



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 0 803 618 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
02.08.2000 Bulletin 2000/31

(51) Int Cl.7: **E04F 15/024, E04B 5/48**

(21) Application number: **97105979.5**

(22) Date of filing: **11.04.1997**

(54) **Modular element for the support and ventilation of floors**

Modulares Element zur Unterstützung und Lüftung von Decken

Élément modulaire pour le support et la ventilation de planchers

(84) Designated Contracting States:
BE CH DE ES FR GR IT LI LU NL

(72) Inventor: **Pontarolo, Valerio**
33073 Cordovado (PN) (IT)

(30) Priority: **23.04.1996 IT UD960054**
04.09.1996 IT UD960168

(74) Representative: **Petraz, Gilberto Luigi**
GLP S.r.l.
Piazzale Cavedalis 6/2
33100 Udine (IT)

(43) Date of publication of application:
29.10.1997 Bulletin 1997/44

(56) References cited:
EP-A- 0 551 051 **DE-A- 4 129 760**
DE-A- 4 332 155 **DE-A- 4 414 481**
FR-A- 1 533 735 **US-A- 2 602 323**
US-A- 4 702 048

(73) Proprietor: **Pontarolo, Valerio**
33073 Cordovado (PN) (IT)

EP 0 803 618 B1

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] This invention concerns a modular element for the support and ventilation of floors as set forth in the main claim.

[0002] The modular element according to the invention is applied in the building trade, for both civil and industrial buildings and restructuring, so as to achieve structures suitable to insulate the floors from the underlying ground.

[0003] The state of the art includes structures, commonly known as crawl spaces or interspaces, used to make the bases for floors. These structures are suitable to create an insulating interspace between the floor and the underlying ground so as to prevent humidity and/or concentrations of gas from rising inside the buildings.

[0004] For it is well-known that the appropriate health authorities have passed health regulations, which apply both to residential buildings and places of work, specifying the minimum insulation heights which the floors must have with respect to the underlying ground.

[0005] These structures define the interspaces inside which the air is able to circulate. They are generally made of building materials of a conventional type, such as, for example, lath bricks and lug bricks combined with supporting structures such as for example brick partitions and common joists. Such structures are costly to build and, apart from requiring a long time to complete, also require a large quantity of material. Moreover, it is not possible to cover structures of this type immediately with concrete as some time must elapse while they are consolidated.

[0006] In order to overcome such shortcomings, modular structures have been invented which comprise expendable formworks equipped with legs and able to be jointed together. These structures are easy and quick to install, and moreover the concrete can be cast immediately after they have been installed. Once the formworks have been jointed to each other, they define, on the top, a substantially continuous plane which acts as a base for the cast concrete and a plurality of vertical fissures which determine the formation of pillars, uniformly distributed and able to increase the load capacity of the crawl space.

[0007] It is well-known that, in a large number of applications, the covering layer of concrete is reinforced with metal rods, consisting of an electronically welded mesh and/or iron round pieces, in order to consolidate the floor.

[0008] The metal rod reinforcement is placed on the plane defined by the formworks and then incorporated into the covering layer of concrete. Often therefore, in order to completely cover the iron rods which define a thickness on top of the plane of the loose stone floor, it is necessary to cast a thicker layer of concrete than that given by the calculations of the floor, which causes an increase in the costs thereof.

[0009] Moreover, the iron rods can make the pouring

of the layer of concrete difficult, as they constitute an obstacle both for the means employed to perform the casting and also for the movement of the workers.

[0010] Furthermore, when round pieces are used, as it is not possible to anchor these elements to the formworks, the round pieces are attached to each other by means of binding with metallic wire, welding or other operations in order to prevent them from moving from their original collocation during the laying of the concrete.

[0011] All this causes problems which limit the complete and rational use of the crawl spaces with expendable formworks.

[0012] Moreover, it is well-known that these crawl spaces can be of different heights or plan sizes, even considerably so, and that they must possess a high load capacity before the concrete is poured.

[0013] With systems known to the state of the art, pre-fabricated elements made of thin plastic bend and give way, with a danger of breakages and damage, even to people.

[0014] It is also well-known that these pre-fabricated elements include stiffening elements consisting generally of ribs or full ridges which, as such, protrude from the surface of the pre-fabricated elements.

[0015] Therefore, when the pre-fabricated elements of the known type are transported or stored, in a superimposed position, interspaces are formed which substantially coincide with the height of the ribs or ridges. This leads to the creation of stacks which are considerably bulky, even when there are a limited number of elements.

[0016] Pre-fabricated elements of the known type therefore need large spaces for storage, and are not very functional both when they are being transported and when they are temporarily stored on site.

[0017] Document FR-A-1.533.735 discloses a construction element constituted by a stool made of sheet material and having a square plan view; the stool has a dome-like centre portion extending downwardly at each corner of the square to form leg portions which terminate at a common horizontal plane.

