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(54) **Prefabricated module for constructing floors**

(57) The present invention relates to a prefabricated module for constructing modular floors. The module comprises a trimmed joist (2) provided with a lower intrados face (20) and an upper extrados face (21) which exhibits

a longitudinal groove (23) filled with a finishing casting (4) and a lightening element (5) which is arranged on the upper face (21) of the trimmed joist. The joist is made of brick or mineralised wood; the lightening element is made of brick, polystyrene or other plastic material.

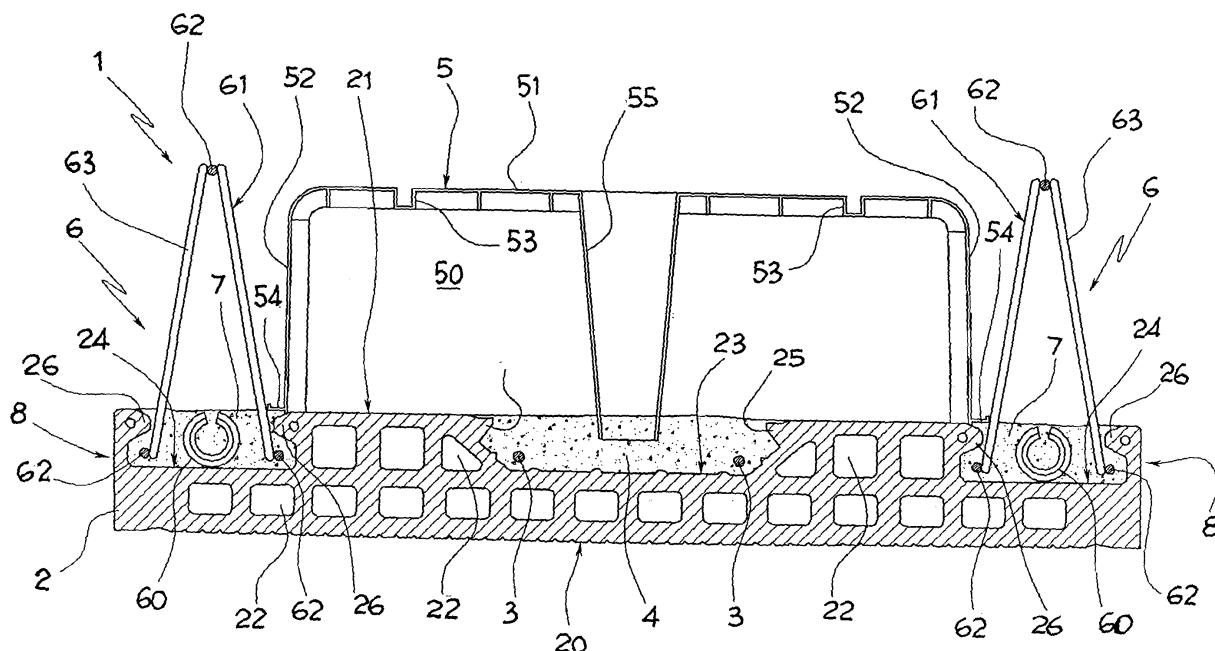


Fig. 1

Description

[0001] . The present invention relates to a prefabricated module for constructing brick cement floors of public and private buildings for residential and/or tertiary use. More particularly, the present invention relates to a prefabricated module for constructing floors.

[0002] . In the prior art, a typical prefabricated module for constructing floors comprises a trimmed joist of brick material and a complex of metal stiffening reinforcements, which are anchored to said trimmed joist by cement concrete casts.

[0003] . Said stiffening reinforcements are generally seated into suitable longitudinal grooves obtained in the body of the trimmed joist and that also serve as a form for the concrete casts, which are cast at the factory during the step of manufacture of the prefabricated modules.

[0004] . The stiffening reinforcements usually comprise stiff steel bars buried in said concrete castings, and reticular trestles that project from the concrete castings to be hooked by special moving means during the transport and/or laying of the prefabricated modules.

[0005] . The prefabricated modules described above are mounted and fixed on a special support platform of the floor, one next to the other so as to make a continuous covering.

