(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 339 382 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
20.03.2024 Bulletin 2024/12

(21) Application number: **23196968.4**

(22) Date of filing: **12.09.2023**

(51) International Patent Classification (IPC):
E03F 5/06 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
E03F 5/06

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **13.09.2022 IT 202200018666**

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(54) **COVERING ELEMENT FOR A ROAD WELL**

(57) Covering element (10, 110) for a road channel or well (20, 120), comprising a support body (11) provided with edges (12) for resting on said road channel or well (20, 120), one or more rest walls (13) and rib walls (14) projecting from the rest walls (13) in a manner coordinated with the direction of application of a weight force (W). The covering element (10, 110) comprises a plurality of contiguous stiffening load-bearing structures, having a structural function of resisting the load generated by said weight force (W) and each being defined by a lower reinforcement wall (15) connected to at least one corresponding rib wall (14) which is in turn connected to a corresponding rest wall (13).

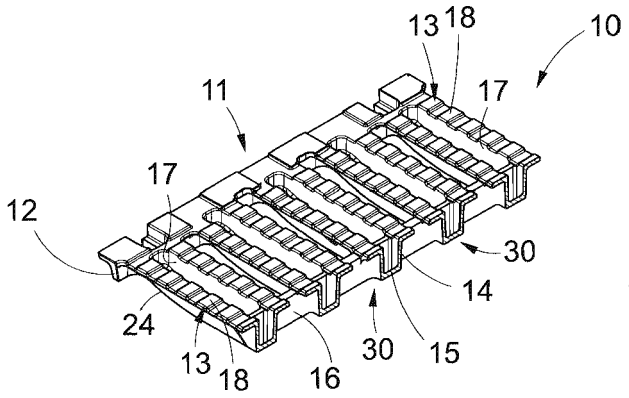

fig. 2

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a covering, closing or crowning element, such as a grid, a manhole cover, a drain cover or suchlike, for a road well, such as for example a drainage channel or other. In particular, the present invention is applied as an inspectable covering or closing element that allows a desired passage of air and/or water inside the corresponding road well, both for drainage purposes and also for aeration purposes.

BACKGROUND OF THE INVENTION

[0002] Elements for covering, closing or crowning road wells are known, such as for example grids, or drains, for drainage channels, for example of the type provided at the edges of sidewalks, cycle paths, road tracks or other traffic routes, but also parking areas or special areas for particularly high loads such as ports, airports or industrial sites.

[0003] It is also known that, depending on the specific application, the relevant regulations require mechanical characteristics that refer to specific and progressive load and bending strengths, defined by current legislation, such as EN 1433.

[0004] Known grids are generally structured with a metal plate, for example in cast iron or steel cast, provided with at least two rest edges on the side walls of the well and on which a plurality of through slots are created or molded, distanced apart from each other to define intermediate rest walls, so as to substantially form a grating capable of draining water and mechanically counteracting the overhead load of a pedestrian or a vehicle, according to the values and modes described in the international regulatory norms of the sector.

[0005] It is also known that, in order to optimize the mechanical resistance characteristics, transverse ribs are provided projecting from the rest walls in a manner coordinated with the direction of application of the load.

[0006] These solutions give each rest wall a substantially T-shaped cross-section, overall defining a substantially comb-shaped transverse conformation of the grid.

[0007] It is also known to provide ribs with a trapezoidal longitudinal shape, that is, arched, or possibly semicircular, to support the load distribution and the intensity of the bending. On the transverse side, on the other hand, known ribs are tapered downward, in order to promote the conditions of extraction from the forming molds that are normally used.

[0008] One of the main disadvantages of this type of conformation is precisely that it has the thinnest, that is, the least performing, section in the point of the grid that is the most stressed and subjected to traction, that is, the lowest part of the rib, precisely due to the tapered transverse conformation of the rib.

[0009] Therefore, in order to increase the compressive strength of the grid, the entire thickness and height of the rib is normally increased proportionally, with a consequent significant increase in weight, overall dimensions in the lower part, as well as waste of material (not involved in giving resistance to the product) and therefore production costs.

[0010] In addition, the climatic conditions of recent years require hydraulic solutions that use channels, pipes and wells of increasingly large sizes, and therefore large grids and manhole covers with large catchment sections to increase the speed of rainwater disposal.

[0011] This market need only emphasizes the disadvantages described so far.

[0012] Document DE202019005414 U1 describes a covering grid for a water collection and drainage offlet, which can be a gutter or can be made in the ground. The covering grid comprises one or more upper rest or walking walls, and rib walls protruding downward with respect to the rest walls, thus forming an inverted "U" with them. The lower parts of the rib walls rest on the offlet, and between them there is a plurality of aligned reinforcement portions reciprocally distanced apart from each other to allow the passage of water toward the offlet, and having a segment that is parallel and a segment that is slightly inclined with respect to the rest walls. The grid is made from a single suitably bent and shaped piece of sheet metal, therefore it has a reduced weight and thicknesses, and it can be able to support and withstand low weight forces, for example a few tens or, at most, a few hundred kilograms.

[0013] Documents KR102049984 B1, KR102353812 B1 and CN213268249 U describe covering grids that are obtained from shaped, or modular, pieces assembled together by means of hooks, pins, bolts or by welding.

[0014] Document DE202014102436 U1 describes a cast iron covering grid having a plurality of water passage holes of various shapes and sizes on the walking surface. The grid is provided with a plurality of rectilinear, or arcuate, rib walls having different shapes and sizes, connected to each other by stiffening plates transverse to them.

[0015] There is therefore the need to perfect a covering, closing or crowning element for a road well that can overcome at least one of the disadvantages of the state of the art.

[0016] To do this, it is necessary to solve the technical problem of creating a covering element that complies with the structural regulations in force, without requiring a proportional increase in the sizes and thicknesses, with a consequent increase in weight and overall dimensions.

[0017] In particular, one purpose of the present invention is to provide a covering, or closing, or crowning element for a road well that allows to respect the loading and bending conditions required by current regulations and, at the same time, allows to reduce the overall dimensions and weights of, in particular, its structural parts.

[0018] Another purpose of the present invention is to

provide a covering, or closing, or crowning element which is simple and economical to produce, while guaranteeing compliance with current regulations.

