Frame, basic framework, module, profile and set of structural elements for modular construction and a modular-construction building

The invention relates to a frame, in particular a wall frame, which is intended for a preferably supporting, in preference self-supporting, basic framework of a module for modular construction and comprises two post profiles which can be, or are, arranged essentially vertically and of which the upper ends can be, or are, connected to one another via a ceiling profile and the lower ends can be, or are, connected to one another via a floor profile.

The invention also relates to a basic framework, to a module, to a profile and to a set of structural elements for modular construction and also to a modular-construction building.

Numerous proposals in respect of modular construction have been made over the decades.

In particular a frame of the type in question is known from EP 1 055 036 B1. A similar frame, has been disclosed by GB 1 350 631.

However, the known frames, and in particular the further development thereof to form cage-like building-block frameworks, still require a very high level of assembly outlay. Although the modular construction concept means that the respective construction site is largely spared this assembly outlay, the latter, rather than being reduced, is merely shifted to the industrial prefabrication stage. This applies, however, not just to the assembly outlay for the cage-like building-block frameworks, that is to say to the steel-construction work in the broadest sense, but also to the further development of these building-block frameworks to form finished-off zones having the requisite room walls, floors, laminates, insulation, windows, doors and, in particular, supply and disposal installations, for example for communications, power, heating, water, wastewater, other sanitary applications and so on.

The aim of modular construction should be to prefabricate, and finish off, room units, or areas of these units, as far as possible to form complete modules or module parts so that, on the construction site, all that is required is for these room units to be assembled to form buildings, to be precise with a reasonable balance of standardization and individual design. At the same time, this forms a principle on which a general problem of the present invention is based.

In specific terms, the invention is based on the problem of further developing structural elements, structural units and/or modules for modular construction such that it is possible, using the smallest possible number of novel, appropriately designed structural elements, and preferably, if need be, in addition structural elements which are common from drywall construction, to produce and prefabricate, with a relatively low level of assembly outlay, finished-off room units, or areas for said units, which can be combined, preferably with a supporting function, to form complete buildings, even relatively high buildings for, for example, urban centres.

This problem is solved according to the invention in an advantageous and surprising manner in respect of a frame according to the invention, by a post profile, a ceiling profile and a floor profile each having differently configured cross-sectional profiles.

According to the invention a frame preferably from four basic structural elements, that is to say from two post profiles, a ceiling profile and a floor profile is provided. These four structural elements are of only three different structural shapes and therefore preferably form basic elements of a kind of modular-construction system. The three structural shapes are designed optimally in accordance with their respective purpose and, at the same time, have certain key shapes which provide for a largely standardized connection and combination with other structural elements from the modular-construction system. On a higher system level, for a basic framework, the frame according to the invention produced accordingly itself, in turn, becomes a basic structural element. The resulting basic framework according to the invention is, on an even higher system level, a basic structural unit for a module.

The frame according to the invention is an important basic element in so far as the frame already predetermines, and ensures, the supporting capability and the self-supporting capability of the basic framework and of the module. This inventive achievement will be explained in yet more detail, and will be clarified, hereinbelow along with the respective embodiments of the invention. It is already anticipated, however, that the frame according to the invention advantageously allows for closing to form a complete room wall and to be finished off and/or for a design decision to be freely made at a later stage, albeit still within the industrial-manufacturing phase rather than on the construction site. The decision which side surfaces of the subsequent basic framework should be closed and/or filled is without relevance to the supporting capability of the module and of the framework. This also ultimately provides for the design freedom forroom units or areas, in particular walls and/or ceiling and/or floor, provided by a basic framework or module to be formed into an enclosed room, or parts thereof, or to be connected to other basic frameworks or modules via still-open side surfaces to form larger rooms. It should be emphasized once again that it is preferably and highly advantageously made possible according to the invention for complete room sections to be industrially manufactured and provided with all surfaces, elements and installations of a complete building area, and all that is required is for these to be fitted, and connected, on the construction site. In particular the drywall work and installation work can thus advantageously be shifted from the construction site to the industrial-manufacturing phase.

It should also be pointed out that it is also possible for closed or filled side surfaces to have (delimited) openings, for example for windows, doors or staircases.

The three different profile shapes of the frame according to the invention can advantageously be designed in accordance with their purpose, that is to say in preparation for configuring a module ceiling, a module floor or a module wall. The different structural shapes also render these profiles distinct, which considerably simplifies, and speeds up, the assembly of a frame, even for untrained personnel. At the same time, the profiles can be configured so as to have

the necessary strength and supporting capability. In addition, as already mentioned, use can be made of “key shapes” in the design of the profiles, and these key shapes could be standardized as interfaces for connection to other structural elements. The possible material to use here is, in particular, steel, preferably lightweight steel.

A further advantage of the invention is also that dismantling of a frame according to the invention, and therefore also of an entire module, is just as easy as the assembly thereof.

An embodiment of the frame according to the invention provides for each of the cross-sectional profiles to be designed essentially, or in certain regions, in the form of a hollow profile. For this purpose, a profile can be formed preferably by virtue of a metal sheet being subjected to a forming operation. The metal sheet may advantageously be cold-rolled.