[0006] . Then, lightening elements of polystyrene with an insulating and soundproofing function are optionally installed on said continuous covering.

[0007] . Finally, the prefabricated modules are coated on site with a fresh concrete casting that completely covers the reticular trestles and the lightening elements, making the floor surface level.

[0008] . A disadvantage of these prefabricated modules consists in that the polystyrene lightening elements sublime at low temperatures with undesired production of gas and consequent low resistance to fire of the floor, so that the floors made with the same are quite hazardous and often inadequate to comply the current safety regulations.

[0009] . Moreover, the on site application of lightening elements on the prefabricated modules is a very complicated and difficult operation, which often subjects the operators to serious risks for their safety.

[0010] . Finally, the positioning of such prefabricated elements is often inaccurate, also due to possible movements of the elements themselves during the final concrete casting, creating construction defects that are not always negligible.

[0011] . The object of the present invention is to solve the above disadvantages with a simple, rational and inexpensive solution.

[0012] . Such object is achieved by the invention as characterised in the claims.

[0013] . In particular, the invention provides a prefabricated module for constructing floors comprising a trimmed joist, for example of brick, provided with a lower intrados face, and an upper extrados face which exhibits

at least a first longitudinal groove filled with a finishing concrete casting.

[0014] . Said prefabricated module further comprises at least one lightening element, preferably made of plastic, which is located on the upper face of the brick joist so as to delimit an air space that develops longitudinally along the entire trimmed joist, and is provided with anchoring means that are buried into said finishing concrete casting.

[0015] . Thanks to this solution it is not necessary anymore to apply the lightening elements on site, effectively reducing both the number of operations to carry out in laying the floor and at the same time, the risks the operators are subject to.

[0016] . Moreover, the fact that the lightening element is anchored to the concrete casting effectively prevents the same from moving relative to the trimmed joist during transport and/or laying.

[0017] . According to a preferred aspect of the invention, the lightening element is a thin wall body shaped as a channel, whose concavity faces the upper face of the trimmed joist so as to surmount said first groove.

[0018] . The anchoring means comprise at least one conical protrusion of said channel body, which develops inside the concavity of the latter up to plunge into said finishing concrete casting contained in the first groove.

[0019] . According to a further preferred aspect of the invention, the upper face of the trimmed joist exhibit at least two second longitudinal grooves, arranged in parallel at opposite ends relative to said first longitudinal groove, each seating respective metal stiffening reinforcements that are individually held by a finishing concrete casting that fills the relative second groove.

[0020] . Each of said metal reinforcements comprises at least one reticular trestle protruding from the relative finishing concrete casting, whose top may be located at a greater height than the top of the lightening element.

[0021] . In this way, the transport and storage of all types of prefabricated modules is effectively facilitated, which can be piled up on top of each other without the risk of damaging the lightening elements.

[0022] . According to a last preferred aspect of the invention, the trimmed joist comprises flared side edges intended for being put next to the flared side edges of other identical brick joists, during the floor laying.

[0023] . In this way, a channel is obtained between two adjacent brick joists that after laying is filled with fresh covering concrete, improving the connection between the prefabricated modules and the floor seal.

[0024] . Further features and advantages of the invention will appear more clearly from the following description, made by way of an indicative non-limiting example with reference to the annexed drawings, wherein:

[0025] . - figure 1 shows the cross section view of a prefabricated module for constructing floors according to a first embodiment of the invention;

[0026] . - figure 2 shows a plan view of the module of figure 1 in a reduced scale;

[0027] . - figure 3 shows a cross section of a portion of a floor constructed with the prefabricated modules of figure 1;

[0028] . - figure 4 shows the cross section of a variation of the prefabricated module of figure 1;

[0029] . - figure 5 shows a cross section of a portion of a floor constructed with the prefabricated modules of figure 4;

[0030] . - figure 6 shows the cross section view of a prefabricated module for constructing floors according to a second embodiment of the invention;

[0031] . - figure 7 shows the cross section of a variation of the prefabricated module of figure 6;

[0032] . - figure 8 shows the cross section view of a prefabricated module for constructing floors according to a third embodiment of the invention;

[0033] . - figure 9 shows the cross section of a variation of the prefabricated module of figure 8;

[0034] . - figures 10a to 10c show perspective views of further embodiment variations; and

[0035] . - figures 11 a to 11 c show perspective views of even further embodiment variations.

