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The present invention relates to a formwork arrangement according to the preamble of claim 1 for creating a cavity during the casting of a building component, especially a ceiling to be created from *in situ* concrete, for joining a tensile reinforcing element, especially of bar shape, to the building component.

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Moreover, the present invention relates to a building element for thermal insulation between two components according to the preamble of claim 14.

And finally the present invention relates to a method according to the preamble of claim 17 of joining a reinforcement element to a building component, particularly a ceiling to be created from *in situ* concrete.

In the field of building construction, it is frequently the case that a building component cast from *in situ* concrete, in particular, such as a ceiling or the like, has to be attached to another element such as, in particular, a projecting structure in the form of balconies, overhanging roofs, etc. and a first approach is, in particular, to introduce a number of bores into the cast building component and then to anchor the element in question in the bores. However, on the one hand, this procedure has proved relatively laborious, especially as these components with their reinforcing elements have to be introduced into a plurality of bores at the same time.

Another approach consists of positioning the bar-shaped tensile reinforcing element on the building component even before the building component is cast and then to at least partly incorporate it by casting during the manufacture of the building component. This procedure makes it possible to absorb higher tensile forces, but – if the elements in question are to be provided on the exterior of a building, for example – it often results in at least parts of the relevant tensile reinforcing element protruding, as a result of which the positioning of scaffolding, in particular, is made significantly more difficult and in some cases impossible (for example in confined site conditions).

There is therefore a need for a solution which makes it possible to attach tensile reinforcing elements to the building component subsequently, i.e. after the building component has been manufactured, without the need to form bores in

the building component and without there being any protrusions from the building component. An example of such a solution is disclosed in EP-A 1 126 092 which relates to a formwork arrangement according to the preamble of claim 1. During the manufacture of the building component, a number of recesses or shafts are
5 provided on one end face, which are lined by formwork arrangements in the form of metal boxes. Extending through the metal boxes are tensile anchor bars which are anchored in the building component and thus produce a positively locking connection between the building component and a filler that is adapted to be introduced into the metal boxes.

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The invention is based on the problem of further developing a formwork arrangement of the type mentioned hereinbefore and a method of the type mentioned hereinbefore such that the subsequent attachment of a tensile reinforcing element to a cast building component is optimised, without the
15 formation of bores and without any elements protruding relative to the building component.

This problem is solved according to the invention by a formwork arrangement having the features of claim 1 and a method having the features of claim 17.

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A further problem of the present invention is to provide a building element for thermal insulation between two building components with integrated tensile reinforcing elements which also improves the subsequent attachment of the tensile reinforcing element thereof to the cast building component without the
25 formation of bores and without any elements protruding relative to the building component.

This problem is solved according to the invention by a building element having the features of claim 14.

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Advantageous further features of the invention form the subject-matter of the subsidiary claims, the wording of which is hereby expressly incorporated by reference in the description, in order to avoid unnecessary repetitions of text.

According to the invention, a formwork arrangement for creating a cavity during the casting of a building component, especially a ceiling to be created from *in situ* concrete, for joining a bar-shaped tensile reinforcing element to the building component, wherein the formwork arrangement has at least one formwork
5 element for forming the cavity for the reinforcing element to be joined and at least one anchoring element, and the anchoring element is constructed in such a way that it enables an interlocking connection to be made between the building component and a curing and/or settable filler that is introducible into the cavity, is characterised in that the anchoring element is constructed in such a way that it
10 acts as a common anchoring element for two or more mutually adjacent formwork elements, and for that purpose the common anchoring element can be joined to the mutually adjacent formwork elements.

A building element according to the invention for thermal insulation between two
15 building components, namely between a supporting building component and a supported projecting exterior part, consisting of an insulator body to be arranged between the two components and having reinforcing elements, in the form of at least tensile reinforcing elements, that pass through the insulator body and are joinable to both components, is characterised in that a formwork arrangement
20 according to at least claim 1 having a formwork element and an anchoring element is associated with the tensile reinforcing elements on the side of the building component.

Finally, a method according to the invention for joining a reinforcing element to a
25 building component, particularly a ceiling to be created from *in situ* concrete, is characterised by the following steps:

- a) using a formwork arrangement according to one of the preceding claims having formwork elements and at least one anchoring element, to define a region of the building component to be created that corresponds to the
30 cavity, a common anchoring element being provided for two or more mutually adjacent formwork elements and being joined to these two or more mutually adjacent formwork elements;
- b) casting the building component outside the formwork element;
- c) arranging a reinforcing element which is to be attached to the building
35 component in the region of the cavity; and

d) introducing a curing and/or settable filler into the cavity, thereby acting on the anchoring element, to produce an interlocking connection between the building component and the filler.

- 5 The tensile reinforcing elements according to the terminology of the present specification are, in particular, tie bars of an element of the Isokorb® type manufactured by the present Applicant. In order to retro-fit the tensile reinforcing element to the component in such a way that it can absorb tensile forces, the formwork arrangement according to the invention is used to create a cavity,
- 10 during the casting of the component, in which the tensile reinforcing element can be secured afterwards, by being inserted into the cavity by its free end which is associated with the building component, the cavity then being filled with a curing and/or settable filler.
- 15 It is an essential feature of the invention that the formwork arrangement comprises not only a formwork element to form the cavity for the reinforcing element that is to be attached, but also an anchoring element which is configured so as to produce an interlocking connection between the building component and the filler. This interlocking connection advantageously ensures that the filler is
- 20 suitable for transmitting, unimpeded, the tensile forces transmitted onto it by the tensile reinforcing element into the surrounding building component. Without the interlocking connection there would be a danger of the filler being pulled out of the building component when first subjected to the tensile force, i.e. the tensile reinforcing element would not be able to guarantee its function of tensile force
- 25 transmission to the effect that there is actually a transmission of tensile force between the building component, on the one hand, and the additional component to be attached to the tensile reinforcing element, on the other hand.

