally oriented horizontal bars 52. The vertical

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posts 51 and the horizontal bars 52 are connected to one another via interfaces. The frame section 3 is constructed in a modular manner, which means that different shapes and sizes of frame sections 3 can be assembled according to the modular principle from standard components such as the vertical posts 51 and the horizontal bars 52. The frame section 3 shown here comprises three tread levels which are arranged one above the other and can be walked on by workers. The system 100 further comprises at least one formwork panel 2. In the embodiment shown, a plurality of formwork panels 2 are provided, which are connected to one another at their edges and together form a formwork. The formwork panels 2 are connected to one another via formwork locks. In the embodiment shown, a support M, which supports and holds in position the formwork panel 2 and the system 100, is attached to the front of the formwork panel 2. However, this support M is optional here, the system 100 is also capable of supporting a load without this support M, wherein the frame section 3 supports and positions the formwork panel. The system can thereby also be used in a free-standing manner, in particular without the support M. Each formwork panel 2 comprises a framework 21 which forms the supporting and load-bearing element of the formwork panel 2. On the framework 21, a formwork skin 22 pointing to the rear left in the representation is releasably fastened to the framework. This releasable arrangement of the formwork skin 22 enables a simple replacement of the formwork skin 22, for example when it is worn. The framework 21 comprises a plurality of cross struts 212 oriented horizontally in the representation and a plurality of longitudinal struts 211 oriented vertically in the representation. The longitudinal struts 211 and the cross struts 212 are oriented substantially perpendicular to one another. The formwork skin 22 rests at least in regions on the longitudinal struts 211 and the cross struts 212. Undercuts 213 are arranged in each case on the cross struts 212, running in their longitudinal direction, whereby grooves are formed with a rectangular cross-section. Details of a cross strut 212 with an undercut 213 are shown in Fig. 3. The undercuts 213 are provided to be connected to a connection component 1 in a form-fitting and frictionally engaged manner. It is also possible for one or more undercuts 213 to be

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arranged on one or more longitudinal struts 211 for fastening a connection component 1. Furthermore, it is possible to arrange further struts in the framework 21, which are oriented at different angles to one another and which can also have one or more undercuts 213. Fig. 1 furthermore shows three connection components 1 which also belong to the system 100. These connection components 1 connect the formwork panel 2 to the frame section 3. In the embodiment shown, each connection component 1 has two formwork interfaces 12 which are connected to the framework 21 of the formwork panel 2. Details relating to a connection component 1 and its interfaces are shown in Fig. 2. Each formwork interface 12 comprises a clamping element 121, which in turn comprises two gripping arms 1211. The gripping arms 1211 engage in an undercut 213 in regions and thus form a form fit between the formwork interface 12 and in the framework 21, in particular a cross strut 212, of the formwork panel 2. One of the two gripping arms 1211 is designed to be movable relative to another gripping arm 1211. The distance between the two gripping arms 1211 is thus adjustable, whereby the clamping element 121 can be brought into engagement with one or more undercuts 213. Each connection component 1 further comprises a support element 13, to which the formwork interface 12 is fastened. The support element 13 is rod-shaped and is formed here by a tube with a round cross-section. The support element 13 has a longitudinal axis which extends in the vertical direction in the representation. The longitudinal axis of the support element 13 is arranged substantially parallel to the surface of the formwork skin 22. In the embodiment shown, the support element 13 is designed to be very similar to a vertical post 51 of the frame section 3. In the embodiment shown, the connection component 1 simultaneously forms a vertical post 51 of the frame section 3 in functional combination. Furthermore, in the embodiment shown, a plurality of frame interfaces 11 are arranged on the support element 13 and are arranged here at regular intervals along the longitudinal axis of the support element 13. The frame interfaces 11 of the embodiment shown correspond to interfaces which are also arranged on the vertical post 51 of the frame section 3. The frame interfaces 11 can thus be connected in the same way to

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other components or elements of the frame section 3, such as the interfaces which are arranged on a conventional vertical post 51. As a result, the connection component 1 is fully integrated into the frame section and can be combined in a modular manner with other components of the frame section 3. The frame interfaces 11 are designed here as connecting disks or rosettes. Both the connection between the frame interface 11 and the frame section 3 and the connection between the formwork interface 12 and the formwork panel 2 are also designed to be capable of supporting a load, such as connections within the frame section 3. A force transmission between the formwork panel 2 and the frame section 3 by the connection component 1 is thereby possible. In this way, the system 100 can be used in a free-standing manner, since the formwork panel 2 and the frame section 3 support one another and hold them in position. Furthermore, it is possible to transport the system with the aid of a crane, wherein it is sufficient to connect the crane either to the formwork panel 2 or to the frame section 3. The other component of the system 100 is held on the crane by the connections by the connection component 1. Fig. 1 clearly shows that the selected embodiment of a connection component 1, which forms a vertical post 51 in functional combination, can save additional vertical posts 51 in the frame section 3. The system 100 according to the invention thus reduces the weight of a connection between formwork panel 2 and frame section 3. Furthermore, components for the frame section 3 are saved compared to the prior art. In the embodiment shown, it is provided that, when the system is constructed or during the production of the wall element, the formwork panel 2 and the frame section 3 remain connected to one another by the connection component 1. However, the connections to the connection component 1 are releasable in a simple manner, so that a separation of formwork panel 2 and frame section 3 is also possible in a simple manner, for example when the system is disassembled.