[0018] Document DE-A-44 14 481 discloses elements for a floor construction, each comprising an upper flat plate of square form having the edges shaped to define linear coupling elements, wherein the flat plate is provided with a plurality of vertical legs, which are regularly distributed spaced apart from the parallel edges of the plate, according to a matrix of rows and columns.

[0019] The present applicants have designed, tested and embodied this invention to overcome the shortcomings of the state of the art and to provide further advantages.

[0020] The invention is set forth and characterised in the main claim, while the dependent claims describe variants of the idea of the main embodiment.

[0021] The purpose of the invention is to provide a modular element to achieve ventilated crawl spaces able to guarantee the desired insulation between the

floor and the underlying ground, which will make possible the easy and rapid positioning of conduits, pipes and cables, and also an easy and exact positioning of those elements which serve to reinforce the covering layer of concrete; the modular element, according to the invention, will also be able to support high loads.

[0022] Another purpose of the invention is to simplify and facilitate the pouring of the layer of concrete, and achieve a covering layer which is substantially level with the plane defined by the upper surfaces of the modular elements, therefore eliminating the irregularities or increases in height which can be caused on the upper part of the plane.

[0023] A further purpose is to facilitate the operations to install and attach the modular elements to each other, and thus provide a structure which is extremely stable and long-lasting, both before and during the pouring of the concrete

[0024] A further purpose of the invention is to considerably reduce the spaces needed for storage, and also to facilitate transport operations and make them more functional.

[0025] It is also a purpose of the invention to arrange pipes and/or conduits so that fluids or cables or other means can pass.

[0026] The modular element for floors according to the invention is made advantageously of plastic material. It has a supporting base which is placed on the ground and which has a greater surface area than the upper surface. The upper surface is defined by a base plane, advantageously but not exclusively convex, which extends downwards in such a way that it extends as legs which function as supporting elements and which rest on the ground.

[0027] The single structure thus obtained contains inside itself a space which guarantees a suitable insulating height between the ground and the floor, and also a ventilation area wherein the air can circulate. The base plane is equipped with first grooves, whose function is to stiffen the structure, which from a substantially central point of the plane extend substantially for the whole length of the legs.

[0028] The first grooves substantially divide the upper face into four quadrants. According to the invention, the base plane also includes second grooves, substantially at a right angle to each other and passing through the central point of the base plane and substantially along the centre line of the quadrants defined by the first grooves.

[0029] According to the invention, the function of the second grooves is to house the reinforcement elements, for example, the iron round pieces, employed to reinforce the covering layer.

[0030] These grooves thus allow the reinforcement elements to remain below the base plane and in a substantially constrained position. In this way, when the workers pour the covering layer, apart from being able to pour the concrete more easily, they run no risk of dis-

placing the reinforcement elements since they are gripped by the grooves. Moreover, the covering layer is placed substantially level with the upper part of the base plane defined by the modular elements of the crawl space.

[0031] When the modular elements, moreover, are transported or stored, they take up less space because these second grooves allow two of the modules to be stacked one on top of the other, and thus the vertical space occupied by a stack of modular elements is limited. The lower end of the legs is shaped in such a way as to guarantee a stable support on the ground, and to allow easy and rapid connections to be made, advantageously by jointing, so that two or more modular elements according to the invention can be associated together. Each leg has connection means cooperating with mating connection means on the adjacent modular element, so that a stable and air-tight connection is formed between the two elements.

[0032] The connection between several adjacent modular elements is further guaranteed by the inclusion of a groove which substantially follows the whole upper perimeter edge and which is able to be associated, advantageously super-imposed, with similar grooves on the other, adjacent modular elements.

[0033] In this way it is possible to connect the first side of each modular element with at least one side of another modular element.

[0034] According to a variant, on the upper face of the element, or in another position which can easily be identified by the workers, there are means to identify the first side.

[0035] According to the invention, the connection means on each leg in cooperation with the grooves give stability to each modular element so that no other support is required, not even when the workers installing the modular elements cut or remove one or even two supporting legs, in order to adapt the elements to the size of the site where they are to be installed.

[0036] According to another variant, the lower ends of the legs include means to attach the modular element to the ground such as for example, holes for screws or nails.

[0037] These attachment means can also be employed to mount possible extensions, used to raise the plane defined by the modular elements.

[0038] According to another variant, in correspondence with the upper face there is at least a hole, of whatever section, whose inner surface defines a truncated cone, or a truncated pyramid.

[0039] According to a first variant, the smaller base of this hole is closed, and is located at the same height as the supporting base of the modular element.

[0040] According to another variant, the hole is central; according to yet another variant, the invention has two or more holes.

[0041] When the elements are stored, at least one hole makes it possible to place the elements one above

the other and stack them temporarily, so as to make a stable and easily transportable stack.

[0042] During the operational step, before the concrete is poured, the independent load capacity is much higher.