[0036] . Figures 1-3 show a prefabricated module 1 intended for being associated to other identical prefabricated modules 1 for constructing a floor.

[0037] . Said prefabricated module 1 comprises a trimmed joist 2, for example of brick material, with constant cross section, which exhibits a lower flat face 20 intended for defining the floor intrados, and an upper flat face 2 intended for defining the extrados.

[0038] . Preferably, the trimmed joist 2 has a width comprised between 550 and 660 mm and a variable thickness, with a minimum of about 70 mm.

[0039] . The body of the trimmed joist 2 is crossed by a plurality of empty longitudinal passages 22 with polygonal cross profile, typically rectangular or triangular or circular.

[0040] . Said longitudinal passages 22 develop by the entire length of the trimmed joist 2 and are evenly distributed so as to leave a grating of solid walls having substantially the same thickness.

[0041] . Preferably, the thickness of such walls is equal to about 10 mm.

[0042] . In this way, the longitudinal passages 22 impart a typical cell-like to the trimmed joist that relieves the overall weight, while increasing the heat insulation and soundproofing properties.

[0043] . The trimmed joist 2 has an indefinite length that can vary according to the requirements.

[0044] . In particular, it consists of a plurality of identical brick segments of predetermined length, which are aligned in a row and reciprocally sided up to obtain the trimmed joist 2 of the desired length.

[0045] . Preferably, the length of each of said segments is comprised between 300 and 400 mm.

[0046] . As shown in figure 1, the upper face 21 of the trimmed joist 2 exhibits three different recesses.

[0047] . Said recesses defines as many longitudinal

grooves with constant cross profile that develop by the entire length of the trimmed joist 2, of which a central groove 23 and two identical side grooves 24 located symmetrical at opposite sides relative to the central one 23.

5 **[0048]** . The cross profile of the central groove 23 exhibits the shape of an isosceles trapezium, with the larger base at the upper face 21 and the side walls inclined by about 45° relative to the bases.

10 **[0049]** . Preferably, the central groove 23 has as maximum depth equal to about 35 mm and a width at the inlet equal to about 200 mm.

[0050] . An undercut appendix 25 with substantially triangular cross section protrudes from each side wall of the central groove 23, which develops by the entire length of the trimmed joist 2.

15 **[0051]** . The undercut appendices 25 are arranged in the proximity of the inlet of the central groove 23, and are reciprocally symmetrical relative to a vertical plane passing by the centre line of the central groove 23 itself.

20 **[0052]** . In particular, each undercut appendix 25 exhibits a lower side that with the relative inclined wall makes a dihedral of about 90°, and an upper side that is substantially parallel to the upper face 21 of the trimmed joist 2.

25 **[0053]** . The side grooves 24 exhibit a generally rectangular cross profile.

[0054] . Preferably, they have a depth at about 35 mm and length equal to about 100 mm.

30 **[0055]** . Each side groove 24 features two undercut appendices 26 with trapezoidal cross section, which protrude from a respective side wall and develop by the entire length of the trimmed joist 2.

35 **[0056]** . In particular, said undercut appendices 26 are arranged in the proximity of the inlet of the side groove 24, and are reciprocally symmetrical relative to a vertical plane passing by the centre line of groove 24 itself.

[0057] . Inside each side groove 24 there is seated a respective metal stiffening reinforcement, globally indicated with reference numeral 6.

40 **[0058]** . In the example shown, said metal reinforcement 6 comprises a steel bar 60 extending by the entire length of the trimmed joist 2, which is laid down at the centre of the side groove 24 and is oriented according to the longitudinal development of the same.

45 **[0059]** . Said steel bar 60 is sized for effectively supporting all the operating loads the prefabricated module 1 is subject to when it is laid.