[0048] Fig. 2 shows a side view of a connection component 1 in functional combination with a vertical post 51. Fig. 2 shows a connection component 1 according to the embodiment which is also shown in Fig. 1. The connection

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component comprises a support element 13, the longitudinal axis of which is oriented vertically in the representation. Two formwork interfaces 12 are arranged on the support element 13 pointing to the left, spaced apart from one another. A total of eight frame interfaces 11 are arranged on the support element 13 opposite the formwork interfaces 12, likewise at a distance from one another. Six of these frame interfaces 11 are designed as connecting disks or rosettes which extend to the right from the support element 13. These connecting disks or rosettes are identical or at least very similar to interfaces which are also arranged on a vertical post 51 of the frame section 3. A connection of components of the frame section 3 to the frame interfaces is thus possible in the same way as in the case of a connection of components within the frame section 3 constructed in a modular manner. The upwardly facing end and a recess in the downwardly facing end of the support element 13 are also frame interfaces 11. These two frame interfaces 11 can be used to produce a connection to vertical posts 51 of the frame section 3 by insertion at the ends of the support element 13. The frame interfaces 11 are arranged on the support element 13 at intervals from one another which correspond to the grid of connection interfaces in the frame section 3. In the embodiment shown, the connection component 1 can thus be integrated fully into the frame section 3. Each formwork interface 12 has a clamping element 121, which in turn comprises two gripping arms 1211. The lower of the gripping arms 1211 is designed to be immovable relative to the support element 13, whereas the upper of the two gripping arms 1211 is designed to be movable relative to the lower gripping arm 1211. The clamping element 121 furthermore comprises an unlocking mechanism 1220, which can be operated via a lever. The distance between the two gripping arms 1211 can be changed by the unlocking mechanism 1220. In order to connect the connection component 1 to the formwork panel 2, the unlocking mechanism 1220 is initially actuated such that the distance between the two gripping arms 1211 is greater than the width of a cross strut 212 of the framework 21. In this state, the two gripping arms 1211 are pushed over the cross struts 212 in regions. Subsequently, the unlocking mechanism 1220 is actuated so that the distance between the two gripping

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arms 1211 is reduced. A projection 1211a, which is arranged at the tip of the gripping arm 1211 pointing to the left, penetrates into an undercut 213 on the cross struts 212. Details regarding this connection can be seen in Fig. 3. By further actuation of the unlocking mechanism 1220, the cross strut 212 is then clamped between the gripping arms 1211. In this state, there is then a form fit and a frictional engagement between the formwork interface 12 and the framework 21. In the embodiment shown, each clamping element 121 has an unlocking mechanism 1220 which is operated individually. However, it is also possible to couple the unlocking mechanisms 1220 of both formwork interfaces 12 to one another, for example by a connection to a cable or a rod. In this coupled embodiment, both unlocking mechanisms 1220 can then be operated simultaneously. This accelerates the connection and the separation between connection component 1 and formwork panels 2. The distance between the two formwork interfaces 12 in a direction parallel to the longitudinal axis of the support element 13 corresponds to an integer multiple of the distance between two cross struts 212 of the formwork panel 2 from Fig. 1. A compatibility between the grid of the connection component 1 and the grid of the formwork panel 2 is thereby ensured. Due to this compatibility of the grids, the connection component 1 can be securely and stably fastened flexibly at different positions of the formwork panel 2, without further components having to be arranged in between for compensating a grid difference. Alternatively, it can be provided that the position of a formwork interface 12 on the support element 13 is provided adjustably in order to compensate for tolerances. In addition, a compensating element 14 can be provided which allows the formwork interface 12 to be displaced relative to the support element 13 in the longitudinal direction thereof. However, such a compensating element 14 is optional and therefore not shown in Fig. 2. A compensating element 14 can also be arranged between the support element 13 and one or more frame interfaces 11.

[0049] Fig. 3 shows a sectional view through a cross strut 212 of a formwork panel 2 which belongs to an embodiment of the system according to the

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invention. Fig. 3 shows the cross struts 212, which are connected to the formwork interface 12 of the connection component 1 in Fig. 2. The cross strut 212 is shown cut in a plane perpendicular to its longitudinal direction. In the representation on the left of the cross strut 212, the formwork skin 22 can also be seen in section and is connected to the framework 21. The formwork skin 22 rests flat here on the side of the cross struts 212 facing left. In the background, a longitudinal strut 211 can be seen in regions and is connected to the cut cross strut 212. In the illustration, the two gripping arms 1211 of the clamping element 121 can also be seen, which are connected to the cross strut 212 in a frictionally engaged and form-fitting manner. The cross strut 212 is formed by a profile tube which has the shape of a bone. An undercut 213, which is designed here as a groove, which extends in the longitudinal direction of the cross strut 212, that is to say in the representation into the plane of the drawing, can be seen on the side of the cross strut 212 pointing upward in the representation. The grooves which form the two undercuts 213 here have an identical, rectangular cross-section. The two undercuts 213 are arranged symmetrically and opposite one another on the cross strut 212. The regions of the gripping arms 1211, which are shown in Fig. 3, are designed identically. The two gripping arms 1211 have a projection 1211a on their tip facing the left in the representation, which projection forms a region here, which in each case engages in one of the undercuts 213. In the embodiment shown, the lower of the two gripping arms 1211 is designed to be movable in a direction parallel to the formwork skin 22, whereby the distance between the two gripping arms 1211 is designed to be adjustable. To produce a connection between the formwork interface 12 and the formwork panel 2, the lower gripping arm is moved vertically downward in the direction symbolized by an arrow in the representation, so that the distance between the two projections 1211a is greater than the width of the cross struts 212 in the vertical direction. Subsequently, the two gripping arms 1211 are pushed partially over the cross struts 212, until the projections 1211a are located adjacent to the two undercuts 213. Subsequently, the lower gripping arm 1211 is moved toward the upper gripping arm 1211 and the distance between the two gripping