[0043] In the next operational step, the hole is filled with concrete, possibly reinforced by a suitable metallic core, and this causes a pillar to be formed. The pillar is suitable to increase still further the load capacity of each individual modular element and therefore of the crawl space or interspace made by the modular elements.

[0044] According to another variant, the smaller base of the hole is placed at a height slightly greater than that of the supporting base of the modular element, which compensates for any possible irregularities or unevenness of the ground.

[0045] In this case, not only is the stability of the modular element guaranteed on the installation site before the concrete is cast, but also the modular element is guaranteed to be self-supporting, both before the concrete is poured and also during the subsequent operational step, since the pillar which is formed is resting on the ground, either because of the weight of the worker or of the concrete.

[0046] According to the invention, before the modular element is laid, or before the covering layer of concrete is cast, it is possible to avoid the formation of the pillar by closing the hole with a mating plug and eliminating the underlying part which causes the formation of the pillar. By doing so, it is possible to increase the volume of the ventilation interspace, and to allow large pipes or other bulky elements to pass.

[0047] According to one variant of the invention, the hole is closed by using at least the end part of the hole, that is to say, the part which constitutes the smaller, closed base, by detaching it from the modular element and jointing it into the hole.

[0048] According to another variant, it is easy to separate the end part and other possible intermediate parts which have to be eliminated or jointed into the hole in cooperation with the end part, thanks to the pre-breakage furrows or ridges which are included on the circumference of the wall which defines the hole.

[0049] According to another variant, the supporting and reinforcing pillars are made with one or more autonomous elements, of whatever shape and section, constructed separately from the modular element and able to be connected thereto at any point whatsoever, by means of attachment elements of a known type.

[0050] According to a first embodiment, these autonomous elements are concave and cooperate with mating connection holes on the upper face of the modular element so that they can be filled with concrete.

[0051] According to another embodiment, the autonomous elements serve only as supports.

[0052] According to another variant, the supporting pillars, whether they be autonomous elements or an integral part of the modular element, can be folded back

on themselves according to requirements.

[0053] The attached figures are given as a non-restrictive example, and show a preferred embodiment of the invention as follows:

5

Fig. 1 shows a lengthwise cross section of a modular element to support and ventilate floors according to the invention, in its first configuration;

Fig. 2 shows Fig. 1 in its second configuration;

10

Fig. 3 shows a reduced scale view from above of the modular element of Fig. 2;

Fig. 4a shows a part view of a variant of Fig. 1;

Fig. 4b shows a part view of another variant of Fig. 1;

15

Figs. 5a and 5b show two variants of Fig. 1.

20

[0054] The modular element 10 according to the invention consists substantially of a single structure made of plastic or some other equivalent material, advantageously of a recyclable or environmental-friendly type. The structure is defined at the upper part by an upper face 11, convex and substantially circular in shape, with a centre 12.

25

[0055] At four points, two by two and diametrically opposed, the upper face 11 extends downwards so as to constitute four supporting legs 13, respectively 13a, 13b, 13c and 13d.

30

[0056] Each supporting leg 13 has at the lower part a supporting base 14 which includes at the side its own, specific connection means 15a and/or 15b, and is equipped with holes to attach the element to the ground, by means of screws, nails or other means. These holes can also be used to position possible extensions if it should be desired to increase the height of the plane defined by the elements 10.

35

[0057] The connection elements 15b consist of an extension of the supporting base 14 and are equipped with an abutment element 16 of a substantially semi-circular shape which delimits a supporting surface 17 for the mating elements 15a of the adjacent modular element 10.

40

[0058] The connection elements 15a also constitute an extension of the supporting base 14 but their supporting surface 18 is at a height, with respect to the ground on which the supporting base 14 is placed, substantially corresponding with the thickness of the supporting surface 17. In this way, when several modular elements 10 according to the invention are connected together, the connection elements 15a are superimposed above the connection elements 15b.

45

[0059] In this case, so as to allow every modular element 10 to be connected with the four adjacent modular elements 10, the legs 13a and 13c include both the connection element 15a and also 15b, the leg 13b includes two connection elements 15b, and finally the leg 13d includes two elements 15a, as shown in Fig. 3.

50

[0060] Each of the legs 13 is connected to an adjacent leg 13 by means of an arch 19, as shown in Fig. 1. The

55

function of these arches 19 is to define an area through which air can pass, underneath the upper face 11.

[0061] In this case, the two arches 19 which converge towards the leg 13d are equipped with the appropriate grooves 20a so that, when several modular elements 10 are connected together, the grooves 20a are super-imposed over mating grooves 20b on the two arches 19 which converge towards the legs 13b.

[0062] The cooperation between the connection elements 15a and the connection elements 15b and, at the same time, the cooperation between the grooves 20a and the grooves 20b, guarantees a connection between the modular elements 10 which is stable and secure even under critical operational conditions.

[0063] The upper face 11 includes first stiffening means 21 consisting of first grooves 21 which extend from the centre 12 substantially for the whole length of the legs 13, thus reinforcing the structure.