In this context it is particularly advantageous if, in order to make the interlocking

30 connection between the building component and the curing and/or settable filler that is introducible into the cavity, the anchoring element at least partly projects into the cavity to be formed by the formwork element, i.e. the interlocking connection is made directly in the region of the cavity. As for the curing and/or settable filler, this may consist for example of a cement-containing, optionally

35 fibre-reinforced building material such as concrete, especially a high-strength or

ultra-high-strength concrete or high-strength or ultra-high-strength mortar and/or of a synthetic resin mixture, a reactive resin or the like.

It should be explained in this context that the main loading case in the
5 transmission of tensile load arises when the tensile reinforcing element is installed so as to extend in the horizontal direction and the tensile forces initially act predominantly in this horizontal direction, i.e. the interlocking connection must be designed so as to prevent these horizontal movements. However, in the case of horizontally acting tensile forces, particularly when there are corresponding
10 torques acting on the tensile reinforcing element or on the components attached thereto, there is a danger that the tensile reinforcing elements will be lifted upwards, i.e. towards the top of the building component. Thus it is also necessary to prevent the filler from being lifted vertically out of the cavity. It is therefore advisable for the anchoring element to provide an interlocking connection not only
15 in the horizontal direction but also in the vertical direction, i.e. to ensure vertical securing.

To ensure that the anchoring element has the desired effect, it is also expedient for the anchoring element to project at least partly from the cavity in the region of
20 the building component surrounding the cavity, i.e. to provide an interlocking connection on the building component side.

For this purpose, finally, it is advisable for the anchoring element to at least partly pass through the formwork element and thus extend from the side of the
25 formwork element facing the cavity to the side of the formwork element remote from the cavity.

It is also essential for the formwork arrangement according to the invention that the anchoring element is in the form of a lost anchoring element and is intended
30 to remain permanently in the building component after the cavity has been created by means of the formwork arrangement in order to make the interlocking connection between the building component and the filler that is introducible into the cavity. Only by having the anchoring element remain in the cavity can the interlocking connection with the filler be achieved and maintained up to the
35 loading case.

By contrast, however, with respect to the formwork element, it is particularly advisable that it is removable from the cavity after the cavity has been created and before the reinforcing element has been attached. In this way, not only can
5 the filler, i.e. particularly the concrete that is to be poured into the cavity, act on the anchoring element to form a permanent interlocking connection, but also the filler comes into direct abutment with the building component, i.e. particularly the (set) *in situ* concrete of the building component. As a consequence, the formwork element is not subject to any conditions with regard to stability, durability, etc.,
10 but rather the formwork element has only to perform as shuttering during the manufacture of the building component, i.e. particularly during the pouring of the *in situ* concrete, and keeps the cavity free from the material of the building component, after which the formwork element can be removed. It is irrelevant to subsequent operation whether the formwork element is destroyed during removal
15 or retains its original shape and is optionally of multi-sectional construction for this purpose so as not to cause any damage during the removal of the anchoring element remaining in the building component.

For reasons of cost it is naturally advantageous if the formwork element is of the
20 simplest possible construction, for which purpose it may be in the form of a shell or box and may be made of plastics and/or metal, for example. It may be of thin-walled construction, of the thickness of foil or sheet metal, preferably less than one millimetre and particularly a few microns thick, so that the overall manufacturing costs can be kept low. In other words, the formwork element itself
25 does not have a load-bearing function – other than during the casting of the building component – but can be thin-walled and designed to be optimal in terms of easier removal after the setting of the building component.

As for the removal of the formwork element, this naturally depends on the nature
30 of the installation in the building component. In the embodiment by way of example which is to be inferred from the appended drawings, the formwork element is arranged in the building component to be essentially flush with the upper side and end face thereof, so as to form the cavity adjacent to the upper side and end face of the building component. In this case, the reinforcing element
35 which is to be joined to the cavity then extends horizontally outwards from the

cavity through the end face of the building component . The formwork element is thus configured so as to be removable in the direction of the top of the building component and/or in the direction of the intended path of the reinforcing element that is to be attached.

5

As for the anchoring element, it is particularly advantageous if this is embodied as a reinforcing bar. This is because reinforcing bars not only have proven and permitted material properties in respect of their use in building components made of concrete, but also have the desired static capabilities, as the aim and purpose
10 of the anchoring element is to form the interlocking connection with the filler in the cavity which is able to transmit the tensile forces transmitted into the filler through the reinforcing element on into the building component.

In a bar-shaped anchoring element in the form of a reinforcing bar, the anchoring
15 element is configured so as to act as a common anchoring element for two or more adjacent formwork elements or apparatus and the common anchoring element can be attached for this purpose to two or more mutually adjacent formwork elements. In this way, a mutual positional association of the anchoring element and formwork elements or formwork apparatus is advantageously
20 achieved, so that a grid of formwork arrangements can be provided which is matched to the grid of the reinforcing bars that are to be installed.

Thus, a grid of formwork arrangements is obtained in the form of a continuous anchoring element consisting of a reinforcing bar and a plurality of formwork
25 elements attached thereto, and in order to create the desired cavities, this grid can easily be inserted into the building component or into/onto the formwork of the building component on the building site. For example, this grid can be placed on the structural reinforcement of the building component and the operator has only to take account of the position of the tensile reinforcing elements.