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arms 1211 is reduced. In this case, the two projections 1211a each engage in an undercut 213, whereby a form fit is created. In this state, in which the two projections 1211a already form a form fit with the undercuts 213, the clamping element 121 can be displaced parallel to the running direction of the undercuts 213 along the cross struts 212, as long as the desired relative position between the clamping element 121 and cross strut 212 is reached. Subsequently, the lower gripping arm 1211 is moved toward the upper gripping arm 1211 until the two gripping arms 1211 clamp the cross struts 212. In this state, a force flow is then also present between clamping element 121 and cross struts 212. The described adjustability of the relative position of the clamping element 121 along the undercut 213 is particularly advantageous for a flexible connection between the connection component 1 and the formwork panel 2. Such a connection can also be carried out between a clamping element 121 and a longitudinal strut 211. In the background, an undercut 213 is likewise arranged on the illustrated longitudinal strut 211 and is aligned with the undercuts 213 of the cross strut 212.

[0050] Fig. 4 shows a perspective detailed view of an embodiment of a formwork interface 12 of a connection component 1. The connection component 1 in the embodiment shown in Fig. 4 does not comprise a support element 13. In the embodiment shown, the clamping element 121 of the formwork interface 12 comprises an intermediate post 122 which is formed by a tube portion with a round cross-section. The size and shape of the cross-section of the tube portion of the intermediate post 122 corresponds here to the shape and the size of a vertical post 51 of the frame section 3. The two gripping arms 1211 and the unlocking mechanism 1220 are arranged on the intermediate post 122 and are connected to a cross strut 212 of the formwork panel 2. A frame interface 11 is arranged on the intermediate post 122. The relative position of the frame interface 11 and the intermediate post 122 is adjustable here, wherein at least three possible positions of the frame interface 11 are provided at the intermediate post 122. These three positions can be set by displacing the frame interface 11 on the intermediate post 122

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along the longitudinal direction thereof. In the embodiment shown, both the frame interfaces 11 and the intermediate post 122 have bores into which a plug element for plugging the position of the components relative to one another can be introduced. Thus, in the embodiment shown, the position of the frame interface 11 relative to the clamping element 121 is designed to be adjustable. As a result, the connection component 1 can be adapted to different applications in a simple manner. The frame interface 11 is designed here in terms of shape and size identically to an interface which is also inserted within the frame section 3, in particular on a vertical post 51. Elements of the frame section 3, such as a horizontal bar 52 shown in Fig. 4, can thus be connected in the same way to the frame interface 11, such as a connection of different frame elements within the frame section 3. In the embodiment shown in Fig. 4, the clamping element 121 also comprises an unlocking mechanism 1220 by means of which the connection between the gripping arms 1211 and the cross strut 212 can be produced and released again simply and quickly.

[0051] Fig. 5 shows a perspective detailed view of a further embodiment of a formwork interface 12 of a connection component 1. In this embodiment, one of the gripping arms 1211 is formed by a pin element 1212 which is introduced into a recess in a cross strut 212 of the formwork panel 2. In Fig. 5, this pin element 1212 is covered and thus not shown. A corresponding recess, which is suitable for receiving the pin element 1212, is shown on the right-hand side adjacent to the clamping element. Here, the recess forms an undercut 213. In the embodiment shown, the second gripping arm 1211 is formed by a tensioning element 1213. This tensioning element 1213 grips around the cross strut 212 in regions and rests against it. The clamping element 121 further comprises a tensioning mechanism, which here contains a threaded spindle and a handwheel. The relative position between the pin element 1212 and the tensioning element 1213 can be changed by this tensioning mechanism. When the clamping element 121 is attached to the cross strut 212, the pin element 1212 is inserted into the recess and then the clamping mechanism is actuated. As a result, the pin element 1212 and the tensioning

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mechanism 1213 are moved toward one another and a form-fitting and frictional engagement arises between the clamping element 121 and the cross strut 212. A support element 13 is arranged on the clamping element 121 and the frame interfaces 12. This support element 13 connects the formwork interface 12 to a frame interface 11. The frame interface 11 is designed here as a connection clip 1214 which is connected to a vertical post 51 of the frame section 3. The connection clamp 1214 grips around the vertical post 51 and is fastened to the vertical post with frictional engagement with the aid of a screw connection. The advantage of this embodiment is that the frame interface 11 designed as a connection clip 1214 can be continuously displaced along the vertical post 51 and then positioned with frictional engagement. The relative position of the connection component 1 relative to the frame section 3 can thereby be set very flexibly. It is also possible to arrange a plurality of frame interfaces 11 on the support element 13 if necessary.

[0052] Fig. 6 shows a perspective detailed view of a further embodiment of a formwork interface 12 of a connection component 1. In this embodiment of a connection component 1, the relative position of the formwork interface 12 relative to the frame interface 11 is designed to be adjustable. For this purpose, the formwork interface 12 is designed as a compensating rail 1215. This compensating rail 1215 comprises a first partial region which forms a gripping arm 1211 which is introduced into the undercut 213 in the cross strut 212. This first partial region is hereby formed by two flat irons arranged at an angle to one another, which are connected by a vertically oriented bolt in the representation. This bolt is introduced into a cylindrical recess in the cross strut 212 which forms an undercut 213. The second gripping arm 1211 is not visible in the representation and is formed by a securing pin which is introduced into the vertically oriented bolt on the side which is located below the cross strut 212 in the representation. The compensating rail 1215 further comprises a second partial region which faces right, toward the front in the representation. This second partial region is formed by a rail with a constant cross-section, which in this case has a rectangular cross-section. In this embodiment, the