[0019] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0020] The present invention is set forth and characterized in the independent claim. The dependent claims describe other characteristics of the present invention or variants to the main inventive idea.

[0021] In accordance with the above purposes and to resolve the technical problem disclosed above in a new and original way, also achieving considerable advantages compared to the state of the prior art, a covering or crowning element according to the present invention, for a road well or a drainage channel, comprises a metal support body, made of cast iron or steel cast, produced from a single casting. The support body is provided with one or more rest walls which, in some embodiments, are substantially coplanar with respect to the walking plane on which the road well is created, and are distanced apart from each other by a plurality of drainage slots, the latter being created on the support body, defining a grating. Advantageously, the support body also comprises two rest edges, by means of which it is positioned and possibly attached to the lateral side walls of the road well.

[0022] The support body also comprises rib walls projecting from the rest walls in a manner coordinated with the direction of application of a weight force.

[0023] Moreover, the covering element also has the advantage of guaranteeing economic savings linked to the use of a smaller quantity of raw material. It follows that, advantageously, there are lower transport costs linked to the reduction in the weight of the covering elements.

[0024] Here and hereafter in the description, we will specifically refer to a support body made of cast iron or cast steel, but it is not excluded that the same support body can be effectively made with other known materials having structural characteristics that are equivalent to, or substitutes for, the metals indicated here, and in any case suitable for the purpose.

[0025] In accordance with one aspect of the present invention, the covering element comprises a plurality of contiguous stiffening load-bearing structures, having a structural function of resisting the load generated by said weight force, and each being defined by a lower reinforcement wall connected to at least one corresponding rib wall, which is in turn connected to a corresponding rest wall. Each reinforcement wall is capable of resisting the tensile stresses generated by the weight force and disposed substantially parallel, or slightly inclined, with respect to the rest wall. Moreover, each reinforcement wall is monolithic and continuous along the entire longitudinal extension of the corresponding rib wall.

[0026] Doing so achieves at least an increase in the inertial mass in the direction of application of the load, due to the position of the reinforcement wall on the rib wall, so as to increase the corresponding moment of inertia and, therefore, the tensile resistance in the section that is more subjected to stress when the covering element is placed under load.

[0027] In other words, the masses are increased in an optimized manner and disposed appropriately, essentially only where they intervene effectively for the purposes of resisting the mechanical stresses involved, in this case the overall capacity of the covering or crowning element.

[0028] Therefore, with the solution according to the present invention, in the same manner in which the masses are increased and disposed where the mechanical stress to be counteracted is greatest, they can be lightened or even removed from the zones in which the stresses are reduced, or irrelevant, in terms of capacity.

[0029] In some particularly advantageous embodiments, the Applicant has tested that, with the same mechanical and bending resistance as known solutions, the covering or crowning element according to the present invention creates a saving in weight of material comprised in a range between approximately 10% and approximately 25%, in relation to the overall dimensions, the production technique and the choice of geometry or aesthetics that are to be achieved.

[0030] It is clear that such a range of weight reduction entails a consequent reduction in production costs, as well as overall dimensions, meeting the current market demands relating to the increase in size of road wells, with large catchment sections, to increase the speed of rainwater disposal.

[0031] It is clear that the solution according to the present invention can also be effectively applied to smaller wells, generally with a free gap of between 100mm and 200mm.

[0032] In accordance with another aspect of the present invention, each reinforcement wall is made at a lower end of the rib wall, on the opposite side with respect to the rest wall. This advantageous solution allows to take the resistant mass precisely in correspondence with the maximum bending traction to which the rib wall is subjected, and therefore optimize its effective positioning to the maximum.

[0033] In accordance with another aspect of the present invention, each reinforcement wall at least partly protrudes from one side with respect to the rib wall. According to possible embodiments, each reinforcement wall at least partly protrudes from both sides with respect to the rib wall.

[0034] In accordance with another aspect of the present invention, at least one of the reinforcement walls is made as a connection between two adjacent rib walls, forming a substantially box-shaped structure.

[0035] In accordance with another aspect of the present invention, the rib walls which are disposed trans-

versely with respect to the walls of the drainage channel have a shaped longitudinal conformation, and the reinforcement walls have a conformation shaped in a coordinated manner with respect to that of the rib walls.

[0036] According to another aspect of the present invention, each reinforcement wall has a substantially continuous conformation along the entire longitudinal extension of the rib wall.

[0037] Furthermore, according to some embodiments, the reinforcement walls are possibly made in an alternating manner on the rib walls, along the longitudinal extension of the drainage channel or well. In addition, each reinforcement wall comprises at least one lightening aperture made along the longitudinal extension of the rib wall.

[0038] According to another aspect of the present invention, the covering or crowning element comprises at least one stiffening wall disposed substantially transverse to the rib walls.

[0039] In accordance with another aspect of the present invention, the covering element rests with perimeter portions directly on the lateral side walls of the drainage channel, while the rest edges contact, with a lateral surface thereof, an upper lateral portion of the draining cavity, thus guaranteeing an effective and solid coupling between the grid itself and the drainage channel.

[0040] In accordance with some embodiments of the present invention, the stiffening load-bearing structures are each defined by a box structure comprising a reinforcement wall connected to two reciprocally facing rib walls, which are each connected to a corresponding rest wall in such a way as to determine an inverted Ω shape.

[0041] In accordance with other embodiments of the present invention, the stiffening load-bearing structures are conformed in such a way as to have an "S" or "Z" shape.

[0042] In accordance with another aspect of the present invention, according to a first variant, the covering element comprises first drainage slots which are delimited by two corresponding rest walls of a same box structure, wherein the rest walls of two different adjacent box structures are in contact with each other.

[0043] In accordance with another aspect of the present invention, according to a second variant, the covering element comprises first drainage slots which are delimited by two corresponding rest walls of a same box structure, wherein the rest walls of two different box structures are adequately distanced apart from each other in such a way as to define second drainage slots.