A hollow profile can be realized with lower weight, less material and therefore also fewer resources, and in a more ecological and cost-effective manner, and nevertheless, in particular as a result of its cross-sectional shaping, can provide adequate and appropriate stability and supporting capability and also functionality. Manufacturing from a metal sheet is particularly expedient for this purpose and it is possible to make use of conventional forming techniques, in particular folding, bending and/or rolling. By virtue of bending or folding radii being predetermined, it is possible to ensure that there is no undesired weakening in material or workpieces. For reasons relating to stability and/or manufacture, provision may be made for not all regions to be of hollow design.However, it is also possible, during manufacture from the metal sheet, to work, for example, with multi-layered regions as well. The metal-sheet thickness for example of a steel sheet used could be, for example, preferably 3 to 5 mm, preferably approximately 4 mm.

Hollow regions in the profiles can be used as channels for supply lines, although such lines can also be accommodated in the usual manner, as for drywall construction, in compartments, other profiles, shafts, channels or the like.

In the first instance the advantageous embodiment of the different cross-sectional profiles according to the invention will now be considered, and explained, in detail hereinbelow.

An embodiment of the invention is characterized by the post profile being designed in the form of a corner profile to allow for connection of two ceiling profiles and/or floor profiles. The profiles are preferably connected essentially at angles to one another, especially preferably at right angles to one another. The angle is bigger than 10°, preferably bigger than 20° and smaller than 180°.

The post profile according to the invention thus advantageously ensures, and provides for, a precise corner design for the basic framework. At the same time, it can perform its important supporting-capability task for the entire structure as a corner column of a frame and of a basic framework made therefrom. It is therefore in particular also the the corner profile that provides the basis for all the structural elements to be constructed in a dimensionally accurate manner

with the correct angles.and the corner profile thus also has a positive effect on the assembly outlay along with simultaneously reliable quality and reproducibility.

An embodiment of the invention provides for the post profile to have at least one slot guide which extends at least over a portion of the longitudinal direction of the post profile and into which at least one connecting element for the connection of a ceiling profile and/or floor profile is inserted and retained. The slot guide provides a defined and reliable interface for the attachment of the other cross-sectional profiles, and this interface preferably also ensures the correct orientation of said other cross-sectional profiles, since preferably each assembly operation can proceed with orientation taking place with abutment. It is preferably possible, in the case of an embodiment of the post profile according to the invention, for the at least one slot guide also to be incorporated in the cross-sectional profile of the post profile.

To design the post profile according to the invention in the form of a corner support, provision is preferably made for the cross-sectional profile of the post profile to have at least two slot guides with opening directions oriented at an angle, preferably essentially at right angles, to one another. As already explained, the orientation of the opening direction preferably also ensures the correct orientation of the other profiles which are to be mounted thereon.

A preferred and particularly advantageous embodiment of the post profile according to the invention and of the frame according to the invention provides for the cross-sectional profile of the post profile, at least in a cross-section plane, to have essentially the contour of a rectangle, preferably essentially of a square, with concavities present in two of its adjacent side-surface contours forming the cross sections of the respective slot guides. This simultaneously ensures the stability and supporting capability of the post profile and of the frame, the corner formation of the frame and of the resulting basic framework and the correct and reliable attachment of the other profiles. It also allows for the post profile being manufactured in a relatively quick, straightforward and cost-effective manner.

A preferred post-profile design, in which the cross section of the slot guide is of approximately dovetail shape, predominantly provides for easier and smoother insertion of a connecting element into said slot guide by providing a kind of insertion funnel or insertion cone.The funnel does not adversely affect the final correct orientation of the connection, which can be ensured by other elements or features. For example it is possible for both the correct orientation and reliable fastening to be achieved by preparing the slot guide such that the connecting element can be fastened in a form-fitting manner, in particular can be hooked in. For example it would be possible for the slot guide to have, in its base region, insertion slots, into which hook elements of connecting elements could be inserted and then hooked in from above by way of downward movement. The, preferably each, connecting element could be designed essentially straightforwardly in the form of a connecting plate which can be arranged essentially vertically.

Another embodiment of the invention is characterized by the ceiling profile and the floor profile each having essentially a double-T-shaped cross-sectional profile, of which the crosspiece is

provided for essentially vertical arrangement. The transverse extremities which are present at the top and bottom of the crosspiece forming the double-T shape, are designed in the form of a thickened head portion and/or thickened foot portion. The thickened foot portion in the cross-sectional profile of the floor profile preferably has a greater vertical extent than the vertical extent of the thickened foot of the ceiling profile.

According to the invention, the ceiling profile and the floor profile are therefore preferably, in part, of a similar structural shape, in particular in their central crosspiece region, and this promotes interoperability. On the other hand, however, they are also of structural shapes which differ from one another in accordance with their purpose. They both preferably have thickened head portions and thickened foot portions, as a result of which it is, in particular, possible to predetermine, and set, the stability and supporting capability of the respective profile. Taking account of their different purposes, preferably the thickened foot portion of the floor profile is of greater dimensions than that of the ceiling profile, as a result of which, in particular in the region of the ceiling, weight is reduced and, in the region of the floor, the supporting capability is increased. The supporting capability can be increased in addition by virtue of the ceiling profile and the floor profile being connected, during assembly, to form supports which are located one above the other.

In particular it is possible for a embodiment to provide for the thickened head portion and the thickened foot portion of the floor profile to be of approximately equal size, preferably with the thickened foot portion being designed to be somewhat more extensive.

An embodiment of the ceiling profile preferably provides for the thickened head portion of the ceiling profile to be designed to be larger than the thickened foot portion of said profile.

It is advantageous for the shaping of the basic framework and of the module if the thickened head portion and/or the thickened foot portion are essentially box-shaped in cross section. This can simplify the manufacturing of the profiles and ensure the stability and supporting capability of the profiles.