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frame interfaces 11 are formed by a clamping clip 1216 which is adjustably connected to the compensating rail 1215. For this purpose, the clamping clip 1216 has a connection region which is designed to be dimensionally complementary in regions to the rail with a constant cross-section of the compensating rail 1215. The connection region grips around the rail with a constant cross-section and is displaceable along the longitudinal axis of the rail with a constant cross-section. The clamping clip 1216 furthermore comprises a bar element which can be introduced into the connection region and which clamps the clamping clip 1216 on the rail with a constant cross-section in the shown state. In this state, the bar element and the connection region completely enclose the rail with a constant cross-section. When the frame interface 11 and formwork interface 12 are connected, the connection region is first displaced relative to the compensating rail 1215, until the desired position of formwork interface 12 and frame interfaces 11 is reached. The bar element is then introduced and this relative position is fixed. The clamping clip 1216 further comprises a connection clip 1214 which is fixedly connected to the connection region. As in the embodiment shown in Fig. 5, the connection clip 1214 is connected in a frictionally engaged manner to a vertical post 51 of the frame section 3. The shown embodiment of a connection component 1 is particularly advantageous since, on the one hand, the relative position between the formwork interface 12 and the frame interface 11 is designed to be adjustable and, on the other hand, the connection clip 1214 of the frame interface 11 can be adjusted continuously in its position relative to a vertical post 51. This embodiment of a connection component 1 thus enables an adaptation of the position between the formwork panel 2 and the frame section 3 in two spatial directions oriented perpendicular to one another.

[0053] The embodiments of a connection component 1 shown in Fig. 4 to Fig. 6 can all be used in a system 100. It is also possible to use a plurality of embodiments of a connection component 1 with one another and combined with one another in a system 100. Furthermore, it is possible in a system 100

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alternatively and/or additionally to use one or more connection components 1 according to the embodiments shown in Fig. 1 and 2. The embodiments shown in Fig. 1, 2, 4, 5 and 6 can thus be used in any way combined with one another in a system 100 according to the invention, whereby a very high flexibility with respect to the type and the position of the connection between a formwork panel 2 and a frame section 3 is made possible.

[0054] Fig. 7 shows a perspective representation of a first state when carrying out a method according to the invention. In Fig. 7 to 9, states occurring in chronological succession are shown, which occur in a method for producing a wall element using a system 100 according to the invention. In Fig. 7, an adjustable formwork was already set up according to method step A) and is located to the rear left in the representation. The adjustable formwork corresponds to the prior art and is constructed from a plurality of formwork panels 2 which are connected to one another. The adjustable formwork is held in its vertically oriented position by at least one support M. Opposite the formwork skin of the adjustable formwork, a system was constructed in parallel with the adjustable formwork according to method step B). The system 100 here comprises a total of twelve formwork panels 2 which are joined together to form a common formwork. The formwork panels 2 are connected to a frame section 3 via a plurality of connection components 1, which are covered in the representation. The frame section 3 points toward the adjustable formwork and is oriented parallel to its formwork skin. There is a distance between the adjustable formwork and the frame section 3, which distance corresponds approximately to the thickness of the wall element to be produced. In the state shown in Fig. 7, a reinforcement B was also already attached to the adjustable formwork. The reinforcement B is hereby formed by a plurality of iron mats. The reinforcement B was attached and fastened by persons working from the frame section 3. The frame section 3 with its three tread levels arranged one above the other is designed such that the entire surface of the adjustable formwork can be conveniently reached by workers. A reinforcement can thus be easily and quickly attached from the frame section 3. In the state shown in

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Fig. 7, the reinforcement B is already attached completely to the adjustable formwork and the workers have left the frame section 3. In the next step, the system 100 is rotated about a vertically oriented imaginary axis VA in order to orient the formwork skin 22 of the formwork panels 2 of the system 100 toward the front right in Fig. 7 toward the adjustable formwork and toward the reinforcement B. For this rotation, the entire system can be raised by a crane and rotated in the state hanging from the crane. The system 100 is rotated according to the arrow P shown on the right next to the system 100.

[0055] Fig. 8 shows a perspective representation of a second state when a method according to the invention is carried out. Fig. 8 shows a state which occurs during the rotation of the system 100 according to method step D). Starting from the state shown in Fig. 7, the system 100 was already rotated by an angle of approximately 120° about the imaginary, vertically oriented axis VA. In the state shown in Fig. 8, the frame section 3, which also points toward the adjustable formwork in Fig. 7, already points away from the adjustable formwork. Starting from the state shown in Fig. 8, the rotation of the system about the axis VA is continued in the direction of the arrow P until the formwork panels 2 of the system 100 are aligned parallel to the adjustable formwork and the formwork skin 22 of the frame system 100 points toward the reinforcement B and toward the adjustable formwork. Overall, the system 100 is rotated by 180°. This rotation according to method step D) enables a very rapid construction of a closing formwork which is formed by the same system 100 which previously served with its frame section 3 for fastening the reinforcement B. The system is simply rotated through 180° with the aid of a crane and set up parallel to the adjustable formwork. The formwork is thus already fully constructed and the adjustable formwork and the system together delimit the spatial region in which the wall element is to be produced. A further advantage is that after the rotation through 180°, the frame section 3 is still connected to the formwork panels 2 of the system 100. After rotation, the filling of a liquid concrete material according to method step E) from the frame section 3 can thus be started directly with the preparation of the formwork. In

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this preparation of the formwork, for example, anchors can be arranged between the system and the adjustable formwork and connect the two parts of the formwork to one another and hold the two parts of the formwork together during filling of the concrete material and take up forces. The work for preparing the formwork can again be carried out by persons located on the frame section 3, who from there can easily reach any point of the formwork. The rotation according to method step D) thus eliminates the degradation of a reinforcement framework which has to be used according to the prior art for attaching the reinforcement to the adjustable formwork. In addition, the construction of a working frame or a working platform for preparing the formwork is dispensed with after the installation of the system 100 as a closing formwork, since the frame section 3 is already connected to the formwork panels 2.