30

It is particularly advantageous if a modular formwork system is obtained which can easily be adapted to all kinds of conditions of installation and use, such as for example the grid of reinforcing bars. On the one hand, the production costs of the formwork elements are not very high, with the result that a change in their
35 shape and size does not give rise to any particular additional costs, and on the

other hand the possibility of changing the mutual spacing of the formwork elements by means of the anchoring element in the form of the reinforcing bars ensures that the components are kept simple and thus costs are reduced.

- 5 As mentioned hereinbefore, the formwork arrangement according to the invention can be used particularly advantageously to provide thermal insulation in an otherwise standard or known building element. For this, the formwork arrangement is associated with the tensile reinforcing element of this building
- 10 component, while a common formwork arrangement can in turn be associated with a plurality of tensile reinforcing elements, i.e., for example, a formwork element can be associated with each tensile reinforcing element and a common anchoring element can be associated with a plurality of formwork elements.
- 15 Because the building element for thermal insulation and the formwork arrangement according to the invention are installed at staggered times, there is no need for them to be delivered simultaneously to the building site; rather, it is also possible for the formwork arrangement and the remainder of the thermally-insulating building element to be delivered to the building site separately from
- 20 one another, for the formwork arrangement to be installed first, in the manner described hereinbefore, and for the remainder of the thermally-insulating building element to be positioned and installed after the production of the cavity and optionally after removal of the formwork element or elements.
- 25 The effect which is an essential feature of the invention is predominantly obtained when this staggered installation constitutes a time difference of several days or weeks. For this purpose, the construction of a building may initially be almost finished, leaving the specified cavities, and only afterwards are the tensile reinforcing elements attached to the associated thermally-insulating building
- 30 elements, namely expediently when the projecting components, such as balcony slabs, that are to be attached to the thermally-insulating building element are ready to be installed.

It is possible to position the scaffolding close to the building wall when erecting

35 the building, and this may be important and advantageous particularly in confined

building sites. Once the building has been erected, the projecting structures can then be added later, for which purpose optionally either new scaffolding is erected at a greater distance or perhaps mobile staging and cranes can be used, in which case the corresponding reinforcing elements that are to be attached are

- 5 positioned in the cavity and the filler is introduced into the cavity and in this way the desired interlocking connection is produced between the reinforcing element, filler and building component.

The same applies when installing a thermally-insulating building element with a
10 reinforcing element of this kind to be attached, or when installing a complete projecting structure optionally with an attached thermally-insulating building element and a corresponding reinforcing element to be attached. However, it is essential that this subsequent installation can be carried out in an extremely short time on site and thus the disturbance to the building site and its environs is
15 reduced to a minimum.

The thermally-insulating building elements with the reinforcing element and optionally together with the attached projecting structures can be installed extremely easily by placing them with their tensile reinforcing elements in the
20 cavities from above. Because the cavities are oversized in relation to the reinforcing elements this does not require any great accuracy during installation – and the subsequent alignment of the structure relative to the building component is unproblematic and simple – as long as the filler has not been introduced into the cavity.

25

The method according to the invention is particularly characterised by the advantages described if there is a break in the installation process between steps b) and c) of the method. In other words, the cavity in the building component can be produced at any desired first point in time and the attachment of the
30 reinforcing element to this cavity can be carried out at any desired second point in time which is independent of the first. Theoretically this may even be used to provide a building with a large number of cavities and for these cavities only to be used if necessary, whereas otherwise they could be temporarily or permanently closed off without the corresponding reinforcing element having to be arranged
35 therein or attached thereto.

However, the normal and particularly advantageous application to which the present invention is directed consists in providing the building with the above-mentioned cavities and at a later stage attaching several or all the reinforcing
5 elements thereto, where possible, resulting in considerable synergistic effects during the site operation and during assembly.

As previously indicated hereinbefore, the formwork element can be removed from the cavity after the casting of the building component. This step e) can
10 expediently be carried out between steps b) and c) of the method.

Further features and advantages of the present invention will become apparent from the following description of embodiments by way of example by reference to the drawings, wherein:

15 Figure 1 shows a perspective side elevation of a formwork arrangement according to the invention;

Figure 2 shows the formwork arrangement of Figure 1 in side elevation;

20 Figure 3 shows a detail of the formwork arrangement from Figures 1 and 2;

Figure 4 shows an end-on side elevation of part of the formwork arrangement according to the invention from Figures 1 to 3;
25 Figures 5 to 8 show the formwork arrangement according to the invention from Figure 1 in a state in which it is combined with a building element for thermal insulation and in a state of installation in a building component;

Figures 9 to 13 show an alternative embodiment of a formwork arrangement
30 according to the invention in perspective side elevation (Figure 9), in side elevation (Figure 10), in detailed side elevation (Figure 11), in end-on side elevation (Figure 12) and in vertical section (Figure 13).

The formwork arrangement 1 according to the invention shown in Figure 1
35 consists of a plurality of formwork elements 2, arranged parallel to one another

substantially in a horizontal direction, made from a plastic shell and from bar-shaped anchoring elements 3 arranged perpendicularly thereto and acting upon the formwork elements in the region of their undersides. The formwork arrangement 1 is shown in Figure 1 in a position in which it is attached to a
5 formwork board 4 for a building component (not shown) that is to be erected, corresponding to the installation on the building site, although this formwork board 4 is not a part of the formwork arrangement of the present invention.

Figure 2 and the detail in Figure 3 in particular show how the anchoring element 3
10 consisting of a cylindrical reinforcing bar made of construction steel cooperates with the formwork elements 2: The two anchoring elements 3 extending parallel to one another pass through the formwork element in its lower region and thus – as can be seen in Figure 4 – extend partly through the inside of the formwork element and thus have an inner region 3a and outer regions 3b (cf. Figure 4).