It has already been mentioned that, for interoperability, the ceiling profile and the floor profile may have similar regions, in particular in the crosspiece region. An embodiment of the invention provides for the height of the crosspiece and/or the distance between the outer surface of the thickened head portion and the outer surface of the thickened foot portion to be available as a space for a preferably insulated drywall construction having at least one layer of panelling, or part thereof, on at least one side. Provision may preferably be made for the free space which is bounded by the thickened head portion, the thickened foot portion and the crosspiece, and is essentially U-shaped in cross-sectional profile, to be provided in the form of a mount in order for at least one drywall-construction profile to be inserted in a form-fitting manner approximately orthogonally in relation to the crosspiece.

In particular in this region it is thus preferably possible to create and provide an interface (preferably standardized) for, if need be, additional structural elements which are common

from drywall construction, as has already been mentioned above in conjunction with the problem of the invention. Rather than using profiles from conventional, non-supporting drywall construction, use would preferably be made here of profiles from lightweight-steel construction, wherein it is basically immaterial whether the lightweight-steel construction is considered as being a special kind of drywall construction or a separate kind of construction. In the present context, for the sake of simplicity, the lightweight-steel construction is considered to be a special kind of the drywall construction since within the context of the invention, depending on requirements, use could be made of non-supporting or supporting elements.

It is however possible for drywall-construction profiles in the broadest sense mentioned, preferably C profiles, to be inserted in a form-fitting manner in the mounts formed in the ceiling profiles and in the floor profiles according to the invention. It is also possible for the panelling, or any other lamination or covering, of said drywall-construction profiles, to use an outer surface of the respective profile, in particular if a multi-layered construction of a ceiling or of a floor is envisaged.

It is preferably possiblethat the ceiling profile according to the invention and also the floor profile according to the invention, having a crosspiece height of approximately 100 mm, or at least appropriate for a correspondingly dimensioned C profile. Since, depending on requirements or application, very differently dimensioned drywall-construction profiles can be useful, in particular taking into account different national customs or standards, it would be possible to vary such a dimension appropriately for different embodiments of frames and profiles according to the invention, on the one hand for example by $\pm$ 3 mm, as a variation in dimension rather than as a manufacturing tolerance.On the other hand dimensions can also vary by orders of magnitude such as, for example, approximately 150, 200 or 250 mm.

For a ceiling profile, for example the thickened head portion could have a height of approximately 30 to 42 mm, preferably of approximately 36 mm. The thickened foot portion could have, for example, a height of approximately 10 to 18 mm, preferably approximately 14 mm.

In the case of the floor profile, for example the thickened head portion could have a height of approximately 40 to 56 mm, preferably of approximately 48 mm. The thickened foot portion could have, for example, a height of approximately 40 to 64 mm, preferably approximately 52 mm.

The width for the two profiles could be, for example, in the range from approximately 60 to 80 mm, and could be preferably approximately 70 mm.

Independent protection is also sought for a basic framework according to the invention which belongs to a module for a modular construction and, in an independent solution to the stated problem, is characterized in that the framework comprises two frames, wherein the respective post profiles are designed in the form of corner profiles and wherein the two frames are

arranged parallel to one another, and wherein the corner profiles of a first frame are connected to the corner profiles of a second frame via a ceiling profiles and floor profiles, respectively.

In other words, a basic framwork comprises two frames according to the invention, in which the respective post profiles are designed in the form of corner profiles according to the invention. The two frames are arranged parallel to one another and in alignment (congruently) with one another, and, for the purpose of connecting the two frames, those corner profiles of the two frames being located opposite one another are connected to one another via a respective ceiling profile and a respective floor profile.

It is therefore preferably in accordance with the same principle, on a higher system level, that frames according to the invention are advantageously used to form a stable basic framework which, for its part, forms the skeleton of a building block or a room unit of a module. Attention is drawn to the fact that two frames are connected via corner posts with the same ceiling profiles and floor profiles as the frames themselves, although they can differ in length, essentially to form a cuboidal framework. It is then no longer possible to make out the original frames and the connecting profiles in said basic framework since, following connection, all four wall surfaces ultimately present themselves as similar frames. The assembly of a plurality of such frameworkscan further contribute to architectural variety and development possibility, since the orientation of the basic framework is not a decisive factor for stability and supporting capability.

In particular it is possible, according to an embodiment of the basic framework according to the invention, for any desired side-length ratios and cuboidal shapes to be achieved (with the static requirements being taken into consideration) by for example the ceiling profiles and floor profiles which are used to build the frames being of a different length from the ceiling profiles and floor profiles which are used for connecting the frames to one another. This means that once the two frames have been connected it is no longer possible to make out the original frames as such.

As has already been mentioned above, an embodiment may be characterized by realizing different effective lengths of ceiling profiles and/or floor profiles by longitudinal connection of at least two ceiling-profile portions and/or floor-profile portions.