[0056] Fig. 9 shows a perspective representation of a third state when carrying out a method according to the invention. Before the state shown in Fig. 9, liquid material, in particular concrete material, was filled into the formwork according to method step F) after preparation of the formwork according to method step E). The reinforcement B was enclosed in the concrete material. The formwork can also be filled by persons located on the frame section 3. Furthermore, the filling of the formwork from the frame section 3 can be monitored conveniently. Furthermore, before the state shown in Fig. 9, the filled material was cured in the formwork according to method step G), whereby the wall element W was formed, which consists of the cured concrete material and the reinforcement B. The curing of the concrete material can also be monitored from the frame section 3. In the state shown in Fig. 9, the adjustable formwork and the system 100 are removed from the wall element W produced. In the illustration, the adjustable formwork and the system 100 are shown in parallel offset away from the wall element W. However, the adjustable formwork and the system can also be lifted upwards with the aid of a crane. After the production of this wall element W, the system can be used without further conversion work directly for attaching a further reinforcement B to a

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further adjustable formwork, analogously to the state shown in Fig. 7. For example, the system 100 can simply be rotated back again about the imaginary vertically oriented axis VA by a crane and can be positioned at a different location on the construction site. The system can thus be used again without interruptions to produce a further wall element. The production of a wall element is thereby simplified, since significantly less effort is required for the construction and disassembly of formwork and frames. This also reduces the time which is required to produce a wall element W.

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List of reference signs:

1	Connection component
11	Frame interface
12	Formwork interface
121	Clamping element
1211	Gripping arm
1211a	Projection
1212	Pin element
1213	Tensioning element
1214	Connection clamp
1215	Compensating rail
1216	Clamping clip
1220	Unlocking mechanism
13	Support element
14	Compensating element
2	Formwork panel
21	Framework
211	Longitudinal strut
212	Cross strut
213	Undercut
3	Frame section
51	Vertical post
52	Horizontal bar
100	System
B	Reinforcement
M	Support
W	Wall element
P	Arrow
VA	Vertically oriented axis

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Claims

1. A formwork system (100) for a wall element, comprising at least one formwork panel (2), at least one connection component (1), and at least one frame section (3),

- wherein the frame section (3) comprises a plurality of vertical posts (51) and a plurality of horizontal bars (52) and the frame section (3) extends in three spatial directions,

- wherein the formwork panel (2) comprises a framework (21) and a formwork skin (22), wherein the framework (21) has a plurality of longitudinal struts (211) and a plurality of cross struts (212), wherein the longitudinal struts (211) and the cross struts (212) are arranged substantially perpendicular to one another, and the formwork skin (22) can be releasably fastened to the framework (21), wherein, in a connected state, the formwork skin (22) rests on at least a portion of the longitudinal struts (211) and the cross struts (212), wherein at least a part of the longitudinal struts (211) and/or cross struts (212) has an undercut (213) which is oriented in the longitudinal direction of the longitudinal struts (211) and/or cross struts (212), wherein the undercut (213) is provided for the form-fitting and frictionally engaged connection to the formwork interface (12) of a connection component (1),

- wherein the connection component (1) comprises at least one frame interface (11) which is provided for releasable connection to the frame section (3) and comprises at least one formwork interface (12) which is provided for releasable connection to the formwork panel (2), wherein the formwork interface (12) comprises at least one clamping element (121) and the clamping element (121) comprises at least two gripping arms (1211), wherein at least one of the gripping arms (1211) is designed to be movable relative to another gripping arm (1211), wherein the distance between the at least two gripping arms (1211) is designed to be adjustable,

wherein the at least one connection component (1) is connected with its frame interface (11) to the frame section (3) and the connection component (1)

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is connected with its formwork interface (12) to the at least one formwork panel (2),

wherein the gripping arms (1211) of the clamping element (121) engage in the undercut (213) on the framework (21) of the formwork panel (2) at least in regions, as a result of which at least one form-fitting, preferably also a frictionally engaged connection between the formwork interface (12) and the formwork panel (12) is present,

wherein this connection can be arbitrarily positioned along the undercut (213), whereby the relative position between the connection component (1) and the formwork panel (2) is designed to be adjustable in a direction parallel to the running direction of the undercut (213),

wherein, when the system (100) is constructed, the frame section (3) supports and positions the formwork panel (2) and the system (100) can be used in a free-standing manner, in particular without additional support elements.

2. The system (100) according to claim 1, **characterized in that** a support element (13) is provided which is connected to the formwork interface (12) and the frame interface (11), in particular wherein the support element (13) is rod-shaped, wherein the formwork interface (12) and the frame interface (11) are arranged at a distance from one another on the support element (13), and the support element (13) has a longitudinal axis and the formwork interface (12) and the frame interface (11) are arranged at a distance from one another along the longitudinal axis, and wherein the longitudinal axis is oriented substantially parallel to the surface of the formwork skin (22) or substantially perpendicular to the surface of the formwork skin (22).