[0064] In this case, further, second slots 22, substantially at right angles to each other, extend from the centre 12 towards the arches 19, and substantially in correspondence with their centre line.

[0065] The function of these second slots 22 is to provide a stable housing for the iron round pieces 23 and/or the possible electrically welded mesh or other reinforcement means conventionally used to reinforce the covering layer of concrete 36.

[0066] The round pieces 23 are thus arranged in a position underneath the upper surface defined by the upper face 11, and therefore allow the covering layer of concrete 36 to be poured substantially to the upper level of the modular element 10. It is thus possible to avoid pouring more concrete 36 than is necessary in order to completely cover the round pieces 23.

[0067] On the upper face 11 in correspondence with the centre 12 there is a hole 35, in this case with a circular section, which defines in cooperation with a wall 31 a concave pillar element 30 to act as a support and reinforcement, in this case shaped like a truncated cone, closed at the bottom by a base 33.

[0068] While the layer of concrete 36 is being poured, this pillar element 30 shaped like a truncated cone is filled with the concrete 36, and possibly one or more metallic elements are inserted. In this way a solid pillar is formed, which is suitable to increase the load capacity of each individual modular element 10 and therefore of the crawl space obtained by associating several modular elements 10 together.

[0069] The base 33 is at the same height as the supporting bases 14 of the legs 13 but, according to a variant, the base 33 can be at a slightly greater height than that of the supporting bases 14, so as to compensate for any unevenness or irregularity of the ground and improve the stability of the modular element 10.

[0070] According to the invention, along the pillar element 30 shaped like a truncated cone there is a furrow 32a on the circumference of the wall 31 which allows the lower portion 30a of the truncated cone to be easily

separated from the modular element 10.

[0071] The lower portion 30a of the truncated cone, once it has been detached, is inserted inside the hole 35 and serves as a plug. This makes it possible to avoid filling the pillar element and at the same time to pass large pipes 34 through the ventilation space or to install other possible bulky elements.

[0072] In this case, in order to further increase the space available for the pipes 34 to pass, it is possible to detach and eliminate from the modular element 10 an intermediate truncated cone element 30b, as another pre-breaking furrow 32b is included.

[0073] According to a variant, the upper face 11 of the modular element 10 is more convex so as to allow a pipe 134 (Fig. 4b) to pass, or several pipes or conduits 134, even large ones (Fig. 4a), on the plane defined by the modular elements 10 destined to be covered with concrete 36.

[0074] According to the embodiment shown in Figs. 4a and 4b, it is thus possible to arrange the pipes and/or conduits 34, 134 both above and below the modular element 10.

[0075] However, in this case, the pipe or conduit 134 placed above the modular element 10 is located at a height not greater than the maximum height defined by the pipe or conduit 34 placed under the modular element 10.

[0076] According to another variant which is not shown here, the pillar element 30 shaped like a truncated cone can be divided, starting from a point immediately below the lower part of the upper face 11, into several elements shaped like a truncated cone which can be reciprocally jointed so as to constitute a single plug to close the hole 35.

[0077] According to a further variant, the hole 35 is polygonal in shape and determines the formation of a pillar shaped like a truncated pyramid or any other shape or section.

[0078] According to the variant shown in Fig. 3, as an alternative to the hole 35 or in cooperation therewith, there are several holes, advantageously arranged at an equal distance and symmetrically with respect to the centre 12 of the upper face 11, each of which defines a pillar element 30 shaped like a truncated cone or truncated pyramid or other shape and of any section, suitable to achieve a supporting and reinforcement pillar.

[0079] According to a first embodiment there are four holes 35a arranged along the four grooves 22.

[0080] According to another embodiment there are four holes 35b arranged along the four stiffening grooves 21.

[0081] According to another variant which is not shown here, the centre of the four holes 35b coincides with the bisecting lines of the angles formed on the upper face 11 by the grooves 22 with the stiffening grooves 21.

[0082] According to still another variant, the pillar elements 30 consist of elements which are constructed

separately from the modular element 10 and are associated therewith in whatsoever position under the upper face 11, by means of any connection means whatsoever.

[0083] In the case shown in Fig. 5b, the concave pillar element 30 is associated with the hole 35a on the upper face 11 of the modular element 10 by means of jointing, in such a way that the cast concrete 36 is able to fill the element 30.

[0084] In the event that the pillar element 30 is to be connected to the modular element 10, for example so as to allow a pipe 34 to pass, the hole 35a will be suitably closed by means of the lower portion 30a which is obtained by separating the latter from the pillar element 30 thanks to the pre-breakage furrow 32a, or will be closed by means of the appropriate plugs.

[0085] According to another variant shown in Fig. 5a, the pillar element 30 which is constructed separate to the modular element 10 is of the solid body type and consists of a prop element 24, which can be associated with and dissociated from the modular element 10 by means of a mating housing seating 25.