Since the basic framework, as already explained, forms the skeleton for a building block or room unit, provision may advantageously be made for at least two basic frameworks, constituting building blocks, to be capable of being connected to one another one above the other, one beside the other and/or one behind the other in order to realise a basic framework for a building having at least two rooms or having at least one relatively large room made of more than one basic framwork. In particular it is also possible for the basic frameworks to be connected to one another in a stable and supporting manner not just on the same level, but also in a stack having different levels. It is advantageously possible for the upper basic framework/module to provide a complete floor and for the lower basic framework/module to provide a ceiling therebeneath. The basic frameworks can be connected to one another by

specific connecting elements or also by relatively straightforward connecting plates. Preferably connecting pieces for a key/lock connection are used. It would thus be possible, for example for a stacking arrangement, for a connecting piece to have form-fitting bodies in the upward and downward directions, it being possible for said form-fitting bodies to be introduced in a form-fitting manner, and latched, in corresponding mounts, for example in the upper and lower end surfaces of the corner profiles, and possibly to be turned by an externally attached tool, for example a kind of handspike.

Independent protection is likewise claimed for a module according to the invention which is intended for modular construction and, in an independent solution to the stated problem, is characterized by at least one frame according to the invention and/or by at least one basic framework according to the invention.

An embodiment of the module according to the invention is preferably characterized by at least one drywall construction for closing and/or for filling at least one of the surfaces defined by the frame and/or the basic framework. As already explained, in principle common structural elements can be used for this purpose. Which surfaces are filled and which remain open depends on the desired combination of the respective module with neighbouring modules to form spaces. As already mentioned above, it is also possible to include requisite supply and disposal installations, as provided for by a preferred embodiment of the invention.

As likewise already mentioned and explained above, it is possible to provide preferably at least one drywall-construction profile for closing and/or for filling at least one of the surfaces defined by a frame and/or basic framework, wherein provision may preferably be made for the at least one drywall-construction profile to have its respective ends inserted, and mounted, in a form-fitting manner, essentially orthogonally in relation to two mutually opposite, essentially parallel ceiling profiles or floor profiles, in mounts which are approximately U-shaped in cross-sectional profile and belong to said ceiling profiles or floor profiles. The at least one drywall-construction profile may preferably have at least one layer of panelling on at least one side.

A preferred embodiment of the module according to the invention provides for at least the ceiling surface, floor surface and at least one of the four side surfaces defined by the basic framework to be closed and/or filled, wherein the respectively open side surfaces can serve for the connection of other room units to form a corresponding room. In particular it is therefore also possible to have tunnel-like modules, which can be used as lengthening intermediaries between two other modules. It is also possible, however, for adjacent side surfaces to remain open and, for example together with three similar modules, to form a room of four times the size. Of course, it is nevertheless also possible for all the side surfaces to be closed in order to form an enclosed room or to remain open, in the latter case for example for a module which can be arranged centrally to provide for a very large room or hall.

As already mentioned, another embodiment of the module according to the invention may preferably be characterized by the module being provided, and finished off, with installations which are necessary in a certain region of a room of a building.

As already described in conjunction with the basic framework according to the invention, it is correspondingly possible for preferably at least two modules, constituting zones, to be capable of being connected to one another one above the other, one beside the other and/or one behind the other in order to realise a building having at least two rooms and/or having at least one relatively large room.

Independent protection is also claimed for a modular-construction building according to the invention which, in an independent solution to the stated problem, is characterized by at least one frame according to the invention and/or by at least one basic framework according to the invention and/or by a module according to the invention.

Additionally, independent protection is claimed for a profile according to the invention which, in an independent solution to the stated problem, is characterized by being designed in the form of a post profile which can be arranged essentially vertically, preferably for a basic framework according to the invention and/or for a module according to the invention.

Preferred embodiments of such a post profile according to the invention have already been explained above, and, in order to avoid unnecessary repetition, reference is made to the explanation above.

Further, independent protection is claimed for a profile according to the invention which, in an independent solution to the stated problem, is characterized by being designed in the form of a profile which can be arranged essentially horizontally and is intended for connecting two post profiles, preferably post profiles according to the invention, to one another, preferably for a basic framework according to the invention and/or for a module according to the invention.

Preferred embodiments of a ceiling profile and/or floor profile according to the invention have likewise been explained above, and therefore, in order to avoid unnecessary repetition in this respect as well, reference is made to the explanation above.

Independent protection is claimed for a set of structural elements according to the invention which is intended for a preferably supporting, in preference self-supporting, basic framework of a module for modular construction and comprises two post profiles which can be, or are, arranged essentially vertically and of which the upper ends can be, or are, connected to one another via a ceiling profile and the lower ends can be, or are, connected to one another via a floor profile. Said set of structural elements, in an independent solution to the stated problem, is characterized by at least one profile according to the invention and/or at least one frame according to the invention.

As already explained above, it is an advantage according to the invention that it is possible to provide a modular-construction system which has a relatively small number of straightforward construction elements and can be used to provide, in particular, basic frameworks for a versatile, reliable and stable and supporting module for modular construction. This can also

be realized in practice in particular in the form of a set of structural elements according to the invention.

According to another embodiment, the set of structural elements according to the invention is characterized by at least one connecting element by means of which a ceiling profile and/or a floor profile which can be arranged approximately horizontally can be connected to a post profile being arranged essentially vertically. The at least one connecting element can be designed preferably in the form of a for the most part flat connecting plate which can be arranged preferably approximately vertically.

According to a preferred embodiment, the at least one connecting element has at least one fastening element for establishing a hook-in connection with the post profile.