[0044] In accordance with another aspect of the present invention, according to a third variant, the covering element comprises first drainage slots which are delimited by two corresponding rest walls of a same box structure, wherein the rest walls of two different box structures are adequately distanced apart from each other in such a way that between them there is disposed a corresponding runoff element for the water, preferably having a "V" or "U" shaped section, which defines second drainage slots with its conformation and which extends up to the rest edges to collaborate with them in order to guarantee a stable support.

[0045] In accordance with other embodiments of the present invention, the stiffening wall is able to distribute the load generated by the weight force on multiple box structures disposed parallel to each other, in such a way as to counteract any torsions or vibrations, and to divide the length of the drainage slots.

[0046] In accordance with another aspect of the present invention, the covering element is in a single piece and obtained by casting molten metal material, in particular iron, cast iron, steel, or one or more plastic or composite materials based on synthetic resins.

DESCRIPTION OF THE DRAWINGS

[0047] These and other aspects, characteristics and advantages of the present invention will become apparent from the following description of some embodiments, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a front view of a first embodiment of a covering element according to the present invention, applied to a drainage channel;
- fig. 2 is a three-dimensional section view of the covering element of fig. 1;
- fig. 3 is a detailed view of the section of fig. 2;
- fig. 4 is a front view of a second embodiment of a covering element according to the present invention, applied to a drainage channel;
- fig. 5a is a three-dimensional section view from above of the covering element of fig. 4;
- fig. 5b is a three-dimensional section view from below of the covering element of fig. 4;
- fig. 6 is a detailed view of the section of fig. 4;
- fig. 7 is a front view of a third embodiment of a covering element according to the present invention, applied to a drainage channel;
- fig. 8 is a three-dimensional section view of the covering element of fig. 7;
- fig. 9 is a detailed view of the section of fig. 8;
- fig. 10 is a front view of a fourth embodiment of a covering element according to the present invention, applied to a drainage channel;
- fig. 10a is an enlarged and out-of-scale detail of fig. 10;
- fig. 11 is a three-dimensional section view of the covering element of fig. 10;
- fig. 12 is a detailed view of the section of fig. 11;
- fig. 13 is a front view of a fifth embodiment of a covering element according to the present invention, applied to a drainage well;
- fig. 14 is a three-dimensional section view of the covering element of fig. 13;
- fig. 15 is a detailed view of the section of fig. 14;
- fig. 16 is a detailed, partly sectioned lateral view of

a covering element according to a first variant;
- fig. 17 is a detailed, partly sectioned lateral view of a covering element according to a second variant;
- fig. 18 is a detailed, partly sectioned lateral view of a covering element according to a third variant; and
- fig. 19 is an enlarged, partly sectioned perspective view of a detail of fig. 2.

[0048] We must clarify that the phraseology and terminology used in the present description, as well as the figures in the attached drawings also in relation as to how described, have the sole function of better illustrating and explaining the present invention, their purpose being to provide a non-limiting example of the invention itself, since the scope of protection is defined by the claims.

[0049] To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one embodiment can be conveniently combined or incorporated into other embodiments without further clarifications.

DESCRIPTION OF SOME EMBODIMENTS OF THE PRESENT INVENTION

[0050] With reference to the attached drawings, a covering, or closing, or crowning element according to the present invention is, in this specific case, a grid 10, or drain, applied to a drainage channel 20, or in the form of a manhole cover 110 applied to a well 120, in this specific case with a square shape.

[0051] In particular, with regard to the manhole cover 110, it is not excluded that it can be understood as a drain or other covering element provided with apertures for water drainage.

[0052] In the embodiments shown and described below, the drainage channel 20, or the well 120, are shown schematically for the sole purpose of further clarifying the operational application of the grid 10, or of the corresponding manhole cover 110. It is clear that the drainage channel 20, or the well 120, can have different sizes and conformations, more aligned with the functional needs of the roadwork to which it is applied.

[0053] We must clarify that the drainage channel 20, or well 120, can be made in correspondence with roads, parking lots, airports and/or transit areas for cars, heavy duty vehicles and motor vehicles in general.

[0054] In the embodiments shown from fig. 1 to fig. 12, the drainage channel 20 is generally defined by a draining cavity 21, having a certain depth and width as a function of the required drainage flow rate, and by two lateral containment side walls 22 made of concrete.

[0055] In the embodiment shown from fig. 13 to fig. 15, the well 120 is generally defined by a runoff cavity 121, having a certain depth and width as a function of the required drainage flow rate, and by at least two lateral containment side walls 122 made of concrete.

[0056] Preferably, the closing element, or grid, 10, or manhole cover 110 are produced by means of a single casting, to thereby obtain a single piece. The material used can be iron, cast iron, steel or similar materials that allow to obtain said single piece.

[0057] Both with reference to the embodiments shown from fig. 1 to fig. 12, and also in the one shown from figs. 13 to 15, the grid 10, or the manhole cover 110, commonly consist mainly of a support body, or a support plate 11 made through cast iron molding, by means of normal foundry machines, for example with the so-called "sand casting" system, both horizontal as well as vertical, and also with multiple castings. In such a system, the metal in the liquid state is cast in a temporary mold created within a block of composite soil resistant to heat and permeable to the gases emitted. Specifically, it is a soil composed of silica sand, clay, bentonite, sodium silicates and various additives in a single block that after cooling is easily destroyed, releasing the desired single piece.

[0058] In particular, the support plate 11 comprises rest edges 12 created at least along the opposite longitudinal sides thereof, that is, perimetrically to the support plate 11 itself, so that they can rest on the upper ends of the corresponding lateral side walls 22 and 122 and keep the support plate 11 intentionally suspended above the draining cavity 21 or the runoff cavity 121.

[0059] With particular, but not exclusive, reference to the solution with the manhole cover 110, the rest edges 12 are also created along the transverse sides of the support plate 11, for example to rest on a corresponding front or rear side wall (not shown), for example in the event it is applied to a well 121 with four concurrent side walls, or to cooperate with a manhole cover 110 or an adjacent grid 10.

[0060] It is also possible, although not shown, that rest edges 12 are provided on all the transverse and longitudinal sides of the plate 11 and with crossed or concurrent reinforcements.