[0086] According to a further variant, at least some of the pillar elements 30 can be folded back on themselves, at least partly, for example to allow pipes, bundles of cables, stiffening elements or other elements to pass underneath.

Claims

1. Modular element for the support and ventilation of floors, the element being suitable to support a layer of reinforced concrete (36) defining a space between the underlying ground in which space the air circulates, the modular element comprising at least a convex upper face and a plurality of peripheral supporting legs (13) disposed in the peripheral portion of the convex upper face (11) to define a dome-like structure, a plurality of said modular elements being able to be associated so as to achieve a substantially continuous structure, the upper face of the modular element including first stiffening means passing through the centre (12) of the convex upper face and extending along the peripheral supporting legs (13), the modular element being characterised in that the convex upper face (11) is provided with at least an auxiliary supporting and reinforcing pillar element (30) which extends towards the underlying ground in an intermediate position with respect to said peripheral supporting legs (13).
2. Modular element as in Claim 1, in which the upper face (11) includes at least second, through grooves (22) arranged substantially at right angles to each other and defining the seating for the reinforcement rods (23) for the layer of concrete (36), the depth of the second grooves (22) being functionally correlated to the size of the reinforcement rods (23) in such a way that they are below the upper surface of the upper face (11).
3. Modular element as in Claim 1 or 2, in which each supporting leg (13) includes at the end a supporting base (14) equipped at the sides with its own, specific connection elements (15a, 15b) which can be super-imposed and functionally associated with mating connection means (15b, 15a) on the mating supporting legs (13) of an adjacent modular element (10).
4. Modular element as in any claim hereinbefore, in which there is a supporting and reinforcing pillar element (30) at the centre of the upper face (11).
5. Modular element as in any Claim from 1 to 3 inclusive, in which there are at least two supporting and reinforcing pillar elements (30) cooperating with the upper face (11) in a symmetrical position.
6. Modular element as in any claim hereinbefore, in which at least one edge of the upper face (11) defines a housing seating for pipes or conduits (134), this seating being positioned at a greater height than the maximum height defined by the pipe or conduit (34) which can be inserted under the modular element (10).
7. Modular element as in any claim hereinbefore, in which the section at right angles to the axis of the supporting and reinforcing pillar element (30) can be of any value whatsoever.
8. Modular element as in any claim hereinbefore, in which the lower end of the supporting and reinforcing pillar element (30) is positioned at the same height as the supporting bases (14) of the modular element (10).
9. Modular element as in any Claim from 1 to 7 inclusive, in which the lower end of the supporting and reinforcing pillar element (30) is positioned at a greater height than that of the supporting bases (14) of the modular element (10).
10. Modular element as in any claim hereinbefore, in which the supporting and reinforcing pillar element (30) is closed at the end by a base (33).
11. Modular element as in any claim hereinbefore, in which the supporting and reinforcing pillar element (30) has at least an area of preferential pre-breaking (32) so as to define at least a sub-element (30a).
12. Modular element as in any claim hereinbefore, in which the supporting and reinforcing pillar element

(30) cooperates with a hole (35) on the upper face (11).

13. Modular element as in any claim hereinbefore, in which at least the sub-element (30a) with the base (33) can be detached from the modular element (10) and inserted as a plug to close the hole (35). 5
14. Modular element as in any claim hereinbefore, in which the supporting and reinforcing pillar element (30) is made in a single piece with the modular element (10). 10
15. Modular element as in any Claim from 1 to 13 inclusive, in which the supporting and reinforcing pillar element (30) is made separately from the modular element (10). 15
16. Modular element as in any Claim from 13 to 15 inclusive, in which the supporting and reinforcing pillar element (30) and the upper face (11) of the modular element (10) have reciprocal positioning means. 20
17. Modular element as in any Claim from 13 to 16 inclusive, in which the supporting and reinforcing pillar element (30) and the upper face (11) of the modular element (10) have reciprocal anchoring means. 25
18. Modular element as in any claim hereinbefore, in which the supporting and reinforcing pillar means (30) can be at least partly folded back upon itself. 30
19. Modular element as in Claim 1, in which the first stiffening means are stiffening grooves (21), opening upwards. 35

Patentansprüche

1. Modulares Element zum Abstützen und Belüften von Fußböden, das geeignet ist, eine Stahlbetonschicht (36) abzustützen und einen Trenn- und Luftzirkulationsraum zwischen dieser Stahlbetonschicht (36) und der darunter liegenden Ebene zu bestimmen, wobei dieses modulare Element mindestens eine konvexe Oberseite und mehrere äußere Stützbeine (13) aufweist, die im Randgebiet der konvexen Oberseite (11) angeordnet sind und eine kuppelförmige Struktur bestimmen, wobei mehrere modulare Elemente zur Bildung einer wesentlich endlosen Struktur zusammengefügt werden können, wobei die konvexe Oberseite dieses modularen Elementes erste Versteifungsmittel aufweist, die durch den Mittelpunkt (12) dieser konvexen Oberseite durchgehen und sich auf die äußeren Stützbeine (13) erstrecken, dadurch gekennzeichnet, daß die konvexe Oberseite (11) minde-

stens einen kleinen Stütz- und Verstärkungspfeiler (30) aufweist, der sich in Richtung auf die darunter liegende Ebene in einer Zwischenlage zwischen diesen äußeren Stützbeinen (13) erstreckt.