Exemplary embodiments from which further inventive features can be gathered, but which are to be considered basically as being given merely by way of example and should not restrict the subject matter of the invention or the scope of protection thereof, are illustrated in the drawing, in which:

Figure 1 shows a side view of a frame according to the invention for modular construction,

Figure 2 shows a perspective view of a basic framework according to the invention, comprising two frames according to **Fig. 1,**

Figure 3 shows a cross section of a ceiling profile for a frame according to **Fig. 1,**

Figure 4 shows a cross section of a floor profile for a frame according to **Fig. 1,**

Figure 5 shows a cross section of a post profile for a frame according to **Fig. 1,** and

Figure 6 shows a perspective view of a connecting element for use in a post profile according to **Fig. 5.**

Figure 1 shows a side view of a frame 1 according to the invention for modular construction.

The frame 1 according to the invention comprises two vertical post profiles 2, a horizontal ceiling profile 3, which connects the upper ends of the post profiles 2 to one another, and a horizontal floor profile 4, which connects the lower ends of the post profiles 2 to one another.

The frame 1 can form essentially the frame for a wall of a module for a modular construction. At the same time, it can serve as a component for constructing an essentially approximately cuboidal basic framework for such a module, wherein the ceiling profile 3 then forms part of the ceiling of the module and the floor profile 4 forms part of the floor of the module.

The post profiles 2 are designed in the form of corner profiles such that ceiling profiles 3 and floor profiles 4 oriented orthogonally with respect to the floor profile 4 and to the ceiling profile 3 shown in **Fig. 1,** can be attached in order to form other walls of the module.

The ceiling profiles 3 and floor profiles 4 are connected to the post profiles 2 via essentially plate-like, flat connecting elements 5.

Figure 2 shows a perspective view of a basic framework according to the invention for a module for modular construction.

Two frames 1 form the longitudinal-side wall frames of this basic framework. As already explained in conjunction with **Fig. 1,** the respective post profiles 2 of these frames 1 are connected to one another transversely via further ceiling profiles 3 and floor profiles 4, to form a cuboidal shape. It is however also possible to connect the narrow sides of the framework to one another longitudinally via ceiling profiles 3 and floor profiles 4, since both the narrow sides and the longitudinal sides represent frames 1 according to the invention. This renders the basic framework particularly stable from the point of view of statics and also gives it a supporting capability, overall also a self-supporting capability. It is thus possible, in particular, for a large number of such basic frameworks to be stacked one upon the other, and connected to one another, to form storeys of buildings, this therefore providing for truly modular construction. This is also possible even when, as shown in **Fig. 2,** for example one frame 1 is open, that is to say remains unfilled even in the module, and therefore it is possible for a basic framework which is open in a correspondingly mirror-inverted manner to be attached to this open side creating a continuous space which is double the size of a room unit formed by a single basic framework. It is possible for two or more side walls to be left open, in order to form even larger spaces using a plurality of basic frameworks. This is possible becuase frame 1 as shown in **Fig. 1,** whether or not completed to form a wall, always establishes the desired stability and supporting capability. This is preferably achieved by the particular shape of the cross-sectional profile of the respective profiles 2, 3, 4, which will be discussed in yet more detail hereinbelow.

As can be seen in **Fig. 2,** the connecting elements 5 butt against the respective profiles 3, 4 from the outside.

To provide further construction elements for drywall constructions, drywall-construction profiles 6, 7, 8, 9, for example C profiles, in particular lightweight-steel drywall-construction profiles, can be inserted between the frame profiles 2, 3, 4. The frame profiles 2, 3, 4 are manufactured preferably from sheet steel.

Figure 3 shows a cross section of a ceiling profile 3 according to the invention for a frame 1 according to **Fig. 1.**

It can be seen that the ceiling profile 3 is formed from a sheet-form material, preferably from a metal sheet, preferably from a steel sheet. Cross-sectionally hollow profile regions have been formed. The metal sheet has been bent or angled in round form by way of corner radii so as to avoid material weakenings in the corner regions.

Additional weld connections for the purpose of further enhancing the stability of the profile are conceivable and possible in some regions, in particular in the seam region of the respective profile.

The ceiling profile 3 is essentially formed into a double-T cross-sectional shape. A hollow thickened head portion 10 and a hollow thickened foot portion 11 are formed. The crosspiece 12 of the ceiling profile 3, said crosspiece being oriented vertically in the frame 1, extends between the thickened head portion 10 and thickened foot portion 11.

Alongside and/or at the ceiling profile 3, **Fig. 3** indicates drywall-construction elements for forming a ceiling for completing a module and for filling the ceiling surface of a basic framework according to **Fig. 2.**

The figure shows the approximately C-shaped cross section of a drywall-construction profile 6, in particular of a lightweight-steel-construction profile, a number of which can also be seen in **Fig. 2.** The end sides of such a profile 6 can be inserted in a form-fitting manner into the cross-sectionally approximately U-shaped mounts 13 which are formed by the thickened head portions 10, the thickened foot portions 11 and the crosspieces 12 of ceiling profiles 3 (orthogonally oriented to the one shown in **Fig. 3),** said insertion operation taking place up to the crosspieces 12.

Figure 3 indicates an insulating-material layer 14, for example made of mineral wool, in the profile 6. In addition, the profile 6 is panelled on both sides with panelling boards 15, 16, for example gypsum boards. The upper panelling 15 is in one layer; the lower panelling 16, which forms the ceiling surface which is visible in the room formed by a module, is double-layered. The insulating material 14, the profile 6 and the panellings 15 and 16, and possibly other structural elements, can also provide for sound insulation and/or fire protection.

Figure 4 shows a cross section of a floor profile 4 according to the invention for a frame 1 according to **Fig. 1.**

It can be seen that the floor profile 4 is formed from a sheet-form material, preferably from a metal sheet, preferably from a steel sheet. Cross-sectionally hollow profile regions have been formed. The metal sheet has been bent or angled in round form by way of corner radii so as to avoid material weakenings in the corner regions.