15

The formwork element now serves to provide a cavity (indicated by reference numeral 5, corresponding to the inside of the formwork element 2) in the building component delimited by the formwork board 4. Therefore, if the building component is produced by casting, the concrete of the building component is
20 adjacent to the formwork elements 2, but then the desired cavities 5 are left in this region.

For further use of these cavities, the formwork elements 2 may now either be removed from the building component. In the embodiment shown in Figures 1 to
25 4, the formwork elements would simply be pulled out upwardly, but then the anchoring elements 3, which are surrounded by the concrete of the building component in the outer regions 3b, remain in the building component.

Irrespective of whether or not the formwork elements are removed before further
30 work is carried out, the anchoring elements 3 form, with their inner regions 3a passing through the cavities 5, the essential region of the present invention, i.e. in this region they form interlocking connections with a filler (not shown in the drawings and indicated only by the reference numeral 15) which is introduced into the cavities 5. As is apparent from Figure 3 in particular, the filler flows as far as
35 the lower regions of the anchoring element 3 and thus, after curing, surrounds

them in interlocking manner, so that it is no longer possible to remove the filler
15 analogously to the removal of the formwork element 2, as the filler cannot be
non-destructively released from this interlocking connection.

5 It should be noted in this context that theoretically it would also be possible, with
identically positioned anchoring elements 3 and identically positioned formwork
elements 2, not to pass the anchoring elements through the formwork elements
but to provide corresponding recesses on the underside of the formwork elements
by means of which the formwork elements completely cover the inner region 3a of
10 the anchoring elements. In this case, part of the formwork element itself would
form the anchoring element entering into the interlocking connection with the
filler and would only be supported on its outside by the anchoring element 3. If
the formwork element were to be removed before the introduction of the filler, the
same embodiment and mode of operation of the anchoring element would be
15 obtained as in the embodiment shown in Figures 1 to 4.

Figures 1 to 4 also show that the formwork element overall has a corrugated outer
shape in the horizontal direction, which is intended particularly to enter into an
interlocking connection with the building component in the direction of tensile
20 force, i.e. horizontally in the direction of the formwork board 4. The corrugations
in the formwork element thus have an overall ribbed shape with ribs arranged
parallel to one another.

At the end of the formwork element 2 on the side remote from the formwork
25 board 4 or the associated end face of the building component, an enlarged rib 2a
is provided which serves to accommodate a corresponding bend in the reinforcing
bar that is to be placed in the cavity 4. A bent reinforcing bar of this kind has the
advantage of managing with a generally shorter length of securing of the
reinforcing bar in the building component. Moreover, this bend also ensures
30 another interlocking connection between the reinforcing element, filler and
building component.

It is also apparent from Figure 4, in particular, that the formwork element 2 has a
virtually V-shaped outer shape in vertical section, through which the ribs also
35 extend virtually in a V-shape, i.e. deviating somewhat from the vertical. This

conically inclined shape has the essential purpose of assisting the removal of the formwork element 2 from the building component and at the same time enabling the filler to be introduced into the cavity 5 with no voids.

- 5 An alternative embodiment of a formwork arrangement 11 is shown in Figures 9 to 13 in which the formwork elements are of essentially identical construction and are therefore labelled with the same reference numerals. The essential difference resides in the shape of the anchoring elements 13 which do not consist of a cylindrical continuous reinforcing bar – as in Figure 1 – but are also substantially
- 10 corrugated and indeed bent upwards to some extent in the outer region 13b, where their function is to be placed on a connecting reinforcement 14 for the building component or to cooperate therewith. This cooperation makes it readily possible to place the formwork arrangement 11 according to the invention in the correct position in the building component (not yet filled with concrete), in order
- 15 then to enable the reinforcing elements with the predetermined grid of reinforcing bars to be placed in the cavities 5 created.

With respect to Figures 12 and 13 it should also be mentioned that here, too, there is an inner region 13a in the anchoring elements 13 which extends through

20 the inside of the formwork elements 2, and corresponding outer regions 13b are shown, while Figure 13, which shows a vertical section in the region of the anchoring elements 13, clearly shows that the anchoring element 13 is passed through the wall of the formwork element 2 and extends with its inner region 13a through the region of the cavity 5.

- 25 Figures 5 to 8 now show the use of the formwork arrangement according to the invention as the process continues: Figure 6 shows, in vertical section, a building component 6 in which, adjacent to its upper side 6a and end face 6b, the cavity 5 is provided which – as can clearly be seen – corresponds to the shape of the
- 30 formwork element 2, although in the embodiment shown the formwork element has already been removed from the building component and has merely transferred its corrugated shape to the building component surrounding it. The anchoring elements 3, however, have remained in the building component and extend with their inner region 3a, as shown particularly in Figure 5, through the
- 35 cavity 5. Because of the cylindrical shape, undercut cavity regions are provided

which ensure the desired interlocking connection between the filler 15 which is to be introduced into the cavity and the building component 6.