2. Modulares Element nach Anspruch 1, dadurch gekennzeichnet, daß die Oberseite (11) mindestens zweite durchgehende Nuten (22) aufweist, die wesentlich rechtwinklig untereinander angeordnet sind und den Sitz der Rundisen (23) für die Stahlbetonschicht (36) bestimmen, wobei die Tiefe dieser zweiten Nuten (22) den Abmessungen dieser Rundisen (23) für Beton zweckmäßig angepaßt ist, so daß diese Rundisen für Beton sich unterhalb der Oberfläche der Oberseite (11) befinden.
3. Modulares Element nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß jedes Stützbein (13) am unteren Ende eine Auflagefläche (14) aufweist, die auf den Seiten mit eigenen und besonderen Verbindungsmitteln (15a, 15b) versehen ist, die durch Übereinanderlagerung mit entsprechenden Verbindungsmitteln (15b, 15a) der entsprechenden Stützbeine (13) eines anliegenden modularen Elementes (10) zweckmäßig verbindbar sind.
4. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß ein Stütz- und Verstärkungspfeiler (30) im Mittelpunkt der Oberseite (11) vorhanden ist.
5. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche 1-3, dadurch gekennzeichnet, daß mindestens zwei Stütz- und Verstärkungspfeiler (30) vorhanden sind, die mit der Oberseite (11) in einer symmetrischen Lage zusammenwirken.
6. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß mindestens ein Rand der Oberseite (11) einen Sitz zur Aufnahme von Rohrleitungen (134) bestimmt, wobei dieser Sitz sich oberhalb der Höhe befindet, die von der größten, unterhalb des modularen Elementes (10) einsetzbaren Rohrleitung (34) bestimmt ist. 40
7. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der auf die Achse des Stütz- und Verstärkungspfeilers (30) orthogonale Querschnitt beliebig ist. 50
8. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das untere Ende des Stütz- und Verstärkungspfeilers (30) sich auf derselben Höhe

- der Auflageflächen (14) des modularen Elementes (10) befindet.
9. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das untere Ende des Stütz- und Verstärkungspfeylers (30) sich oberhalb der Höhe der Auflageflächen (14) des modularen Elementes (10) befindet.
10. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das Ende des Stütz- und Verstärkungspfeylers (30) durch eine Unterlage (33) geschlossen ist.
11. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Stütz- und Verstärkungspfeyler (30) vorzugsweise mindestens einen Vorbrechabschnitt (32) aufweist, der ein Unterelement (30a) bestimmt.
12. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Stütz- und Verstärkungspfeyler (30) mit einer Öffnung (35) der Oberseite (11) zusammenwirkt.
13. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß mindestens das Unterelement (30a), das eine Unterlage (33) aufweist, vom modularen Element (10) abnehmbar und als Verschlußstopfen der Öffnung (35) durch Einklemmen verwendbar ist.
14. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Stütz- und Verstärkungspfeyler (30) einstückig mit dem modularen Element (10) hergestellt ist.
15. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Stütz- und Verstärkungspfeyler (30) getrennt vom modularen Element (10) hergestellt ist.
16. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Stütz- und Verstärkungspfeyler (30) und die Oberseite (11) des modularen Elementes (10) Mittel zum gegenseitigen Positionieren aufweisen.
17. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche, dadurch ge-

kennzeichnet, daß der Stütz- und Verstärkungspfeyler (30) und die Oberseite (11) des modularen Elementes (10) Mittel zur gegenseitigen Verankerung aufweisen.

18. Modulares Element nach dem einen oder dem anderen der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Stütz- und Verstärkungspfeyler (30) mindestens teilweise auf sich selbst zusammenfaltbar ist.
19. Modulares Element nach Anspruch 1, dadurch gekennzeichnet, daß die ersten Versteifungsmittel aus Versteifungsnuten (21) bestehen, die nach oben geöffnet sind.