Additional weld connections for the purpose of further enhancing the stability of the profile are conceivable and possible in some regions, in particular in the seam region of the respective profile.

The floor profile 4 is essentially formed into a double-T cross-sectional shape. A hollow thickened head portion 17 and a hollow thickened foot portion 18 are formed here. The crosspiece 19 of the floor profile 4, said crosspiece being oriented vertically in the frame 1, extends between the thickened head portion 17 and thickened floor portion 18.

Alongside and/or at the floor profile 4, **Fig. 4** indicates drywall-construction elements for forming a floor for completing a module and for filling the floor surface of a basic framework according to **Fig. 2.**

The figure shows the essentially C-shaped cross section of a drywall-construction profile 8, in particular of a lightweight-steel-construction profile, a number of which can also be seen in **Fig. 2.** The end sides of such a profile 8 can be inserted in a form-fitting manner into the cross-sectionally approximately U-shaped mounts 20 which are formed by the thickened head portions 17, the thickened foot portions 18 and the crosspieces 19 of floor profiles 4 (orthogonally oriented to the one shown in **Fig. 4),** said insertion operation taking place up to the crosspieces 19.

Figure 4 indicates an insulating-material layer 14, for example made of mineral wool, in the profile 8. In addition, the profile 8 is panelled on both sides with panelling boards 21, 22, for example gypsum boards and/or woodbased-material boards or any other suitable building boards known by the artisan. The two panellings 21, 22 are formed in one layer. In addition, in the exemplary embodiment shown in **Fig. 4,** the floor has three further layers 23, 24, 25, of which the uppermost layer 25 forms the floor surface which is visible in the room formed by a module. The insulating material 14, the profile 8, the panellings 21, 22 and the layers 23, 24, 25, and possibly other structural elements, can also provide for sound insulation and/or fire protection.

Side walls of a module may be formed and panelled, for example, in a similar manner to a ceiling according to **Fig. 3.**

Figure 5 shows a cross section of a post profile 2 according to the invention which is designed in the form of a corner profile and is intended for a frame 1 according to **Fig. 1.**

It can be seen that the post profile 2 is formed from a sheet-form material, preferably from a metal sheet, preferably from a steel sheet. Cross-sectionally hollow profile regions have been formed. The metal sheet has been bent or angled in round form by way of corner radii so as to avoid material weakenings in the corner regions.

Additional weld connections for the purpose of further enhancing the stability of the profile are conceivable and possible in some regions, in particular in the seam region of the respective profile.

The cross section of the post profile 2 shown in **Fig. 5** by way of example is approximately square.

Slot guides 26 which, for reasons relating to stability, are of approximately dovetail shape in cross section are incorporated in two of the outer surfaces of the post profile. As indicated in **Fig. 5,** the slot guides 26 serve for connecting elements 5 to be introduced and fixed therein, the connecting elements thus being oriented orthogonally in relation to one another to form a corner.

Figure 6 shows a perspective view of a connecting element for use in a post profile 2 according to **Fig. 5.**

The connecting element 5 is designed in the form of a flat connecting plate and, at one end, has hooks 27 which can be hooked into slots in the base of a slot guide 26 of a post profile 2 (not illustrated). The connecting element 5 additionally has fastening holes 28, through which screws or similar fastening means can be guided in order to connect the connecting element 5 to crosspieces 12 or 19 of ceiling profiles 3 or floor profiles 4, respectively.

The profiles 2, 3, 4 illustrated in the drawings form, along with the connecting element 5, an easy-to-handle set of structural elements or a modular-construction system which provides for the quick, straightforward, precise and, in particular, also stable construction of basic frameworks which have a supporting function, and can be combined with one another in order to form modules for modular construction.

Patent Claims

1. Frame, in particular a wall frame, which is intended for a preferably supporting, in preference self-supporting, basic framework of a module for modular construction and comprises two post profiles which can be, or are, arranged essentially vertically and of which the upper ends can be, or are, connected to one another via a ceiling profile and the lower ends can be, or are, connected to one another via a floor profile,
characterized,
in that the post profile (2), the ceiling profile (3) and the floor profile (4) each having differently configured cross-sectional profiles.

2. Frame according to claim 1, **wherein** each of the cross-sectional profiles is designed essentially, or in certain regions, in the form of a hollow profile.

3. Frame according to claim 2, **wherein** each of the cross-sectional profiles is formed essentially by virtue of a metal sheet being subjected to a forming operation.

4. Frame according to one of the preceding claims, **wherein** the post profile (2) is designed in the form of a corner profile for to allow for connection of two ceiling profiles (3) and/or floor profiles (4) at angles to one another.

5. Frame according to one of the preceding claims, **wherein** the post profile (2) has at least one slot guide (26) which extends at least over a portion of the longitudinal direction of the post profile (2) and into which at least one connecting element (5) for the connection of a ceiling profile (3) and/or a floor profile (4) is inserted and retained.

6. Frame according to claim 5, **wherein** the at least one slot guide (26) is incorporated in the cross-sectional profile of the post profile (2).

7. Frame according to claims 4 and 6, **wherein** the cross-sectional profile of the post profile (2) has at least two slot guides (26) with opening directions oriented at angles to one another.