[0061] In the solution shown in figs. from 1 to 12 and 17, the support plate 11 comprises a plurality of rest walls 13 disposed substantially transverse and distanced apart from each other grid-wise by corresponding drainage slots 17, 17' made through on the support plate 11 itself. According to possible variants, the drainage slots 17, 17' can be defined by first drainage slots 17 in combination, or not, with second drainage slots 17'.

[0062] Advantageously, a plurality of bosses 18 are provided on the upper surface of the rest walls 13, which are capable of improving the surface friction conditions of the grid 10, so as to substantially uniform the grip of the tires travelling between the asphalted road surface and the metal surface of the grid 10.

[0063] At the bottom part of each rest wall 13 there are corresponding rib walls, or ribs 14, each of which extends toward the draining cavity 21 following a direction coordinated to the direction of application of a certain weight force W.

[0064] Here and hereafter in the description and claims, by the term weight force W, also in view of the

preferential road application of the object of the present invention, we mean both the weight force itself, defined by the mass of the grid 10 or of the manhole cover 110, and also the sum of the loads applied on the grid 10 or on the manhole cover 110, due, for example, to the passage of pedestrians and/or vehicles specific to the actual application of the grid 10, or of the manhole cover 110, that is, all the prevailing stresses that determine the bending sizing criteria of the grid 10, or of the manhole cover 110.

[0065] We must also clarify that the weight force W can also be tens of tons. Therefore, the closing element, or grid, 10, or manhole cover 110, are able to withstand very high loads, higher than said weight force W.

[0066] In addition, the closing element, or grid, 10, or manhole cover 110, is made in such a way as to comply with certain characteristics, or parameters, set forth in current European or international legislation, and contained in the EN 1433 standard, for example.

[0067] The closing element, or grid 10 according to the present invention comprises a plurality of reinforcement walls 15, which are created in one piece with the ribs 14, advantageously at a corresponding lower end of the latter, and oriented substantially parallel to the rest walls 13. In this way, a plurality of contiguous stiffening load-bearing structures are formed, having a structural function of resisting the load generated by the weight force W, and each defined by a lower reinforcement wall 15 connected to at least one corresponding rib wall 14, in turn connected to a corresponding rest wall 13.

[0068] By the term "structural function" we mean that this box structure 30 allows to obtain the maximum performance in terms of stability and reaction to the load generated by the weight force W.

[0069] Each reinforcement wall 15 is able to withstand the tensile stresses generated by the weight force W and disposed substantially parallel, or slightly inclined, with respect to the rest wall 13. Furthermore, each reinforcement wall 15 is monolithic and continuous along the entire longitudinal extension of the corresponding rib wall 14.

[0070] We must clarify that with the expression "monolithic and continuous" it can be understood that the reinforcement wall 15 is made in a single piece along the entire longitudinal extension of the corresponding rib wall 14, from one rest edge 12 to the other. This is valid even if one or more apertures are created in the reinforcement wall 15 along its longitudinal extension.

[0071] With reference to the first embodiment shown in figs. from 1 to 3, the rib 14 has a longitudinal shape that is substantially jointed trapezoidal, so as to be more resistant to bending in correspondence with the greater stress given by the weight force W applied, and in any case allowing the outflow of the water to be drained.

[0072] We must clarify that the term "longitudinal" relating to the ribs 14 and present here and in other parts of the description, is used as a reference to the direction of oblong development of the rib 14 and not with reference to the disposition of the drainage channel 20 itself, which develops in a transverse direction with respect to the disposition of each rib 14.

[0073] According to some embodiments, the rib walls, or ribs, 14 can be made so as to have respective inclined terminal portions 24 that connect to the rest edges 12. Moreover, in correspondence with the inclined portions 24, respective front apertures 23 for draining the water that accumulates inside the box structure 30 (fig. 19) can be made on the corresponding reinforcement wall 15.

[0074] In this case, as shown in fig. 3, the ribs 14 have an extension that is slightly inclined, yet still coordinated, with respect to the direction of application of the weight force W, so as to promote the draft of the normal molding equipment provided to manufacture the grid 10.

[0075] In this first embodiment, the reinforcement walls 15 are created in such a way as to connect the ribs 14 two by two, and thus define the box structures having an inverted Ω shape, which bring additional advantages to the structural stability of the grid 10. In other words, in this embodiment, the stiffening load-bearing structures are each defined by a box structure 30 comprising a reinforcement wall 15 connected to two reciprocally facing ribs 14, each connected to a corresponding rest wall 13, so as to determine the inverted Ω shape.

[0076] According to possible embodiments, the reinforcement walls 15 are possibly created in an alternated manner on corresponding rib walls 14, along the longitudinal extension of the road channel or well 20, 120.

[0077] This solution can provide that the reinforcement walls 15 have a continuous extension coordinated to the longitudinal development of the rib 14.

[0078] In this first embodiment, at least one stiffening wall 16 is also provided, made below the rest walls 13 in a direction that is substantially longitudinal to the support plate 11. In this specific case, a single stiffening wall 16 is provided disposed in a substantially median zone between the two rest edges 12, in order to confer a desired resistance to bending, also in a longitudinal direction to the grid 10, or to divide the length of the drainage slot 17 in order to improve and optimize accessibility on the support plate 11.

[0079] In general, each stiffening wall 16 is able to distribute the load on several box structures 30 disposed parallel to each other, so as to counteract any torsions or vibrations. In addition, the stiffening walls allow to divide the length of the drainage slots 17 in order to improve the passage of pedestrians and cyclists on the grid.

[0080] With reference to the second embodiment shown in figs. from 4 to 6, the rib 14 has an arcuate longitudinal shape, or possibly substantially semicircular, also in this case to be more resistant to the bending given by the weight force W applied.

[0081] Also in this case, as shown in fig. 6, the ribs 14 have an extension that is slightly inclined, yet still coordinated, with respect to the direction of application of the weight force W, so as to promote the draft of the normal molding equipment provided to manufacture the grid 10.

[0082] Also in this embodiment, the reinforcement

walls 15 are created so as to connect the ribs 14 two by two and define the semi-box structures with a substantially inverted Ω shape; however, in this case through lightening holes 19 are provided, which also allow the drainage of the stagnant water toward the draining cavity 21.

