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(54) Venting device for reinforced concrete building components containing closed cavities or weight-reducing elements

(57) The device (10) is applicable to prefabricated *predalle* slabs or curtain panels provided with weight-reducing elements or with closed cavities, and used for constructing reinforced concrete floors or walls. It comprises a tubular element (12) a first end (28) of which is open, the relative end portion (26) being inserted or insertable into a weight-reducing element. The remaining part (14) of the tubular element (12) is embedded into the newly cast base (16) of the *predalle* slab or of the panel during its prefabrication. The second end of the tubular element (12) is closed by a closure element (18) the outer surface of which is intended to at least partly rest on the bottom of the formwork in which the base (16) is cast. The closure element (18), or at least that portion (20) thereof corresponding to that outer surface intended to rest on the formwork, is of a material which loses consistency or is eliminated as a result of its exposure to the high temperatures of the fire, as is the layer of mortar below the closure element (18). In this manner an opening is created which enables the gases present in the cavities or deriving from the material forming the weight-reducing elements to vent through the tubular element (12). Because of this vent, the temperature increase caused by the fire does not result in a corresponding pressure increase of said gases, hence preserving the structural integrity of the floor or of the wall.

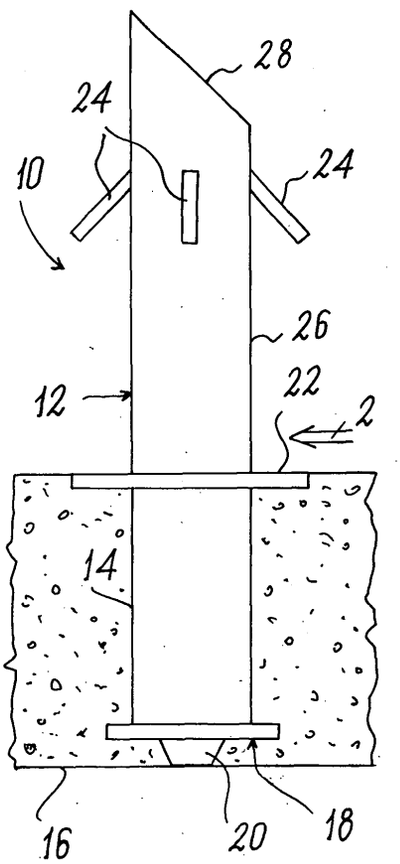

FIG. 1

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Description

[0001] The present invention relates to a device for application to prefabricated *predalle* slabs or curtain panels provided with weight-reducing elements or with closed cavities serving the same purpose, and used for constructing reinforced concrete (hereinafter known as r.c.) floors or walls, the device allowing venting of those gases which may develop in said components within the weight-reducing elements or closed cavities because of a fire involving the relative building.

[0002] It is reminded that prefabricated *predalle* slabs are rectangular slabs of standard width (normally 119.5 or 249.5 cm) and of the required length, and are used to construct r.c. floors. These prefabricated slabs consist of an r.c. base, the lower face of which will form the soffit of the floor. Steel lattices are partially embedded in this base (three lattices in the case of a 119.5 cm wide slab, and five if 249.5 cm wide) to extend longitudinally and project from the upper face of the base. These lattices serve mainly to give the base the necessary static strength during transport and installation of the prefabricated slab. The lattices are usually integrated on site with the necessary additional reinforcement before casting the concrete to complete the floor. Corresponding rows of polystyrene blocks are provided between the lattices to lighten the floor, they being applied to the r.c. base. These blocks are then incorporated into the concrete casting which completes the floor.

[0003] Curtain panels are rectangular prefabricated slabs of variable width, generally of the order of 249 cm, and of the required length; they are used to form r.c. walls. These prefabricated panels consist of two r.c. bases with interposed polystyrene sheets. Steel lattices and electrowelded metal meshes are inserted into these bases, the meshes extending over the whole of their surface. These lattices serve mainly to connect the bases together. The polystyrene sheets of suitable thickness are used for weight-reducing purposes and also as thermal insulation.