3. The system (100) according to claim 2, **characterized in that** two frame interfaces (11) and two formwork interfaces (12) are provided, which are each arranged at a distance from one another on a common support element (13) and the clamping element (121) has an unlocking mechanism (1220) which can be actuated by a simple linear or rotational movement, wherein the form

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fit between the formwork interface (12) and the formwork panel (2) can be canceled by actuating the unlocking mechanism (1211).

4. The system (100) according to any one of the preceding claims, **characterized in that** the direction of movement of at least one of the gripping arms (1211) of the clamping element (121) is oriented substantially parallel to the connection direction of the frame interface (11) and/or substantially parallel to the surface of the formwork skin (22), and/or the direction of movement of at least one of the gripping arms (1211) of the clamping element (121) is oriented substantially perpendicular to the connection direction of the frame interface (11) and/or perpendicular to the surface of the formwork skin (22).

5. The system (100) according to any one of the preceding claims, **characterized in that** the undercut (213) on the framework (21) of the formwork panel (2) is designed as a groove which is oriented in the longitudinal direction of the longitudinal struts (211) and/or cross struts (212), wherein the groove has a U-shaped, rectangular or curved cross-section.

6. The system (100) according to any one of the preceding claims, **characterized in that** at least two connection components (1) are provided and each connection component (1) has at least two formwork interfaces (12), and the formwork panel (2) has a plurality of cross struts (212) with an undercut (213) arranged thereon at least in regions, wherein the distance between the at least two formwork interfaces (12) on the connection component (1) corresponds to an integer multiple of the distance between two adjacent cross struts (212) of the formwork panel (2).

7. The system (100) according to any one of the preceding claims, **characterized in that** the connection component (1) forms a vertical post (51) of the frame section (3) in functional combination, and the frame interface (11) is formed by at least one interface which corresponds to a connection interface within the frame section (3) in terms of shape and size.

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8. A method for producing a wall element, comprising the steps of

A) setting up an adjustable formwork which comprises at least one formwork panel (2),

B) constructing a system (100) according to any one of the preceding claims parallel to the adjustable formwork, wherein the frame section (3) points toward the adjustable formwork,

C) fastening a reinforcement to the attached adjustable formwork, wherein the reinforcement is fastened from the frame section (3),

D) rotating the system (100) until the formwork panel (2) and the adjustable formwork delimit the spatial region in which the wall element is provided, and wherein the reinforcement is arranged between the adjustable formwork and formwork skin (2), and wherein the frame section (3) is arranged on the side of the formwork panel (2) opposite the adjustable formwork,

E) preparing the formwork for the filling of a liquid material between the adjustable formwork and the closing formwork, wherein in particular anchors are introduced which connect the adjustable formwork and the closing formwork to one another,

F) filling the formwork with a liquid material,

G) curing the material, whereby it forms the wall element together with the reinforcement,

H) removing the adjustable formwork and system (100).

9. The method according to the preceding claim, **characterized in that** in method step B), the system is constructed on the underlying surface as in the application or the system (100) is placed on the underlying surface for construction.

10. The method according to any one of the preceding claims, **characterized in that** in method step B), the system (100) is anchored in the ground or a support (M) is attached to the system (100) and points from the formwork panel (2) into the side opposite the frame section (3).

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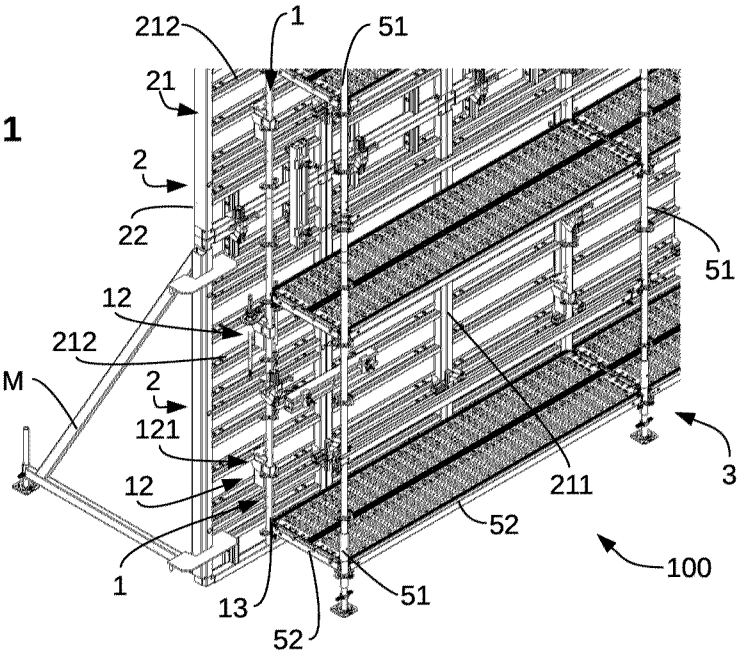
Fig. 1


212
1
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21
2
22
51
12
212
M
2
121
12
211
3
52
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1
13
51
52