[0060] . The metal reinforcement 6 further comprises a trestle 61 consisting of three parallel rods 62 arranged in the space at the vertices of a triangle and that are reciprocally connected by a reticular structure 63.

50 **[0061]** . Said trestle 61 develops by the entire length of the trimmed joist 2 and is oriented so that rods 62 are parallel to the longitudinal development of the relative side passage 24.

55 **[0062]** . In particular, two first rods 62 are seated inside the side passage 24, whereas the third rod 62 is positioned outside, at a higher height than face 21 del of the

trimmed joist 2.

[0063] . Rods 62 seated in the side passage 24 are individually positioned underneath a respective undercut appendix 26, so as to prevent the separation in vertical direction of trestle 61 relative to the trimmed joist 2.

[0064] . The metal reinforcement 6 described above is anchored by a finishing concrete casting 7 that during the construction of the prefabricated module 1, is cast inside the side passage 24 that serves as form.

[0065] . Preferably, said finishing casting 7 fills the side passage 24 flush with the upper face 21 of the trimmed joist 2.

[0066] . In this way, the steel bar 60 is completely buried in the concrete casting 7 while trestle 61 protrudes outwards, so as to be hooked by special handling members during the transport and laying of the prefabricated module 1.

[0067] . The presence of the undercut projections 26 in the side groove 24 ensures that after hardening, the finishing casting 7 is always strongly clinging to the brick joist 2.

[0068] . A concrete casting 4 is also cast in the central groove 23.

[0069] . Preferably, said finishing casting 4 fills the central groove 23 flush with the upper face 21 of the trimmed joist 2.

[0070] . Also in this case, the presence of the undercut projections 25 ensures that after hardening, the finishing casting 4 is always strongly clinging to the brick joist 2.

[0071] . Inside the finishing casting 4 there is buried a further metal stiffening reinforcement.

[0072] . In the example shown, said further stiffening reinforcement comprises two parallel metal rods 3 reciprocally spaced, which are positioned inside the central groove 23 oriented parallel to the longitudinal development of the latter.

[0073] . On the upper face 21 of the trimmed joist 2 there is rested a lightening element 5, which surmounts the central groove 23 and delimits an air space 50 with longitudinal development that extends substantially by the entire length of the trimmed joist 2.

[0074] . In particular, said lightening element 5 consists of a body in thin plastic material wall, which exhibits a channel shape with constant cross section with substantially trapezoidal shape.

[0075] . Preferably, said channel body 5 has a maximum depth comprised between 90 mm and 200 mm according to the needs, and a maximum width equal to about 420 mm.

[0076] . The channel body 5 is oriented parallel to the central groove 23 and has the concavity thereof facing the upper face 21 of the trimmed joist 2.

[0077] . In this way, the channel body 5 provides an upper flat wall 51 and two sides with vertical development 52 that together with the upper surface 21 of the trimmed joist 2, fully delimit the above air space 50.

[0078] . The upper flat wall 51 exhibits a series of stiffening ribs 53 suitable for imparting greater resistance to

the channel body 5.

[0079] . The lower free ends of sides 52 are individually provided with a horizontal flat edge 54, bent outwards, which directly rests on the upper face 21 of the trimmed joist 2.

[0080] . As an alternative, it is possible to provide for the lower free ends of sides 52 to insert into the side grooves 24, thus being buried in a respective concrete casting 7.

[0081] . In both cases, the channel body 5 is provided with suitable anchoring means that are buried into the finishing casting 4 that fills the central groove 23, so as to be firmly fixed to the trimmed joist 2.

[0082] . In the example shown, said anchoring means comprise a plurality of protrusions 55 obtained in a monolith body with the channel body 5, which are reciprocally spaced and are aligned in the direction of the longitudinal development of the channel body 5 itself (see fig. 2).

[0083] . Each protrusion 55 is shaped as a conical impression that protrudes from the upper flat wall 51 of the channel body 5 and that develops inside the concavity of the latter up to plunge its free end into the finishing concrete casting 4.

[0084] . Of course, the channel body 5 is assembled during the construction of the prefabricated module 1, immediately after the cast of the concrete casting 4, so that the conical protrusions 55 plunge into the concrete while it is still fresh and after the hardening are inseparably anchored thereto.