[0004] It has been found that in the case of a fire in a building the floors or walls of which have been constructed with prefabricated slabs of the aforestated type, the temperature which can be attained by the weight-reducing elements in the interior of said slabs or the air itself contained in the closed weight-reducing cavities causes the formation of pressurized gas able to crack the r.c. base of the *predalle* slabs used, and which forms the bottom of the floor. In panels the phenomenon is identical, involving the r.c. base adjacent to the fire. As a result the floor is no longer able to perform its function of load-bearing structural element, while the curtain panel is no longer able to perform its static function or contain the fire within a circumscribed area. It is taken for granted that in such a case the floor and walls will have to be demolished, in practice there being no economically valid alternative.

[0005] Although prefabricated *predalle* slabs and curtain panels of the type provided with weight-reducing elements or closed cavities have existed for decades, nobody has yet succeeded in finding a solution to the problem of preventing the occurrence of the aforedescribed phenomenon in the case of fire.

[0006] The object of the present invention is to provide a device for prefabricated *predalle* slabs or curtain panels comprising weight-reducing blocks or closed cavities which - in the case of fire involving a building the floors and walls of which are constructed using said components - prevents the aforegoing drawback occurring.

[0007] This object is attained by the device of the present invention, comprising a tubular element, a first end of which is open, the relative end portion being inserted or insertable into a weight-reducing element or into a closed cavity provided in the prefabricated *predalle* slabs or in the curtain panels, the remaining part of the tubular element being embedded into the newly cast base of the component during its prefabrication, the second end of the tubular element being closed by a closure element the outer surface of which is intended to at least partly rest on the bottom of the formwork in which the base is cast, the closure element, or at least that portion thereof corresponding to that outer surface intended to rest on the formwork, being of a material which melts or is eliminated as a result of its exposure to the high temperature caused by a fire.

[0008] Consequently, in the case of fire, the closure element, or at least the aforesaid part thereof, acts as a vent valve, which enables the pressurized gases developed in the interior of the floor or of the wall to vent to the outside, hence avoiding compromising the static strength of the base (and hence of the entire floor or wall).

[0009] It should be noted that the high temperature of a fire is able to calcine and hence remove any layer of finishing plaster which may be present on the floor soffit or on the wall, and covering the closure element of the vent device.

[0010] Conveniently the entire closure element and the tubular element of the vent device are of one and the same material, preferably of thermoplastic material (for example a polyethylene sufficiently rigid at ambient temperature), which melts to lose consistency if subjected to the temperature of a fire, which reaches hundreds of degrees.

[0011] The invention will be more apparent from the ensuing description of one exemplary embodiment thereof. In this description reference is made to the accompanying drawing, in which:

Figure 1 is an elevation of a vent device according to the present invention, the device being shown embedded in the base of a prefabricated *predalle* slab or of a curtain panel;

Figure 2 is a view thereof in the direction of the arrow 2 of Figure 1;

Figure 3 is a longitudinal section through the vent

device alone, taken on the line 3-3 of Figure 2.

[0012] As can be seen from the figures, the vent device 10 comprises a tubular element 12 which, in the specific illustrated example, has a circular cross-section. However it should be noted that the shape of the cross-section of the tubular element 12 is not critical, tubular elements being usable having a cross-section of different shape (for example square or hexagonal). The upper end 28 of the tubular element 12 is open and shaped, in the specific illustrated example, as a flute mouthpiece, while the lower end of the tubular element 12 is closed by a closure element 18 presenting an outer central projection 20 of trapezoidal shape (Figure 1).

[0013] This shape could also be different, such as triangular, square or semicircular. As already stated, at least that part of the closure element 18 in correspondence with the projection 20 must, for the entire thickness of this latter, be of a material which loses consistency or is eliminated as a result of its exposure to the high temperature of the fire.

[0014] An intermediate ring 22 extends radially outwards from the lateral surface of the tubular element 12, in an intermediate position. That part of the tubular element 12 above the ring 22 (indicated by 26) is inserted, when installed, into a weight-reducing element (not shown in the figures for simplicity) or into a closed cavity serving the same purpose, the remaining part 14 of the tubular element 12 (from the intermediate ring 22 downwards) being embedded in the r.c. base 16 of a prefabricated *predalle* slab or of a curtain panel. The lower end of the projection 20 of the closure element 18 can be seen to be at the same level as the soffit of the base 16.