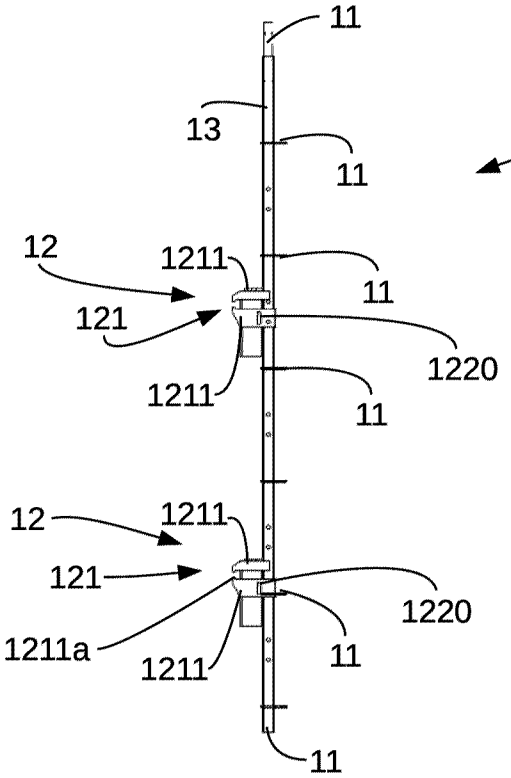
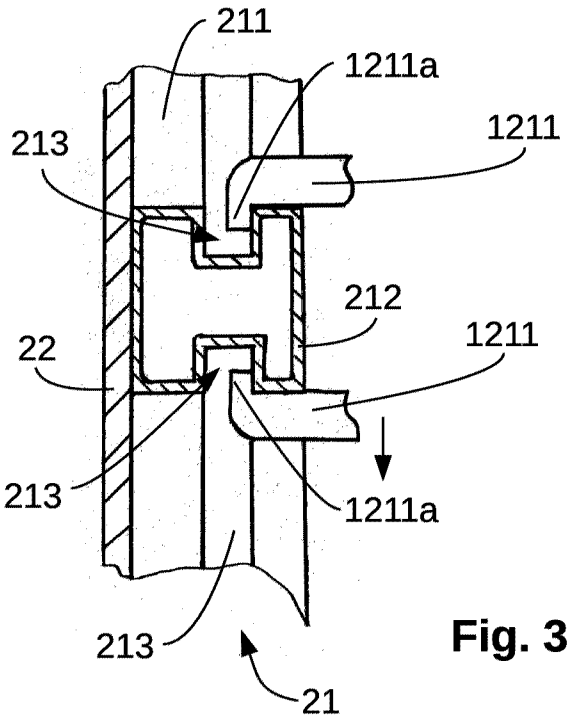

11
1
13
11
12
1211
11
121
1220
1211
11
12
1211
121
1220
1211a
1211
11
11

Fig. 2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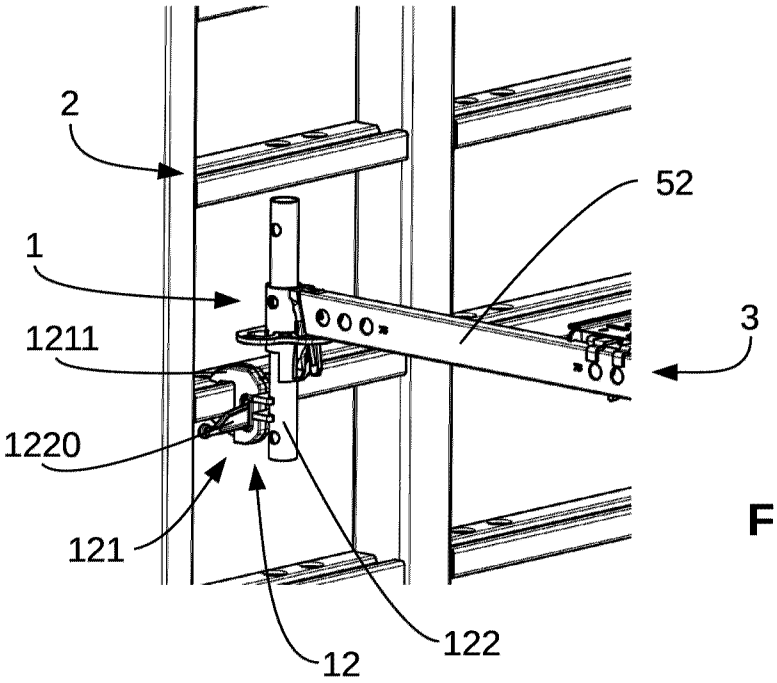
212
22
1211
213
1211a
213
21

Fig. 3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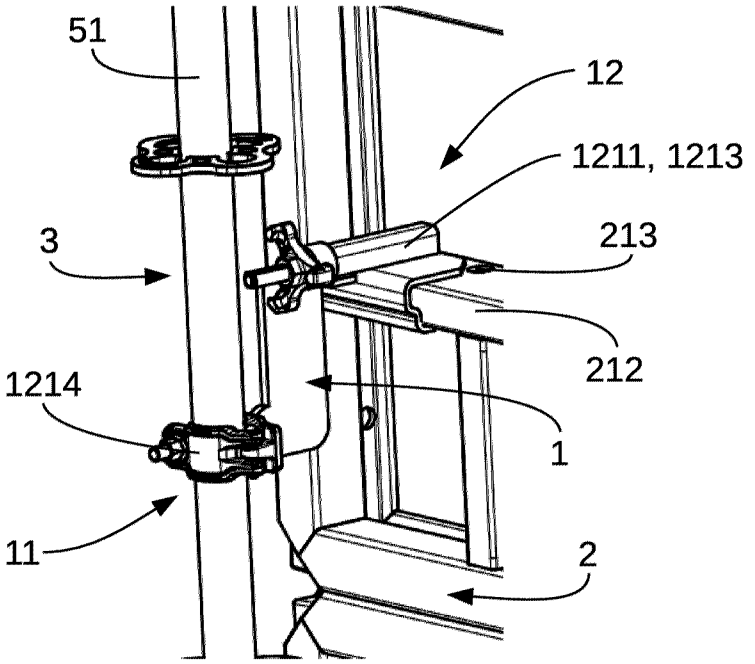
52
1
3
1211
1220
121
122
12