Attached to the building component 6 is a thermally insulating building element 21, also according to the invention, which is disposed between the building component 6 and a projecting exterior part (not shown in the drawing) in the form of a balcony slab, the building component assuming the supporting function and the exterior part assuming the supported function. The thermally insulating building element 21 consists of an insulating body 22 which extends horizontally along the end face 6b of the building component 6 and is of approximately cuboid configuration. In addition, the thermally insulating building element 21 consists of reinforcing elements in the form of tensile reinforcing elements or tensile bars 7 and shear force reinforcing elements 8 as well as compressive reinforcing elements 9. The tensile reinforcing elements 7 extend horizontally through the insulating body in the upper tensile zone and project on both sides of the insulating body 22 into the building component 6 on the one hand and, on the opposite side, into the outer part which is to be arranged there, while the shear force elements 7 are bent at their free end inside the building component 6 substantially at right-angles downwards into a short vertical portion 7a, in order thereby to reduce the overall length of securing of the shear force reinforcing bar 7 in the building component 6.

The tensile reinforcing elements 7 extend, according to the invention, in the region of the cavity 5 and are placed onto the anchoring elements 3, thus making it easier to position the thermally insulating building element 21. The cavity 5 is of such dimensions that the tensile reinforcing elements 7 can be surrounded by the amount of filler needed for the tensile force transmission.

Also extending into the cavity 4 are shear force bars 8 which extend inside the insulating body 22 in mutually parallel vertical planes substantially inclined in a section 8a and which are bent, at their upper section 8b associated with the building component 6, for attachment to the building component 6, such that they protrude substantially horizontally from the insulating body in the above-mentioned vertical planes and extend horizontally through the cavities 5, adjacent to the tensile reinforcing elements 7. In the region of the supported exterior part,

however, the shear force bars 8 transition into a vertical path 8c, extend vertically up to the upper tensile zone and are then bent round again into a horizontal path 8d, which is aligned with the horizontal path 8b on the side of the building component 6.

5

The pressure elements 9 arranged in the lower region of the insulating body extend substantially horizontally through the insulating body 22 and butt up against the end face of the building component 6 – via an interposed pressure distributor plate 9a – on the one hand and against the exterior part (not shown) on the other hand, the end-face contour of the pressure elements essentially comprising a partially cylindrical, curved or domed convex surface known *per se*. The pressure distributor plate 9a is surrounded laterally and on its underside by projections 22a and 22b, which serve as a formwork in the manufacture of the pressure distributor plate cast from *in-situ* concrete.

15

To ensure that the shear force bar 8 with its sloping section 8a does not collide with the formwork element or the material of the building component 6, the formwork element is provided with a correspondingly inclined underside which can also be seen in Figures 1, 2 and 4, where it is indicated by reference numeral 2b.

20

The drawing clearly illustrates the progress of the method according to steps a) to d) with the optional inclusion of step e): First, the formwork arrangement 1 with the formwork elements 2 and the anchoring elements 3 is inserted in the building component which is to be erected and for this purpose expediently placed on the reinforcement for the building component (according to step a), this state is shown in Figure 1); then the building component 6 is cast outside the formwork element (according to step b), this state is shown in Figure 5, for example); finally, the reinforcing elements to be attached to the building component 6, in the form of the tensile reinforcing elements 7 with an associated thermally insulating building element 21, are arranged in the region of the cavity 5 (according to step c), this state is shown in Figure 6, 7 or 8); and then (this is not shown in the drawing) the filler 15, particularly concrete, is introduced into the cavity 5, acting upon the anchoring element 3 (or the inner regions 3a thereof) to produce the desired interlocking connection between the building component 6 and the filler or the reinforcing element to be attached.

35

It is also clear from the drawings that the state shown in Figure 5, i.e. with the reinforcing elements not yet inserted, can be maintained for a long time without any problems and that it is readily possible for the reinforcing elements to be
5 placed in the cavity and the filler introduced at a later date.

To summarise, the present invention provides the essential advantage of making it possible for the first time to use modular assembly in the erection of buildings with projecting exterior parts, such that first of all the building is erected or “built
10 up” and in a subsequent action which takes only a short time the projecting exterior parts are installed with their reinforcing elements to be attached to the building component, for which purpose the reinforcing elements are placed in the cavities and the filler is introduced into the cavity.

Patentkrav

1. Forskallingsindretning til at skabe en udsparring under støbningen af en bygningskomponent (6), i særdeleshed et bygningsdæk som skal skabes fra frisk
5 beton, til at forbinde et trækraft-armeringselement (7), i særdeleshed stangformet, med bygningskomponenten, hvor forskallingsindretningen (1, 11) har mindst et forskallingselement (2) for at danne udsparringen (5) til armeringselementet (7) som skal forbindes og mindst et forankringselement (3, 13), og hvor forankringselementet (3, 13) er udformet på sådan en måde at det
10 muliggør en indgrebsforbindelse at blive lavet mellem bygningskomponenten (6) og et hærdende og/eller afbindende fyldstof som kan indføres i udsparringen (5),
kendetegnet ved at
forankringselementet (3, 13) er udformet på sådan en måde at det agerer som et fælles forankringselement til to eller flere gensidigt tilstødende
15 forskallingselementer (2), og til det formål kan det fælles forankringselement blive forbundet til de gensidigt tilstødende forskallingselementer.
2. Forskallingsindretning ifølge mindst krav 1,
kendetegnet ved at
20 for at skabe indgrebsforbindelsen mellem bygningskomponenten (6) og det hærdende og/eller afbindende fyldstof som kan indføres i udsparringen (5), fremspringer forankringselementet (3, 13) mindst delvist ind i udsparringen som skal dannes af forskallingselementet (2).
- 25 3. Forskallingsindretning ifølge mindst krav 2,
kendetegnet ved at
for at skabe indgrebsforbindelsen mellem bygningskomponenten (6) og det hærdende og/eller afbindende fyldstof som kan indføres i udsparringen (5), fremspringer forankringselementet (3, 13) mindst delvist fra udsparringen (5)
30 og/eller forskallingselementet (2) ind i området af bygningskomponenten (6) som omgiver udsparringen.
4. Forskallingsindretning ifølge mindst krav 1,
kendetegnet ved at
35 for at skabe indgrebsforbindelsen mellem bygningskomponenten (6) og det

hærdende og/eller afbindende fyldstof som kan indføres i udsparingen (5),
passerer forankringselementet (3, 13) mindst delvist igennem
forskallingsselementet (2).