Revendications

1. Élément modulaire pour supporter et aérer des planchers, apte à supporter une couche de béton armé (36) en définissant un espace de séparation et de circulation de l'air entre la couche de béton (36) susdite et le plan sous-jacent, l'élément modulaire susdit étant pourvu au moins d'un côté supérieur convexe et d'une pluralité de pieds-supports périphériques (13) disposés dans la partie périphérique du côté supérieur convexe (11) pour définir une structure en forme de dôme, une pluralité de ces éléments modulaires étant aptes à être assemblés pour réaliser une structure fondamentalement continue, le côté supérieur de l'élément modulaire susdit étant pourvu de premiers moyens de raidissement qui passent dans le centre (12) du côté supérieur convexe (11) susdit et se prolongent le long des pieds-supports périphériques (13), caractérisé en ce que le côté supérieur convexe (11) présente au moins un pilier-support auxiliaire (30) de renforcement qui s'étend vers le plan sous-jacent dans une position intermédiaire par rapport aux pieds-supports périphériques (13) susdits.
2. Élément modulaire selon la revendication 1, caractérisé en ce que le côté supérieur (11) présente au moins de deuxièmes rainures (22) continues, qui sont fondamentalement orthogonales entre elles et définissent le logement pour les fers (23) à béton de la couche de béton (36), la profondeur de ces deuxièmes rainures (22) étant mise fonctionnellement en corrélation avec les dimensions des fers (23) à béton, de façon que ces fers à béton se trouvent au-dessous de la surface supérieure du côté supérieur (11).
3. Élément modulaire selon la revendication 1 ou 2, caractérisé en ce que chaque pied-support (13) présente à son extrémité une base d'appui (14) pourvue latéralement d'éléments d'assemblage

- (15a, 15b) propres et spécifiques, qui peuvent être associés fonctionnellement par superposition à des éléments d'assemblage (15b, 15a) correspondants présents dans les pieds-supports (13) correspondants d'un élément modulaire (10) adjacent. 5
4. Élément modulaire selon l'une ou l'autre des revendications précédentes, caractérisé en ce qu'il y a un pilier-support (30) de renforcement au centre du côté supérieur (11). 10
5. Élément modulaire selon l'une ou l'autre des revendications précédentes 1 - 3, caractérisé en ce qu'il y a au moins deux piliers-supports (30) de renforcement qui coopèrent avec le côté supérieur (11) dans une position symétrique. 15
6. Élément modulaire selon l'une ou l'autre des revendications précédentes, caractérisé en ce que au moins un bord du côté supérieur (11) définit un logement pour tubulures ou conduites (134), le logement susdit étant disposé à une hauteur supérieure à l'hauteur définie par la plus grande tubulure ou conduite (34) qui peut être disposée au-dessous de l'élément modulaire (10). 20
7. Élément modulaire selon l'une ou l'autre des revendications précédentes, caractérisé en ce que la section normale à l'axe du pilier-support (30) de renforcement est une section quelconque. 25
8. Élément modulaire selon l'une ou l'autre des revendications précédentes, caractérisé en ce que l'extrémité inférieure du pilier-support (30) de renforcement se trouve à la même hauteur des bases d'appui (14) de l'élément modulaire (10). 30
9. Élément modulaire selon l'une ou l'autre des revendications précédentes, caractérisé en ce que l'extrémité inférieure du pilier-support (30) de renforcement se trouve à une hauteur supérieure à celle des bases d'appui (14) de l'élément modulaire (10). 35
10. Élément modulaire selon l'une ou l'autre des revendications précédentes, caractérisé en ce que le pilier-support (30) de renforcement est fermé à son extrémité par une base (33). 40
11. Élément modulaire selon l'une ou l'autre des revendications précédentes, caractérisé en ce que le pilier-support (30) de renforcement présente au moins une zone préférentielle de prérupure (32) pour définir au moins un sous-élément (30a). 45
12. Élément modulaire selon l'une ou l'autre des revendications précédentes, caractérisé en ce que le pilier-support (30) de renforcement coopère avec un trou (35) présent dans le côté supérieur (11). 50
13. Élément modulaire selon l'une ou l'autre des revendications précédentes, caractérisé en ce que au moins le sous-élément (30a) qui présente la base (33) peut être désolidarisé de l'élément modulaire (10) et inséré par encastrement en fonction de bouchon pour le trou (35). 55
14. Élément modulaire selon l'une ou l'autre des revendications précédentes, caractérisé en ce que le pilier-support (30) de renforcement forme une seule pièce avec l'élément modulaire (10).
15. Élément modulaire selon l'une ou l'autre des revendications précédentes, caractérisé en ce que le pilier-support (30) de renforcement est réalisé séparément de l'élément modulaire.
16. Élément modulaire selon l'une ou l'autre des revendications précédentes, caractérisé en ce que le pilier-support (30) de renforcement et le côté supérieur (11) de l'élément modulaire (10) présentent des moyens de positionnement réciproques.
17. Élément modulaire selon l'une ou l'autre des revendications précédentes, caractérisé en ce que le pilier-support (30) de renforcement et le côté supérieur (11) de l'élément modulaire (10) présentent des moyens d'ancrage réciproques.
18. Élément modulaire selon l'une ou l'autre des revendications précédentes, caractérisé en ce que le pilier-support (30) de renforcement est au moins partiellement repliable sur soi-même.
19. Élément modulaire selon la revendication 1, caractérisé en ce que les moyens de raidissement sont des rainures de raidissement ouvertes vers haut.