[0085] . Thanks to this solution, the channel body 5 must not be assembled during the laying of the prefabricated module 1, as it happens in the known systems, thus reducing the interventions of the operators with consequent advantages in terms of safety and construction times.

[0086] . Moreover, the presence of the anchoring means ensures that the channel body 5 always maintains its correct position on the trimmed joist 2, both during transport and during the subsequent laying.

[0087] . Preferably, the channel body 5 is modular and consists of a plurality of identical brick segments of predetermined length, which are aligned in a row and connected to one another by special joints up to reach the desired overall length.

[0088] . In particular, each modular segment has a length preferably equal to about 720 mm.

[0089] . As shown in figure 1, the top flat wall 51 of the channel body 51 is at a lower height than the protruding end of trestles 61 that are seated in the side grooves 24.

[0090] . In this way, the prefabricated modules 1 can be effectively piled on top of one another without the risk of damaging the channel body 5, favouring both storage and transport.

[0091] . For example, it is possible to put on the protruding ends of trestles 61 of each prefabricated module 1 a set of wooden ties on which a further prefabricated module 1 is placed.

[0092] . In any case, for the elements shown in figures

1, 2, 3, 4 and 5 it is also possible for the trestles to have lower height than that of the channel body 5.

[0093] . Thanks to the side hold that the trestle ensures to the channel body 5 by edge 54 the elements are directly piled on the channel body 5.

[0094] . In the laying, the brick joists 2 of the prefabricated modules 1 are mounted and fixed on a special platform suitable for supporting the weight of the floor, and are moved one next to the other so as to make a continuous slab (see fig. 3).

[0095] . Then, said slab is covered with a cast of fresh concrete that fully covers both the protruding portions of trestles 61 and the lightening channel bodies 5, leaving only air spaces 50 empty.

[0096] . In the example shown in figures 1 and 3, the trimmed joist 2 has side edges 8 perfectly square, so as to fully abut against the side edges 8 of the adjacent brick joists 2.

[0097] . In the example shown in figure 4, the trimmed joist 2 on the other hand exhibits side edges 8' provided with a flared upper portion.

[0098] . In this way, a channel 80 is defined between two brick joists 2 that are reciprocally sided.

[0099] . During the completion of the slab, said channel 80 is filled with the above fresh concrete, ensuring a more reliable connection of said prefabricated modules 1 (see fig. 5).

[0100] . Figure 6 shows a prefabricated module 100 according to a second embodiment of the invention.

[0101] . Said prefabricated module 100 differs from module 1 described above in that the cross section of the trimmed joist 2 exhibits an intermediate portion with increased thickness that defines a rise 9 of the upper face 21.

[0102] . Said rise 9 extends between the two side grooves 24 and provides an upper flat surface 90, on which the central groove 23 is obtained.

[0103] . The channel body 5 is arranged resting on said upper surface 90 of rise 9 and is anchored, according to the modes described above, to the finishing casting 4 that fills the central groove 23.

[0104] . Thanks to this rise 9, the cross section of the trimmed joist 2 is effectively strengthened at the channel body 5, ensuring higher stiffness and higher resistance of the entire prefabricated module 100.

[0105] . Figure 7 shows the prefabricated module 100 wherein the side edges 8 of the trimmed joist 2 exhibit a flared upper portion.

[0106] . Figure 8 shows a prefabricated module 110 according to a third embodiment of the invention.

[0107] . Said prefabricated module 110 differs from module 1 in that the entire cross section of the trimmed joist 2 has an increased thickness, and in that the side grooves 24 have a depth increased by a quantity substantially equal to the increase of thickness.

[0108] . In this way, the distance that separates the bottom of the side grooves 24 from the lower face 20 of the trimmed joist 2 is substantially the same as prefabri-

cated module 1, whereas the stiffness and the resistance of the trimmed joist 2 are effectively increased.

[0109] . Finally, figure 9 shows the prefabricated module 110 wherein the side edges 8 of the trimmed joist 2 exhibit a flared upper portion.