5 **5.** Forskallingsindretning ifølge mindst krav 1,

kendetegnet ved at

forankringselementet (3) er i formen af et tabt forankringselement og er beregnet
til at forblive permanent i bygningskomponenten (6) efter udsparingen (5) er
blevet skabt ved hjælp af forskallingsindretningen (1, 11) for at skabe

10 indgrebsforbindelsen mellem bygningskomponenten og fyldstoffet som kan
indføres i udsparingen (5).

6. Forskallingsindretning ifølge mindst krav 1,

kendetegnet ved at

15 forskallingsselementet (2) er udformet på sådan en måde at, efter udsparingen (5)
er blevet skabt og før armeringselementet (7) er blevet forbundet, det kan fjernes
fra udsparingen, efterladende forankringselementet (3, 13) i
bygningskomponenten og/eller udsparingen.

20 **7.** Forskallingsindretning ifølge mindst krav 6,

kendetegnet ved at

forskallingsselementet (2) er udformet på sådan en måde at det kan fjernes i
retningen af den øvre side af bygningskomponenten (6) og/eller i retningen af den
påtænkte bane af armeringselementet (7) som skal forbindes.

25

8. Forskallingsindretning ifølge mindst krav 1,

kendetegnet ved at

forankringselementet er dannet af et underområde af forskallingsselementet selv
og/eller er helt forbundet med forskallingsselementet.

30

9. Forskallingsindretning ifølge mindst krav 1,

kendetegnet ved at

forankringselementet (3, 13) er i formen af en armeringsstang.

10. Forskallingsindretning ifølge mindst krav 1,

kendetegnet ved at

afstanden af forskallingselementerne passer med gitteret af trækraft-armeringselementerne (7) som skal forbindes.

5

11. Forskallingsindretning ifølge mindst krav 1,

kendetegnet ved at

forskallingselementet (2) i særdeleshed er af skalagtig eller æskeagtig konstruktion og egnet til anbringelse i bygningskomponenten (6) for i alt

10 væsentligt at flygte med den øvre side (6a) og endeflade (6b) deraf til tilsvarende positionering af udsparringen (5) tilstødende den øvre side (6a) og endeflade (6b) af bygningskomponenten (6).

12. Forskallingsindretning ifølge mindst krav 1,

15 **kendetegnet ved at**

forskallingselementet (2) består af et tyndvægget plastmateriale og/eller metal.

13. Forskallingsindretning ifølge mindst krav 1,

kendetegnet ved at

20 det hærdende og/eller afbindende fyldstof består af et cement-indeholdende, eventuelt fiber-forstærket byggemateriale såsom beton, i særdeleshed et højstyrke- eller ultrahøjstyrkebeton eller højstyrke- eller ultrahøjstyrkemørtel og/eller af en syntetisk resinblanding, en reaktiv resin eller lignende.

25 **14.** Bygningselement til termisk isolering (21) mellem to komponenter, det vil sige mellem en bærende bygningskomponent (6) og en båret fremspringende udvendig del, bygningselementet bestående af et isoleringslegeme (22) som skal anbringes mellem de to komponenter og med armeringselementer (7, 8), i formen af mindst trækraft-armeringselementer (7), som passerer igennem

30 isoleringslegemet og kan forbindes med begge komponenter,

kendetegnet ved at

en forskallingsindretning (1, 11) ifølge mindst et af de foregående krav med to eller flere forskallingselementer (2) og mindst et forankringselement (3, 13) er associeret med trækraft-armeringselementerne (7) på siden af

bygningskomponenten (6), hvor et fælles forankringselement er tilvejebragt til to eller flere gensidigt tilstødende forskallingselementer (2).

15. Bygningselement til termisk isolation ifølge mindst krav 14,

5 kendetegnet ved at

en fælles forskallingsanordning (1, 11) er associeret med en flerhed af trækkraft-armeringselementer (7).

16. Bygningselement til termisk isolation ifølge mindst krav 14,

10 kendetegnet ved at

formen af forskallingselementet (2) passer med positionen, udstrækningen og formen af trækkraft-armeringselementet (7) associeret dermed, og forskallingselementet (2) kan anbringes, med afstand fra positionen og udstrækningen påtænkt til trækkraft-armeringselementet (7) i

15 bygningskomponenten (6), mindst omkring i området af trækzonen.

17. Fremgangsmåde til at forbinde et armeringselement med en bygningskomponent, i særdeleshed et bygningsdæk som skal skabes fra frisk beton, **kendetegnet ved** de følgende trin:

20 a) ved hjælp af en forskallingsindretning (1, 11) ifølge et hvilket som helst af de foregående krav med forskallingselementer (2) og mindst et forankringselement (3, 13), som definerer et område af bygningskomponenten (6) som skal skabes som svarer til udsparingen (5), hvor et fælles forankringselement tilvejebringes til to eller flere gensidigt tilstødende forskallingselementer (2) og hvor to eller flere

25 gensidigt tilstødende forskallingselementer forbindes dertil;

b) at støbe bygningskomponenten (6) uden for forskallingselementerne (2);

c) at anbringe i området af udsparingen (5) et armeringselement (7) som skal forbindes med bygningskomponenten (6); og

30 d) at indføre et hærdende og/eller afbindende fyldstof, i særdeleshed beton, i udsparingen (5), hvor fyldstoffet agerer på forankringselementet (3, 13) for at skabe en indgrebsforbindelse mellem bygningskomponenten (6) og fyldstoffet.