[0083] Always in order to promote the drainage of the water toward the draining cavity 21 and prevent the stagnation of the same water within the inverted Ω shape defined by the ribs 14 and the reinforcement walls 15, corresponding front apertures 23 are created, which allow the drainage of the residual water also from the end front portions, further improving the drainage capacity of the grid 10 thus manufactured.

[0084] Also in this embodiment, the stiffening load-bearing structures are each defined by a box structure 30 which comprises a reinforcement wall 15 connected to two reciprocally facing ribs 14, each connected to a corresponding rest wall 13, so as to determine the inverted Ω shape.

[0085] In this second embodiment, two stiffening wall 16 are also provided, made below the rest walls 13 in a direction that is substantially longitudinal to the support plate 11. In this specific case, the stiffening walls 16 are disposed substantially symmetrical with respect to a median plane between the two rest edges 12, in order to confer a desired resistance to bending, also in a longitudinal direction to the grid 10. The number and position of the stiffening walls 16 is advantageously chosen as a function of the sizes and loads to which the grid 10 is operatively subjected.

[0086] In a first variant (fig. 16), first drainage slots 17 are provided which are delimited by two corresponding rest walls 13 of a same box structure 30. In this case, the rest walls 13 of two different adjacent box structures 30, with the exception of the initial and terminal ones, are in contact with each other.

[0087] In a second preferred variant (figs. from 1 to 12 and 17), the first drainage slots 17 are provided and the rest walls 13 of two different box structures 30 are adequately distanced apart from each other in such a way as to define second drainage slots 17'.

[0088] In a third variant (fig. 18), the first drainage slots 17 are provided and the rest walls 13 of two different box structures 30 are adequately distanced apart from each other in such a way that a corresponding runoff element 28 is disposed between them, preferably having a "V" or "U" shaped section. With its conformation, the runoff element 28 defines the second drainage slots 17' and extends up to the rest edges 12 cooperating with them in order to guarantee a stable support of the grid 10.

[0089] With reference to the third embodiment shown in figs. from 7 to 9, the rib 14 has a substantially arcuate longitudinal shape, or possibly substantially semicircular, also in this case to be more resistant to the bending given by the weight force W applied.

[0090] Also in this case, as shown in fig. 9, the ribs 14 have an extension that is slightly inclined, yet still coordinated, with respect to the direction of application of the weight force W, so as to promote the draft of the normal molding equipment provided to manufacture the grid 10.

[0091] In this embodiment, the reinforcement walls 15 are created either on one side or on the other side, with respect to the rib 14, so that they define, with the corresponding rest walls 13, a substantially "S" or "Z" shaped section. In this specific case, there are also two central ribs 14 without the reinforcement walls 15, thus generating a symmetry that counteracts the deformations imposed by the load W.

[0092] Therefore, in this embodiment, the stiffening load-bearing structures are conformed in such a way as to have a reinforcement wall 15 connected to at least one rib 14, and each connected to a corresponding rest wall 13, thus determining an "S" or "Z" shape.

[0093] In this third embodiment, five stiffening wall 16 are provided, made below the rest walls 13 in a direction that is substantially longitudinal to the support plate 11. In this specific case, there are provided a median stiffening wall 16 that extends for the entire depth of the ribs 14, and four lateral stiffening walls 16 having a lower depth and disposed substantially symmetrically with respect to a median plane between the two rest edges 12.

[0094] With specific reference to the fourth embodiment shown in figs. from 10 to 12, the rib 14 has an arcuate longitudinal shape, or possibly substantially semicircular, also in this case to be more resistant to the bending given by the weight force W applied.

[0095] In this case, as shown in fig. 12, some ribs 14 have an extension that is slightly inclined, yet still coordinated, with respect to the direction of application of the weight force W, while other ribs 14 are substantially vertical, but tapered downward, again to promote the draft of the normal molding equipment provided to manufacture the grid 10.

[0096] In this embodiment, substantially as in the second embodiment, the reinforcement walls 15 are created so as to connect the ribs 14 two by two, and through lightening holes 19 are provided which also allow the drainage of the stagnant water toward the draining cavity 21. Unlike the second embodiment, in this case there are also ribs 14 without reinforcement walls 15.

[0097] Therefore, also in this embodiment, the stiffening load-bearing structures are each defined by a box structure 30 which comprises a reinforcement wall 15 connected to two reciprocally facing ribs 14, each connected to a corresponding rest wall 13, so as to determine the inverted Ω shape.

[0098] In this fourth embodiment, triangular-shaped stiffening walls 16 are provided, created as a connection between the ribs 14 and the corresponding rest walls 13, in specific and individual positions.

[0099] In fact, the limited lateral sizes of the grid 10, compared to the other embodiments described and shown so far, do not require one or more stiffening walls 16 extending longitudinally to the support plate 11, but can be reduced and focused on specific positions, to

achieve the desired mechanical strength conditions.

[0100] According to the invention, the number and position of the stiffening walls 16 are advantageously chosen as a function of the sizes and loads to which the grid 10 is operatively subjected, further optimizing the ratio between mechanical strength and weight of the grid 10, as well as the aesthetics and accessibility of the support plate 11.

[0101] It should be noted that in this fourth embodiment the grid 10 can rest with perimeter portions 26 of the support plate 11 directly on the lateral side walls 22 of the drainage channel 20, while the rest edges 12 contact the draining cavity 21 with a lateral surface 27 thereof, thus guaranteeing an effective and solid coupling between the grid 10 itself and the drainage channel 20 (fig. 10).

[0102] With specific reference to the fifth embodiment shown in figs. from 13 to 15, the manhole cover 110 has the rib 14 with a longitudinal shape that is substantially trapezoidal, so as to be more resistant to bending, in correspondence with the greater stress given by the weight force W applied and, in any case, allowing the outflow of the water to be drained.

[0103] In this embodiment, the ribs 14 are disposed two by two, so as to extend and define two transverse pairs and two longitudinal pairs, with respect to the rest wall 13.

[0104] According to the invention, also in this embodiment, the reinforcement walls 15 are created so as to connect the ribs 14 two by two and define the box structures, having a substantially inverted Ω shape, which, in this case, are substantially orthogonal to each other. Also in this case, the reinforcement walls 15 are monolithic and such as to withstand the tensile stresses generated by the weight force W.