[0015] As can be seen from the figures, the closure element 18 projects laterally from the lateral surface of the tubular element 12 and is fixed to this latter (for example glued thereto or formed in one piece therewith). By virtue of this lateral projection the tubular element 12 cannot withdraw from the base 16 during transportation and installation of the *predalle* slab, the device 10 thus also acting as a fixing for the relative weight-reducing block.

[0016] In the specific illustrated example (in which weight-reducing elements are present), the device 10 is also provided with four laterally projecting fins 24 inclined downwards. It has to be noted that the flute mouthpiece-shaped upper end 28 of the tubular element 12 facilitates insertion of the upper portion 26 of the tubular element 12 into the relative weight-reducing element. When this operation has been completed, the fins 24 ensure that the vent device 10 cannot withdraw from the weight-reducing element. As stated, in the case of a *predalle* slab, the vent device 10 also serves to fix the weight-reducing element to the relative base.

[0017] As already stated, the vent device 10 can be advantageously entirely formed of a convenient plastic material, in particular thermoplastic (for example a sufficiently rigid polyethylene), so that the device 10 can be injection moulded in one piece. It should be noted, for example, that the device 10 can have actual dimensions such as those of the figures.

[0018] A brief description will now be given by way of example, of the construction of a prefabricated *predalle* slab comprising vent devices such as the aforedescribed device 10. For a curtain panel the operations are evidently similar.

[0019] Vent devices 10 are firstly driven into relative weight-reducing blocks (for example one vent device 10 about every square metre of the floor under construction) so that the ring 22 comes into contact with the lower surface of the block. The reinforcement mesh, the relative longitudinal lattices and the reinforcement bars are then placed on the bottom of the formwork used to form the prefabricated slab. Concrete is then cast in the formwork to form the base 16 of the *predalle* slab, immediately afterwards placing the rows of weight-reducing blocks on the casting in the prescribed position with their relative vent devices projecting downwards, so that the portion 14 of the tubular element 12 is completely embedded in the casting (hence obtaining the situation of Figures 1 and 2, in which the lower end of the projection 20 rests on the bottom of the formwork). It is then left for the concrete of the casting to set sufficiently to obtain the required *predalle* slab, which can be removed from the formwork.

[0020] It should also be noted that because of the particular shape of the closure element 18 of the vent device 10, when the part 14 of the tubular element 12 is embedded in the casting, the reinforcement mesh (not shown in Figures 1 and 2 for simplicity) of the base 16 does not prevent the resting of the lower projection 20 on the bottom of the formwork, because the shape and dimensions of this projection enable it to pass through the apertures of the reinforcement mesh (generally of dimensions 20 x 20 cm).

[0021] With reference to Figures 1 and 2, it will now be assumed that the vent device 10 shown therein forms part of a prefabricated *predalle* slab used to form a floor of a generic building (the lower face of the r.c. base 16 hence forms the soffit of this floor). It will also be assumed that a fire occurs below this floor, so that the floor may be subjected to temperatures which transform the polystyrene blocks contained in the floor into pressurized gas. If only closed cavities are used as weight-reducing elements, the fire causes the contained air to increase in pressure by being strongly heated. As the *predalle* slabs used comprise the vent devices 10 (for example formed in one piece from polyethylene), and as the said temperatures cause the closure element 18 or at least its projection 20 to melt, in addition to calcining the mortar layer (normally present) below the closure element 18, vent points from which said pressurized gas can escape are obtained in the bottom of the floor (where the devices 10 are located). Consequently these gases can vent downwards without damaging the base 16. It has already been stated that the presence of any

plaster on the lower face of the floor does not prevent the gas venting, as the plaster is the first to be calcined and destroyed by the flames of the fire.

Claims

1. A device (10) for application to prefabricated *predalle* slabs or curtain panels provided with weight-reducing elements or with closed cavities serving the same purpose, and used for constructing reinforced concrete floors or walls, comprising a tubular element (12) a first end (28) of which is open, the relative end portion (26) of the tubular element (12) being inserted or insertable into a weight-reducing element or into a closed cavity, the remaining part (14) of the tubular element (12) being embedded into the newly cast base (16) of the component during its prefabrication, the second end of the tubular element (12) being closed by a closure element (18) the outer surface of which is intended to at least partly rest on the bottom of the formwork in which the base (16) is cast, the closure element (18), or at least that portion (20) thereof corresponding to that outer surface intended to rest on the formwork, being of a material which loses consistency or is eliminated as a result of its exposure to the high temperatures of the fire.