18. Fremgangsmåde til at forbinde et armeringselement med en bygningskomponent ifølge mindst krav 17,

kendetegnet ved det yderligere trin, som skal udføres efter trin b) og før trin c) i krav 17:

- 5 e) at fjerne forskallingselementet (2), efterladende forankringsselementet (3, 13) som fremspringer ind i udsparingen (5) i bygningskomponenten (6).

19. Fremgangsmåde til at forbinde et armeringselement med en bygningskomponent ifølge mindst krav 17,

kendetegnet ved at

der er en periode på mindst flere dage mellem trinnene b) og c).

20. Fremgangsmåde til at forbinde et armeringselement med en bygningskomponent ifølge mindst krav 17,

kendetegnet ved at

- et bygningselement til termisk isolering (21) ifølge mindst krav 12 med mindst en forskallingsindretning (1, 11) og et armeringselement (7) leveres til en byggegrund, hvor forskallingsindretningen (1, 11) fjernes fra det resterende af bygningselementet til termisk isolering (21), og først forskallingsindretningen (1, 11) og derefter det resterende af bygningselementet til termisk isolering (21) indbygges i bygningskomponenten (6).

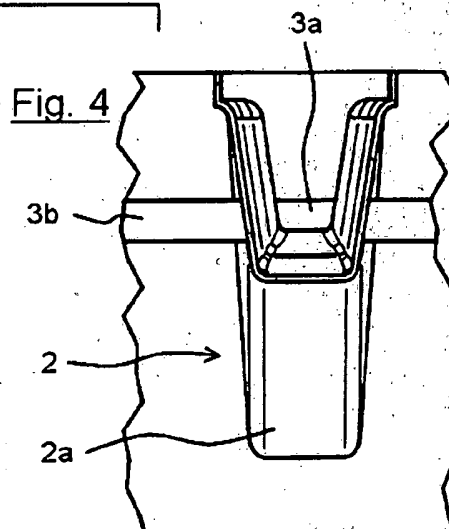
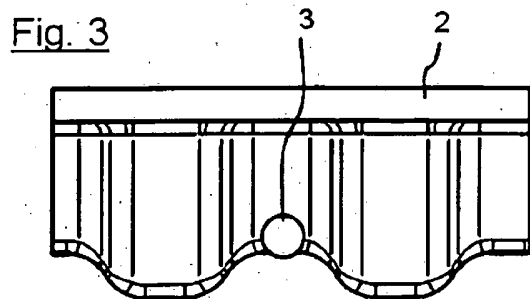
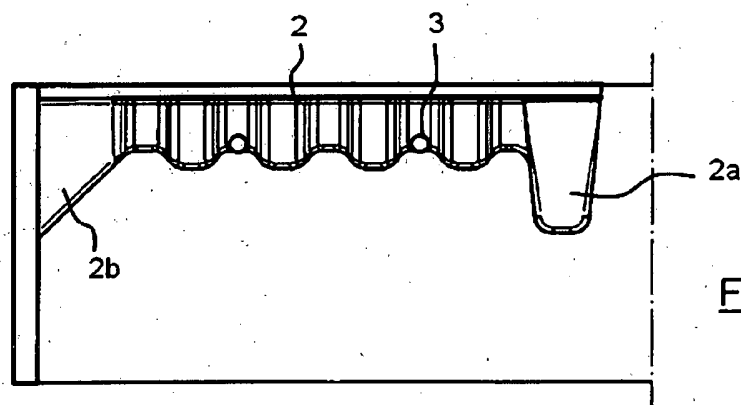
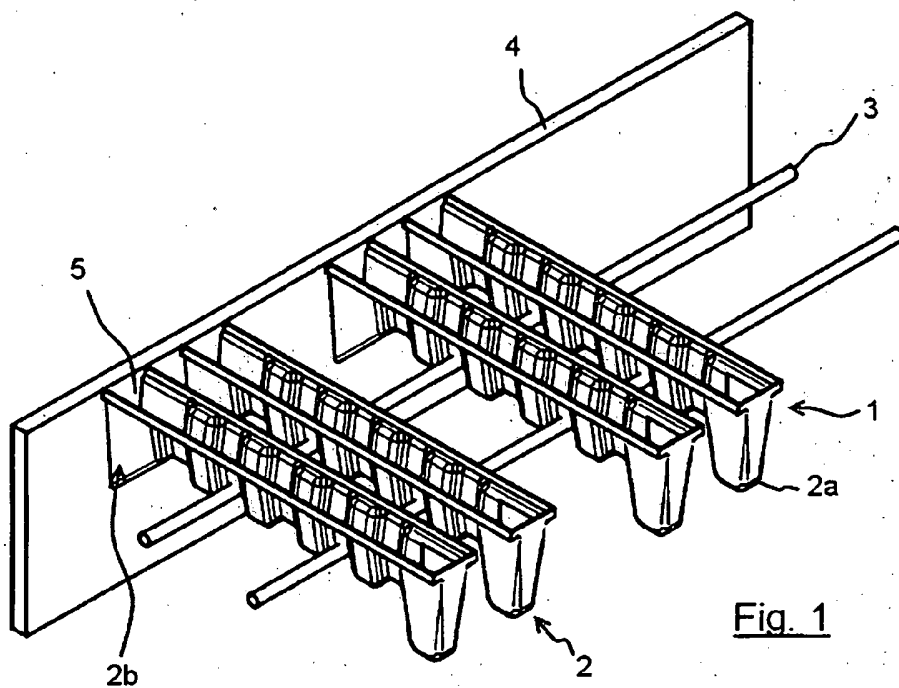