8. Frame according to claim 7, **wherein** the cross-sectional profile of the post profile (2), at least in one cross-section plane, has essentially the contour of a rectangle, preferably essentially of a square, with concavities present in two of its adjacent side-surface contours forming the cross section of a respective slot guide (26).

9. Frame according to one of preceding claims 5 to 8, **wherein** the cross section of the slot guide (26) is of dovetail shape.

10. Frame according to one of preceding claims 5 to 9, **wherein** the slot guide (26) is prepared in order for the connecting element (5) to be fastened in a form-fitting manner, in particular hooked in.

11. Frame according to one of preceding claims 5 to 10, **wherein** the, preferably each, connecting element (5) is designed essentially in the form of a connecting plate which is arranged essentially vertically.

12. Frame according to one of the preceding claims, **wherein** the ceiling profile (3) and the floor profile (4) each have essentially a double-T-shaped cross-sectional profile, of which the crosspiece (12, 19) is provided for essentially vertical arrangement, wherein the transverse extremities which are present at the top and bottom of the crosspiece (12, 19), for the purpose of forming the double-T shape, are designed in the form of a thickened head portion (10, 17) and/or a thickened foot portion (11, 18), and the thickened foot portion (11, 18) in the cross-sectional profile of the floor profile (4) has preferably a greater vertical extent than the vertical extent of the thickened foot of the ceiling profile (3).

13. Frame according to claim 12, **wherein** the thickened head portion (17) and the thickened foot portion (18) of the floor profile (4) are of approximately equal size, preferably with the thickened foot portion (18) being designed to be somewhat more extensive.

14. Frame according to claim 12 or 13, **wherein** the thickened head portion (10) of the ceiling profile (3) is designed to be larger than the thickened foot portion (11) of said profile.

15. Frame according to claim 2 and one of claims 12 to 14, **wherein** the thickened head portion (10, 17) and/or the thickened foot portion (11, 18) are essentially box-shaped in cross section.

16. Frame according to one of claims 12 to 15, **wherein** the height of the crosspiece (12, 19) and/or the distance between the outer surface of the thickened head portion (10, 17) and the outer surface of the thickened foot portion (11, 18) is available as a space for a preferably insulated drywall construction (6, 8, 14, 15, 16, 21, 22, 23, 24) having at least one layer of panelling, or part thereof, on at least one side.

17. Frame according to claim 16, **wherein** a free space which is bounded by the thickened head portion (10, 17), the thickened foot portion (11, 18) and the crosspiece (12, 19), and is essentially U-shaped in cross-sectional profile, is provided in the form of a mount (13, 20) in order for at least one drywall-construction profile (6, 8) to be inserted in a form-fitting manner approximately orthogonally in relation to the crosspiece (12, 19).

18. Basic framework of a module for modular construction,
characterized
in that the framework comprises two frames (1) according to one or more of the preceding claims, wherein the respective post profiles (2) are designed in the form of corner profiles according to claim 4, wherein the two frames (1) are arranged parallel to one another, and wherein one the corner profiles of a first frame are connected to the corner profiles of a second frame via a ceiling profiles (3) and floor profiles (4), respectively.

19. Basic framework according to Claim 18, **wherein** the ceiling profiles (3) and floor profiles (4) which are used to build the frames (1) are of a different length from the ceiling profiles (3) and floor profiles (4) which are used for connecting the frames (1) to one another.

20. Basic framework according to either of claims 18 and 19, **wherein** at least two basic frameworks, constituting building blocks, can be connected to one another one above the other, one beside the other and/or one behind the other in order to realise a basic

framework for a building having at least two rooms and/or having at least one large room made of more than one basic framework.

21. Module for modular construction,
characterized
by at least one frame (1) according to one or more of preceding claims 1 to 17 and/or by at least one basic framework according to one or more of preceding claims 18 to 20.

22. Module according to claim 21, **comprising** at least one drywall construction (6, 8, 14, 15, 16, 21, 22, 23, 24) for closing and/or for filling at least one of the surfaces defined by a frame (1) and/or basic framework.

23. Module according to claim 22, **comprising** at least one drywall-construction profile (6, 8) of a drywall construction (6, 8, 14, 15, 16, 21, 22, 23, 24) for closing and/or for filling at least one of the surfaces defined by a frame (1) and/or basic framework.

24. Module according to claim 23, **wherein** the at least one drywall-construction profile (6, 8) has its respective ends inserted, and mounted, in a form-fitting manner, essentially orthogonally in relation to two mutually opposite, essentially parallel ceiling profiles (3) or floor profiles (4), in mounts (13, 20) which are approximately U-shaped in cross-sectional profile and belong to said ceiling profiles (3) or floor profiles (4).

25. Module according to claim 23 or 24, **wherein** the at least one drywall-construction profile (6, 8) has at least one layer of panelling on at least one side.

26. Module according to one of claims 21 to 25, **wherein** at least the ceiling surface, floor surface and at least one of the four side surfaces defined by the basic framework are closed and/or filled.

27. Module according to one of claims 21 to 26, **wherein** the module is provided, and finished off, comprising installations.

28. Module according to one of claims 21 to 27, **wherein** at least two modules, constituting zones, can be connected to one another one above the other, one beside the other and/or one behind the other in order to realise a building having at least two rooms and/or having at least one large room.

29. Modular-construction building,
characterized
by at least one frame (1) according to one or more of preceding claims 1 to 17 and/or by at least one basic framework according to one or more of the preceding claims 18 to 20 and/or by a module according to one or more of the preceding claims 21 to 28.