2. A device (10) as claimed in claim 1, wherein said material which loses consistency or is eliminated, and which forms the closure element (18) or at least a part (20) thereof, is a thermoplastic material sufficiently rigid at ambient temperature.

3. A device (10) as claimed in claim 2, wherein the thermoplastic material is polyethylene.

4. A device (10) as claimed in claim 1, wherein the entire vent device (10) is formed of said material which loses consistency or is eliminated.

5. A device (10) as claimed in claim 4, wherein the vent device (10) is in one piece.

6. A device (10) as claimed in claims 3 and 5, wherein the vent device (10) is obtained by injection moulding.

7. A device (10) as claimed in claim 1, wherein the tubular element (12) presents in an intermediate position an external lateral ring (22) which bounds that part (26) of the tubular element (12) to be inserted into the relative weight-reducing block or into the closed cavity.

8. A device (10) as claimed in claim 1, wherein, if weight-reducing elements are present, the tubular element (12) is provided with downwardly projecting lateral fins (24).

9. A device (10) as claimed in claim 1, wherein the closure element (18) is fixed to the tubular element (12) and projects laterally beyond the lateral surface of the tubular element (12).

10. A device (10) as claimed in claim 1, wherein the upper end (28) of the tubular element (10) is shaped as a flute mouthpiece.