Fig. 5

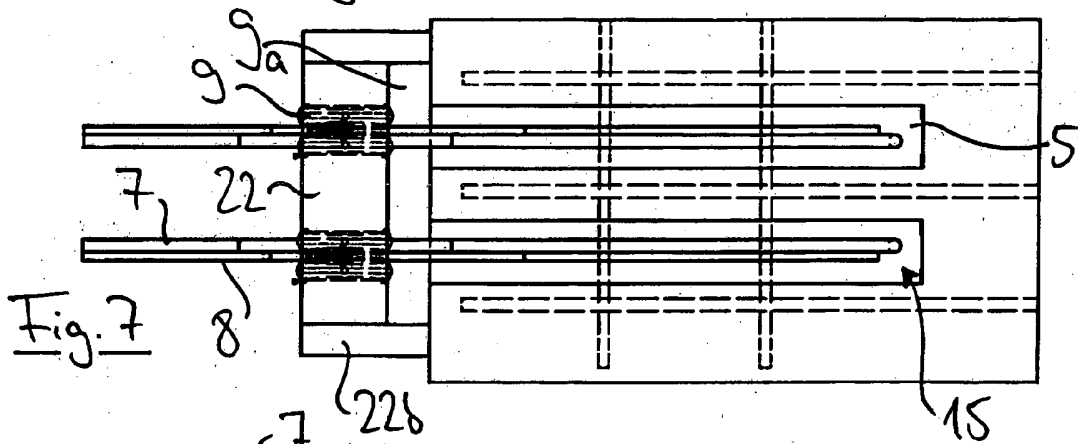
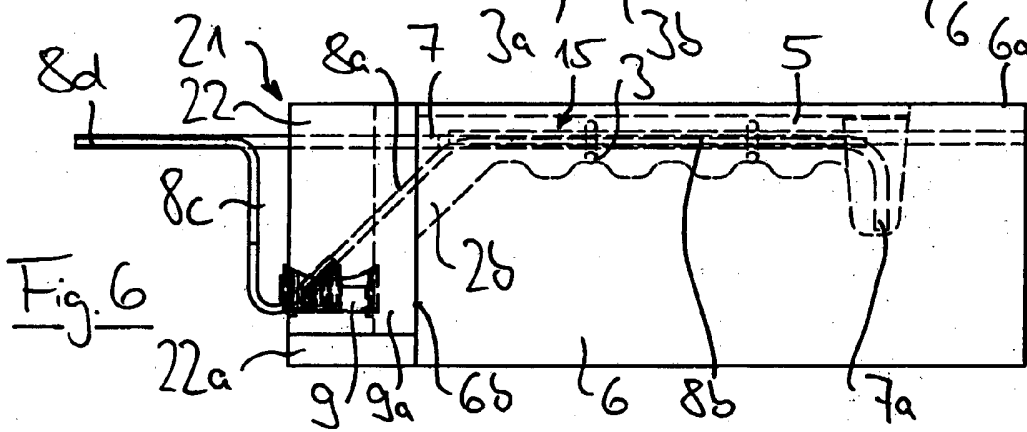
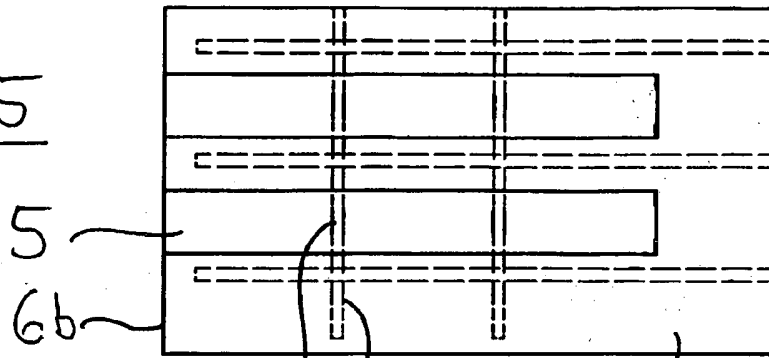


Fig. 7

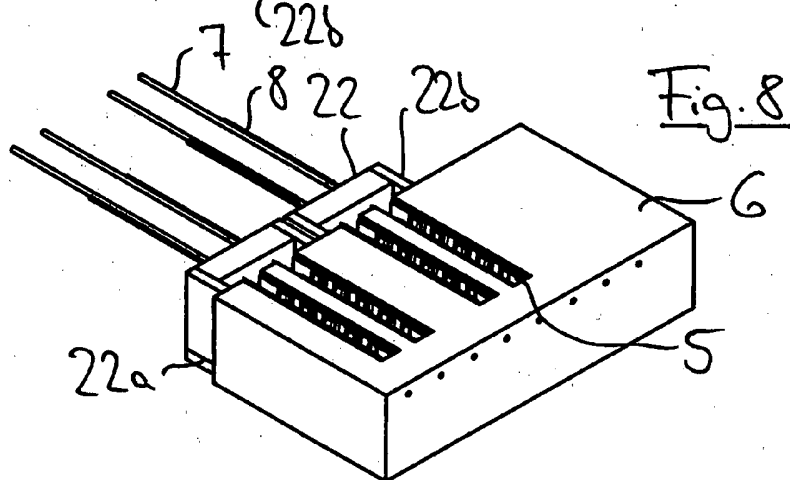


Fig. 8