[0110] . Of course, changes or improvements can be made to the invention as described, as required by special or incidental needs, without departing from the scope of the invention itself.

[0111] . According to an embodiment variation, the lightening element 5 is made of brick, for example as shown in figure 10a.

[0112] . Preferably, the brick lightening element rests on the trimmed joist 2.

[0113] . According to such embodiment variation, the lightening element 5 exhibits empty longitudinal passages 56, which define a cell-like structure, useful for lightening the structure, while maintaining considerable stiffness.

[0114] . For example, passages 56 are arranged at different heights, that is, superimposed to one another.

[0115] . Preferably, moreover, surface 51 is provided with longitudinal channels 57 that configure it as a fret pattern.

[0116] . According to a further embodiment variation, the lightening element 5 is made of polystyrene (figure 10b), fixed to the trimmed joist 2 by extensions that plunge into the finishing casting 4.

[0117] . Preferably, surface 51 of the lightening element is smooth.

[0118] . According to an even further embodiment variation, the lightening element 51 is made of a plastic material (figure 10c).

[0119] . According to a further embodiment variation, the trimmed joist 2 is made of mineralised wood (figures 11 a to 11 c).

[0120] . It is clear that also such variations fall within the scope of protection as defined by the following claims.

Claims

1. Prefabricated module for constructing modular floors, comprising:

- trimmed joist (2) provided with a lower intrados face (20) and an upper extrados face (21) which has at least a first longitudinal groove (23) filled with a finishing concrete casting (4);

characterised in that it comprises at least one lightening element (5) which is arranged on the upper face (21) of the trimmed joist (2).

2. Module according to claim 2, wherein the lightening element (5) is provided with anchoring means (55) buried into the finishing casting (4).

3. Module according to claim 1 or 2, wherein the casting (4) is of concrete.
4. Module according to any one of the previous claims, wherein the joist (2) is of brick. 5
5. Module according to any one of claims 1 to 3, wherein the joist (2) is of mineralised wood.
6. Module according to any one of the previous claims, wherein the lightening body (5) is of brick. 10
7. Module according to any one of claims 1 to 5, wherein the lightening body is of plastic material. 15
8. Module according to claim 7, wherein the lightening body is of polystyrene.
9. Module according to any one of the previous claims, wherein the lightening element is a thin wall body (5) shaped as a channel, whose concavity faces the upper face (21) of the joist (2). 20
10. Module according to any one of the previous claims, wherein said anchoring means comprise at least one protrusion (55) of said channel body (5) which develops inside said finishing concrete casting (4). 25
11. Module according to claim 10, wherein said channel body (5) surmounts said first groove (23) of the upper face (21) of the joist (2), and in that said protrusion (55) develops inside the concavity of said channel body (5). 30
12. Module according to claim 11, wherein said channel body (59) comprises a plurality of said protrusions (55) arranged aligned along the longitudinal development of the channel body (5) itself. 35
13. Module according to claim 12, wherein each of said protrusions (55) has a conical shape. 40
14. Module according to any one of claims 9 to 13, wherein said channel body (5) comprises sides (52) that rest in contact on the upper face (21) of the joist (2). 45
15. Module according to any one of the previous claims, wherein the upper face (21) of said joist (2) exhibit at least two second longitudinal grooves (24) arranged in parallel at opposite ends of said first longitudinal groove (21), each of said second longitudinal grooves (24) seating respective metal stiffening reinforcements (6) and being filled by a finishing casting (7) that holds said reinforcements (6). 50
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16. Module according to claim 15, wherein each of said metal reinforcements (6) comprises a trestle (61) that protrudes from the relative finishing casting (7).
17. Module according to claim 16, wherein the top of the lightening element (5) is at a higher height than the top of the protruding portion of said trestle (61), thanks to the particular shape of the lightening element (5).
18. Module according to any one of the previous claims, wherein the joist (2) exhibits flared side edges (8).
19. Module according to any one of the previous claims, wherein the cross section of said joist (2) exhibits a portion with increased thickness that defines a rise (9) of the upper face (21) on which said lightening element (5) is arranged.