[0105] Therefore, in this embodiment, the stiffening load-bearing structures are each defined by a box structure 30 which comprises a reinforcement wall 15 connected to two reciprocally facing ribs 14, each connected to the rest wall 13, so as to determine the inverted SZ shape.

[0106] Always in order to promote the drainage of the water toward the runoff cavity 121 and prevent the stagnation of the same water inside the inverted Ω shape defined by the ribs 14 and the reinforcement walls 15, corresponding front apertures 23 are created (figs. 5b, 6), which allow the drainage of the residual water also from the end front portions, further improving the drainage capacity of the manhole cover 110 thus created.

[0107] Although not shown in detail, also in this embodiment of the manhole cover 110 according to the present invention, a plurality of bosses 18 can be provided on the upper surface of the rest walls 13, which are capable of improving the surface friction conditions of the manhole cover 110, so as to substantially uniform the grip of the tires travelling between the paved road surface and the metal surface of the manhole cover 110 itself, as well as decreasing the possibility of slipping on pedestrian areas.

[0108] In the same way, although not shown, specific drainage slots 17 can be made through on the support plate 11.

[0109] It is clear that modifications and/or additions of parts may be made to the grid 10 as described heretofore, without departing from the field and scope of the present invention, as defined by the claims.

[0110] For example, according to one possible variant, the various ribs 14, the reinforcement walls 15 and the stiffening walls 16, instead of being made in one piece with the support plate 11, can be made individually and then welded together to define the desired resistant geometry according to the characteristics of the present invention.

[0111] It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art will be able to achieve other equivalent forms of covering, closing or crowning element for a road well, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

[0112] In the following claims, the sole purpose of the references in brackets is to facilitate their reading and they must not be considered as restrictive factors with regard to the field of protection defined by the claims.

Claims

1. Covering element (10, 110) for a road channel or well (20, 120) comprising a support body (11) provided with edges (12) for resting on said road channel or well (20, 120), one or more rest walls (13) and rib walls (14) projecting from said rest walls (13) in a manner coordinated with the direction of application of a weight force (W), **characterized in that** it comprises a plurality of contiguous stiffening load-bearing structures, having the structural function of resisting the load generated by said weight force (W) and each being defined by a lower reinforcement wall (15) connected to at least one corresponding rib wall (14) which is in turn connected to a corresponding rest wall (13), wherein each reinforcement wall (15) is capable of resisting the tensile stresses generated by said weight force (W), disposed substantially parallel, or slightly inclined, with respect to said rest wall (13), and is monolithic and continuous along the entire longitudinal extension of the corresponding rib wall (14).

2. Covering element (10, 110) as in claim 1, **characterized in that** each reinforcement wall (15) is made at a lower end of said rib wall (14), on the opposite side with respect to said rest wall (13).

3. Covering element (10, 110) as in claim 2, **characterized in that** each reinforcement wall (15) at least

partly protrudes from one side with respect to said rib wall (14), or from both sides with respect to said rib wall (14).

4. Covering element (10, 110) as in claim 1, 2 or 3, wherein said rib walls (14) have a shaped longitudinal conformation, **characterized in that** each reinforcement wall (15) has a conformation shaped in a coordinated manner with respect to said rib walls (14).

5. Covering element (10, 110) as in one or the other of the previous claims, **characterized in that** the reinforcement walls (15) are made in an alternating manner on corresponding rib walls (14), along the longitudinal extension of said road channel or well (20, 120).

6. Covering element (10, 110) as in one or the other of the previous claims, **characterized in that** each reinforcement wall (15) comprises at least one lightening aperture (19) made along said longitudinal extension of said rib wall (14).

7. Covering element (10, 110) as in one or the other of the previous claims, **characterized in that** said stiffening load-bearing structures are each defined by a box structure (30) comprising a reinforcement wall (15) connected to two reciprocally facing rib walls (14) which are each connected to a corresponding rest wall (13), in such a way as to determine an inverted Ω shape.

8. Covering element (10, 110) as in claim 7, **characterized in that** said box structure (30) is open at at least one end, in correspondence with one of said rest edges (12), thus defining a front aperture (23) for draining the residual water present inside said box structure (30).

9. Covering element (10, 110) as in one or the other of claims from 1 to 6, **characterized in that** said stiffening load-bearing structures are conformed in such a way as to have an "S" or "Z" shape.

10. Covering element (10, 110) as in one or the other of the previous claims, **characterized in that** it comprises a plurality of drainage slots (17, 17') created on said support body (11) between two corresponding rest walls (13).

11. Covering element (10, 110) as in claim 10 when it depends on claim 7 or 8, **characterized in that** it comprises first drainage slots (17) which are delimited by two corresponding rest walls (13) of a same box structure (30), wherein the rest walls (13) of two different adjacent box structures (30) are in contact with each other.

12. Covering element (10, 110) as in claim 10 when it depends on claim 7 or 8, **characterized in that** it comprises first drainage slots (17) which are delimited by two corresponding rest walls (13) of a same box structure (30), wherein the rest walls (13) of two different box structures (30) are adequately distanced apart from each other in such a way as to define second drainage slots (17').

13. Covering element (10, 110) as in claim 10 when it depends on claim 7 or 8, **characterized in that** it comprises first drainage slots (17) which are delimited by two corresponding rest walls (13) of a same box structure (30), wherein the rest walls (13) of two different box structures (30) are adequately distanced apart from each other in such a way that between them there is disposed a corresponding runoff element (28) of said water, preferably having a "V" or "U" shaped section, which with its conformation defines second drainage slots (17') and which extends up to said rest edges (12) in order to collaborate with them to guarantee a stable support.

14. Covering element (10, 110) as in one or the other of the previous claims, **characterized in that** it comprises at least one stiffening wall (16) disposed substantially transverse to said rib walls (14), and able to distribute the load generated by said weight force (W) on multiple stiffening load-bearing structures disposed parallel to each other, in such a way as to counteract any torsions or vibrations.

15. Covering element (10, 110) as in one or the other of the previous claims, **characterized in that** it is in a single piece and obtained by casting molten metal material, in particular iron, cast iron, steel, or one or more plastic or composite materials based on synthetic resins.