Fig. 4

Fig. 5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1214
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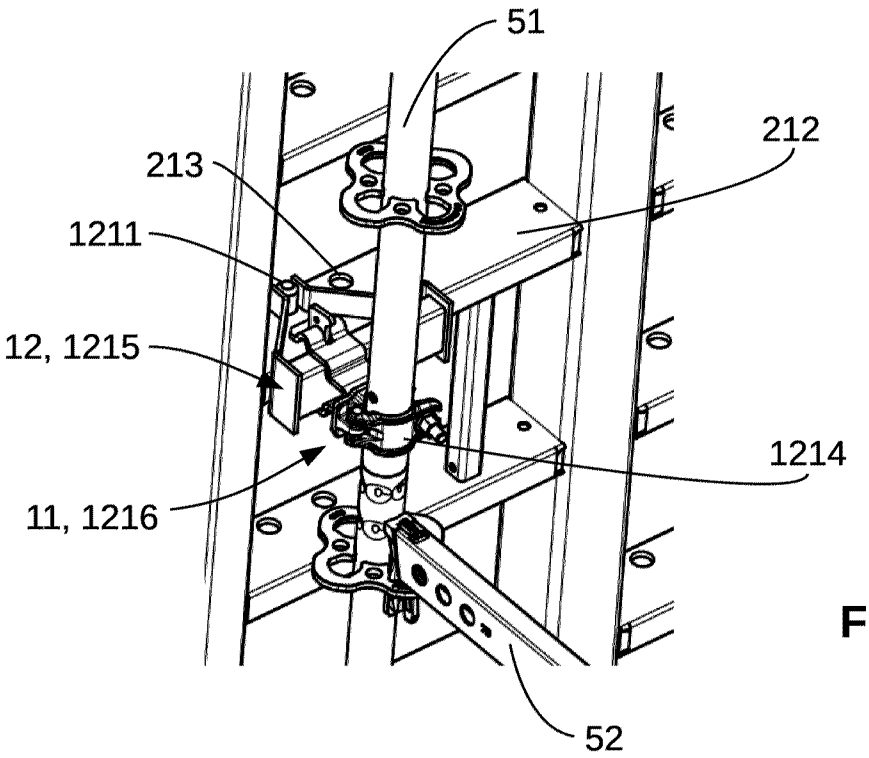
11
2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1211
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1214
11, 1216
52

Fig. 6

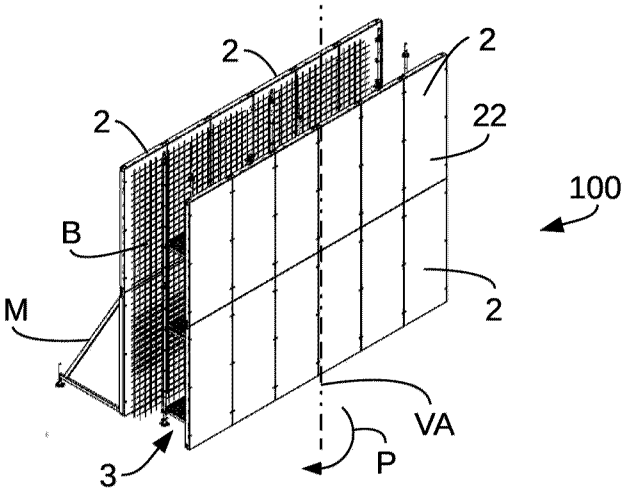
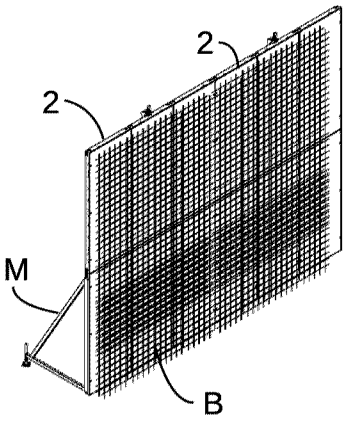


Fig. 7



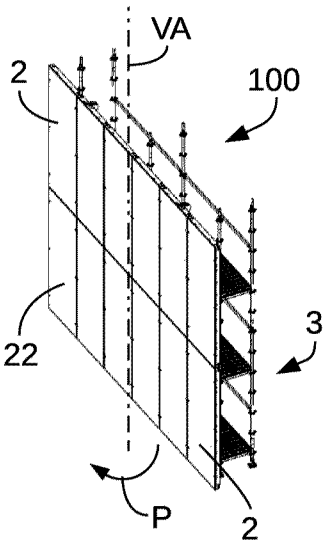


Fig. 8

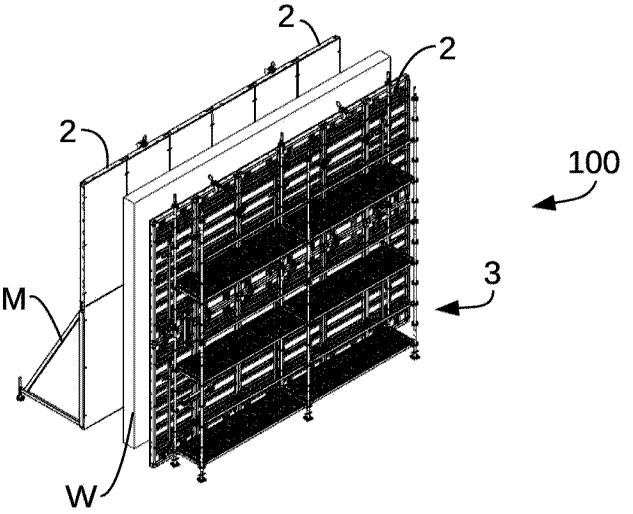


Fig. 9

Fig. 1