30. Profile, in particular a supporting profile which can be subjected to loading, preferably for a basic framework of a module for modular construction,
characterized
in that it is designed in the form of a post profile (2) which can be arranged approximately vertically, preferably for a frame (1) according to one or more of the preceding claims 1 to 17 and/or a basic framework according to one or more of the preceding claims 18 to 20 and/or for a module according to one or more of the preceding claims 21 to 28.

31. Profile according to claim 30, **characterized** in that the post profile (2) is designed in the form of a corner profile for the possible connection of two ceiling profiles (3) and/or two floor profiles (4) at angles to one another.

32. Profile according to claim 31, **wherein** the post profile (2) has at least one slot guide (26) which extends at least over a portion of the longitudinal direction of the post profile (2) and into which at least one connecting element (5) for the connection of a ceiling profile (3) and/or floor profile (4) can be inserted and retained.

33. Profile according to claim 32, **wherein** the at least one slot guide (26) is incorporated in the cross-sectional profile of the post profile (2).

34. Profile according to claims 31 and 33, **wherein** the cross-sectional profile of the post profile (2) has at least two slot guides (26) with opening directions oriented at an angle to one another.

35. Profile according to claim 34, **wherein** the cross-sectional profile of the post profile (2), at least in the cross-section plane, has essentially the contour of a rectangle, preferably essentially of a square, with concavities present in two of its adjacent side-surface contours forming the cross sections of the respective slot guides (26).

36. Profile according to one of preceding claims 30 to 35, **wherein** the cross section of the slot guide (26) is of approximately dovetail shape.

37. Profile according to one of preceding claims 30 to 36, **wherein** the slot guide (26) is prepared such that a connecting element (5), preferably a connecting flange which can be arranged essentially vertically, can be fastened in a form-fitting manner, in particular can be hooked in.

38. Profile, in particular a supporting profile which can be subjected to loading, preferably for a basic framework of a module for modular construction,
characterized
in that it is designed in the form of a profile (3, 4) which can be arranged approximately horizontally connecting two post profiles (2), preferably post profiles (2) according to one or more of preceding claims 30 to 37, to one another, preferably for a frame (1) according to one or more of the preceding claims 1 to 17 and/or a basic framework according to one or more of the preceding claims 18 to 20 and/or for a module according to one or more of the preceding claims 21 to 28.

39. Profile according to claim 38, **wherein** the profile (3, 4) has essentially a double-T-shaped cross-sectional profile, the crosspiece (12, 19) of which is provided for approximately vertical arrangement, wherein the transverse extremities which are present at the top and bottom of the crosspiece (12, 19), for the purpose of forming the double-T shape, are designed in the form of a thickened head portion (10, 17) and/or a thickened foot portion (11, 18).

40. Profile according to claim 39, **wherein** the profile is designed in the form of a ceiling profile (3), and in that the thickened head portion (10) of the ceiling profile (3) is designed to be larger than the thickened foot portion (11) of said profile.

41. Profile according to claim 40, **wherein** the profile is designed in the form of a floor profile (4), and wherein the thickened head portion (17) and the thickened foot portion (18) of the floor profile (4) are of approximately equal size, preferably with the thickened foot portion (18) being designed to be somewhat more extensive.

42. Profile according to one of preceding claims 38 to 41, **wherein** the thickened head portion (10, 11) and/or the thickened foot portion (17, 18) are essentially box-shaped in cross section.

43. Profile according to one of claims 38 to 42, **wherein** the height of the crosspiece (12, 19) and/or the distance between the outer surface of the thickened head portion (10, 17) and the outer surface of the thickened foot portion (11, 18) is available as a space for a preferably insulated drywall construction (6, 8, 14, 15, 16, 21, 22, 23, 24) having at least one layer of panelling on at least one side, or for part of a drywall construction.

44. Profile according to claim 43, **wherein** a free space which is bounded by the thickened head portion (10, 17), the thickened foot portion (11, 18) and the crosspiece (12, 19), and is essentially U-shaped in cross-sectional profile, is provided in the form of a mount (13, 20) in order for at least one drywall-construction profile (6, 8) to be inserted in a form-fitting manner approximately orthogonally in relation to the crosspiece (12, 19).

45. Profile according to one of preceding claims 30 to 44, **wherein** the profile (2, 3, 4) is designed essentially, or in certain regions, in the form of a hollow profile.

46. Profile according to claim 45, **wherein** the profile (2, 3, 4) is formed essentially of a metal sheet being subjected to a forming operation.

47. Set of structural elements which is intended for a preferably supporting, in preference self-supporting, basic framework of a module for modular construction and comprises two post profiles which can be, or are, arranged essentially vertically and of which the upper ends can be, or are, connected to one another via a ceiling profile and the lower ends can be, or are, connected to one another via a floor profile, **characterized**
by at least one profile (2, 3, 4) according to one or more of the preceding claims 30 to 46 and/or by at least one frame (1) according to one or more of preceding claims 1 to 17.

48. Set of structural elements according to claim 47, **comprising** at least one connecting element (5) by means of which a ceiling profile (3) and/or floor profile (4) which can be arranged approximately horizontally are connected to a post profile (2) which can be arranged approximately vertically.

49. Set of structural elements according to claim 48, **wherein** the at least one connecting element (5) is designed as an essentially flat connecting plate which can be arranged preferably essentially approximately vertically.

50. Set of structural elements according to claim 48 or 49, **wherein** the at least one connecting element (5) has at least one fastening element (27) for establishing a hook-in connection with a post profile (2).