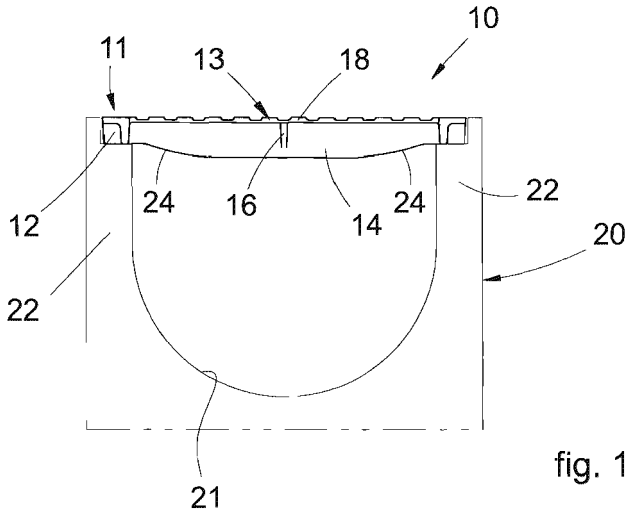

fig. 1

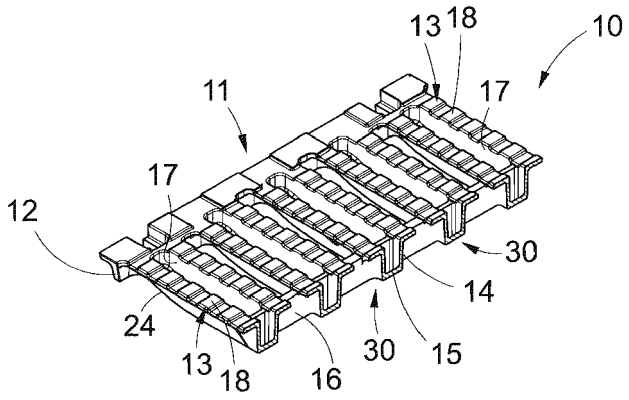

fig. 2

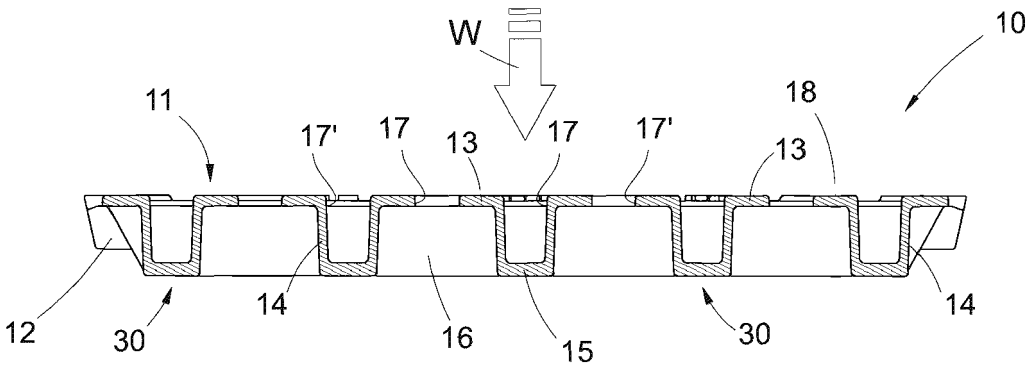

fig. 3

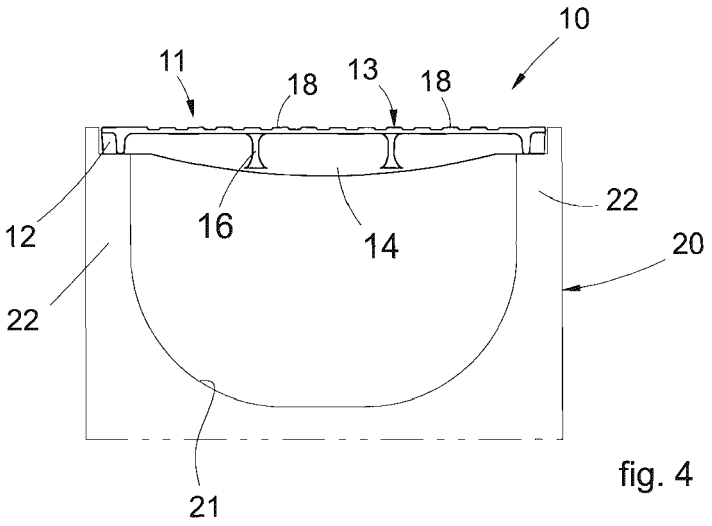

fig. 4

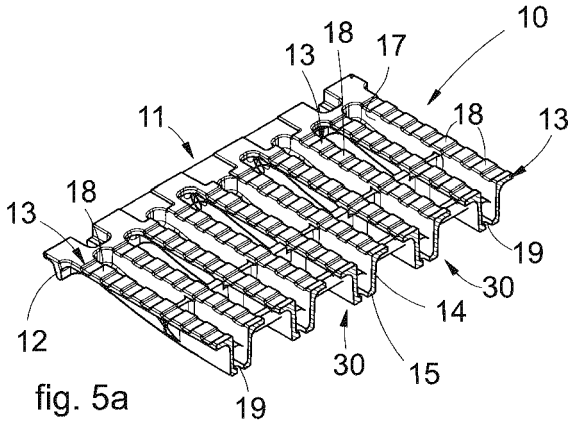

fig. 5a