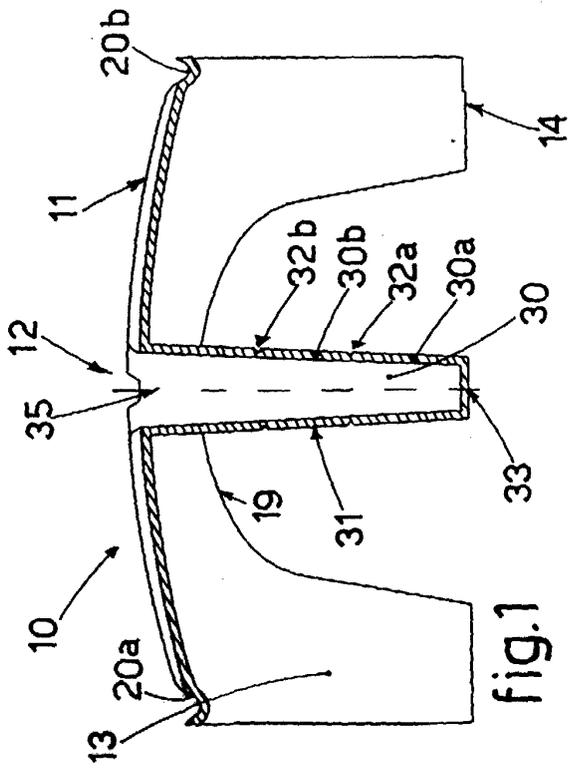


fig.1

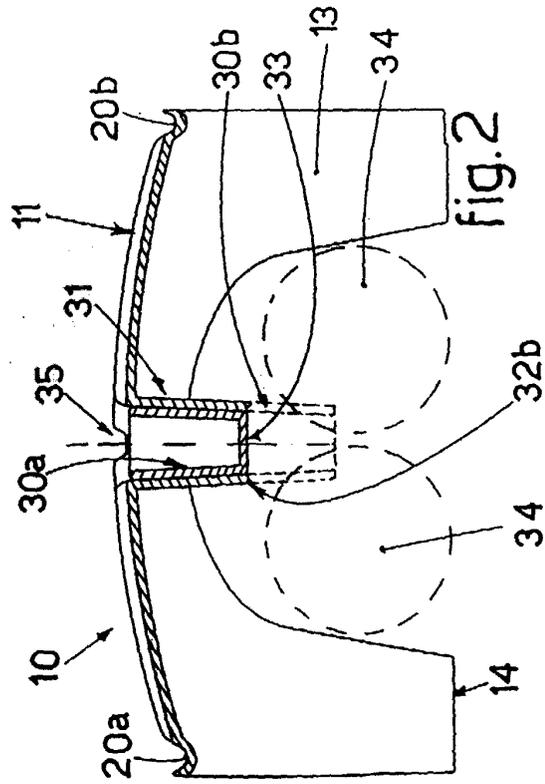


fig.2

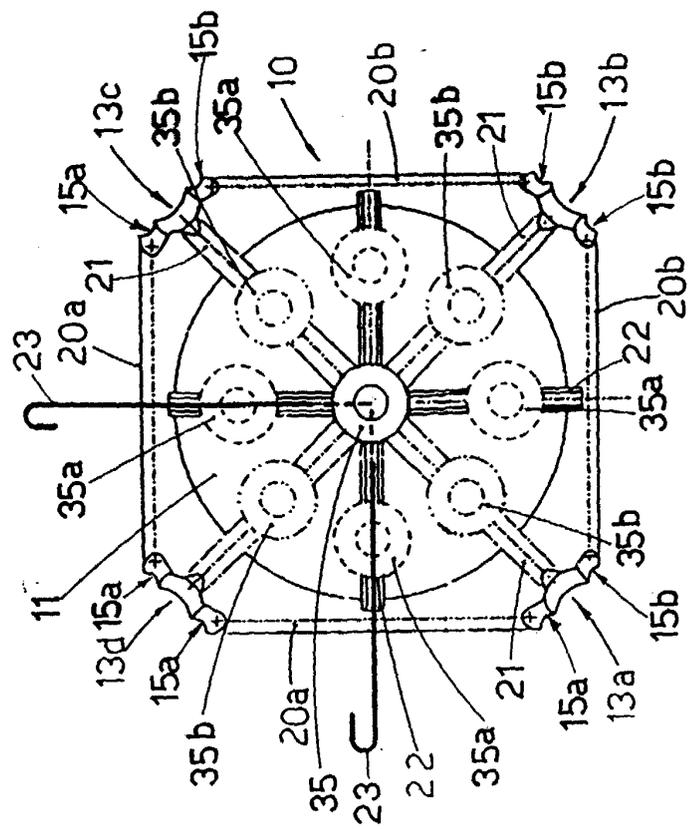


fig.3