11. A device (10) as claimed in claim 1, wherein the cross-section of the tubular element (12) is circular.

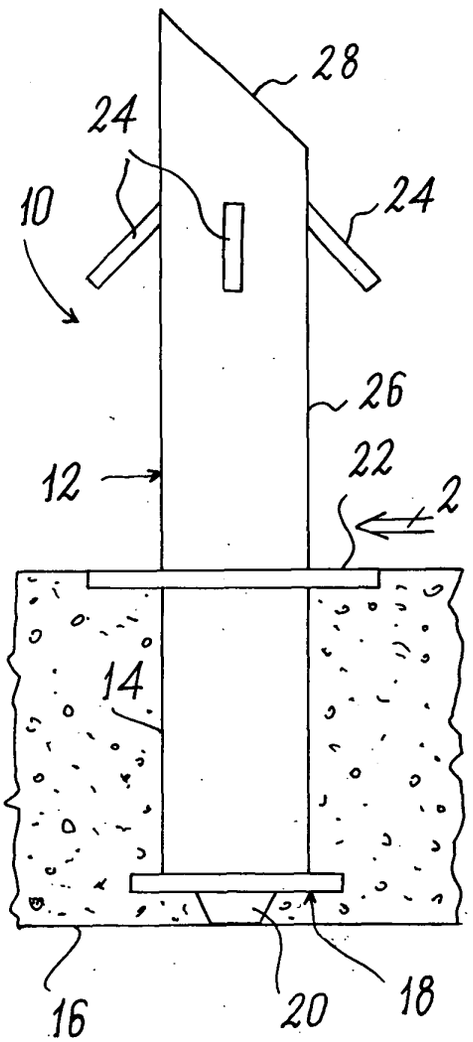

FIG. 1

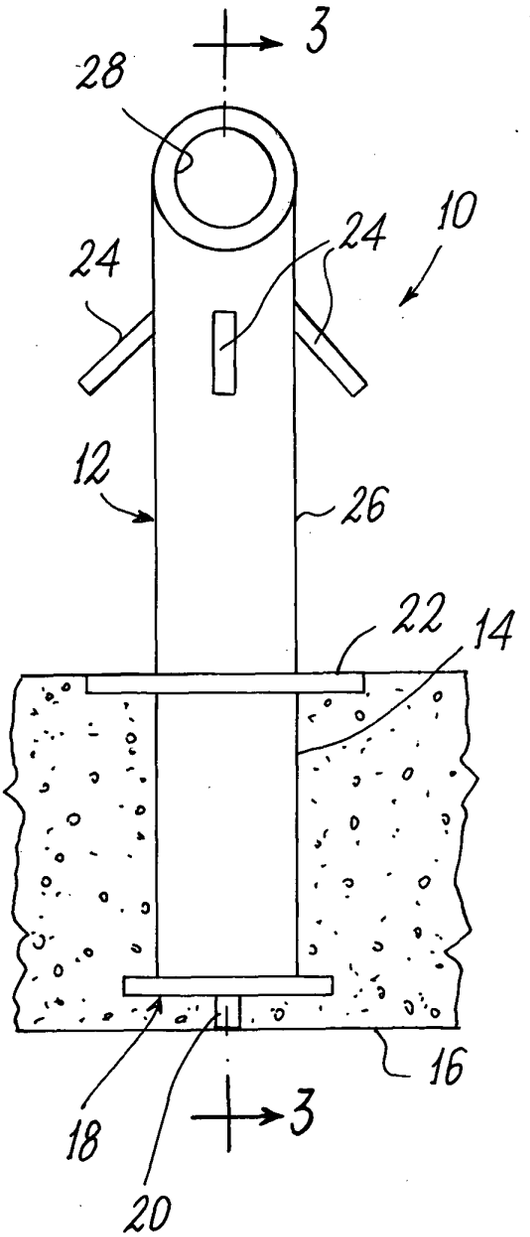

FIG. 2

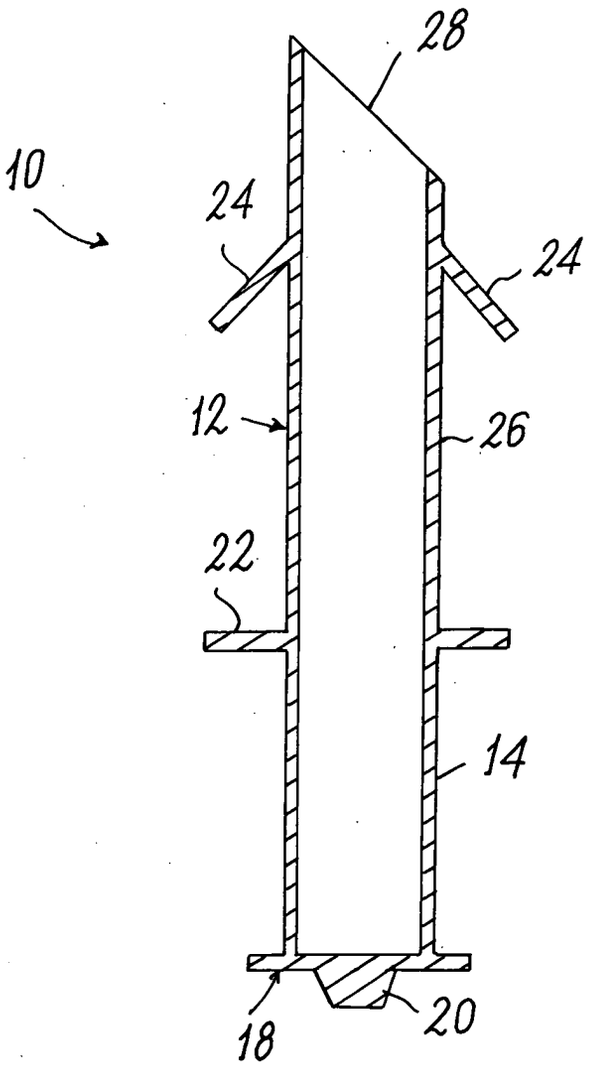

FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 04 00 3596

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	EP 0 136 252 A (STEINBACH & VOLLMANN) 3 April 1985 (1985-04-03) * claim 1; figures 1-3,5,6 *	1-11	E04C2/288 E04B5/02
A	US 3 803 784 A (BECKER O) 16 April 1974 (1974-04-16) * claims 1-4,11; figure 1 *	1-11	
A	US 4 084 362 A (PIAZZA MATTHEW R) 18 April 1978 (1978-04-18) * claim 1; figure 1 *	1-11	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

E04C
E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 April 2004	Rosborough, J

CATEGORY OF CITED DOCUMENTS

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