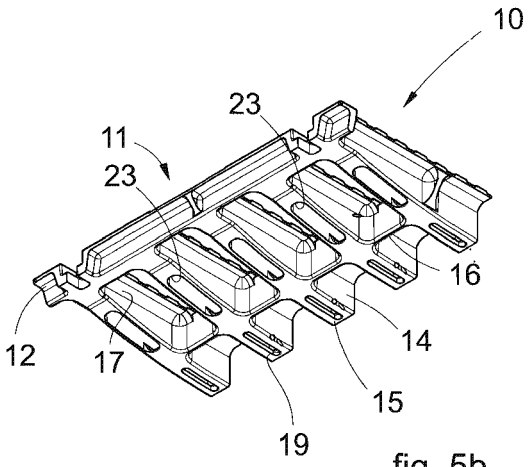

fig. 5b

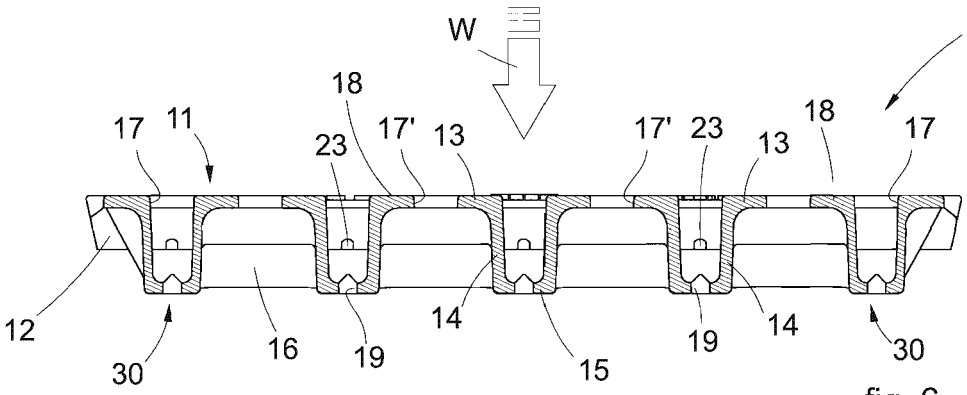

fig. 6

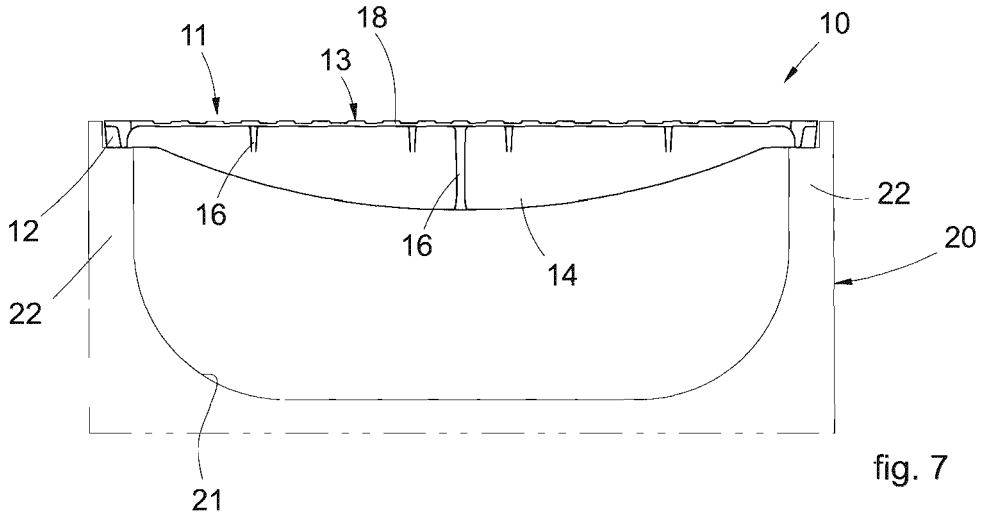

fig. 7

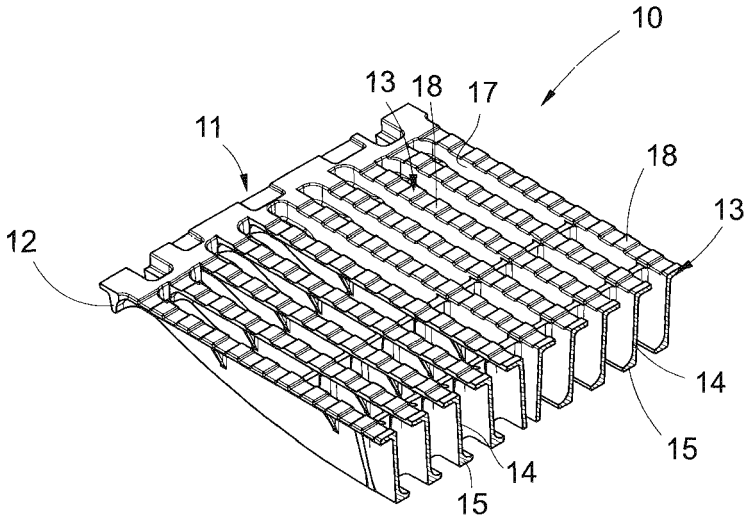

fig. 8

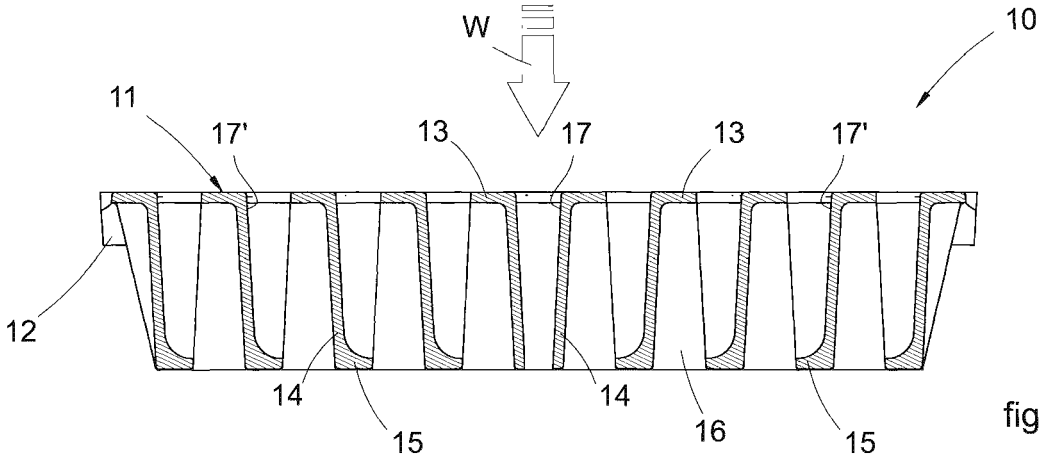

fig. 9

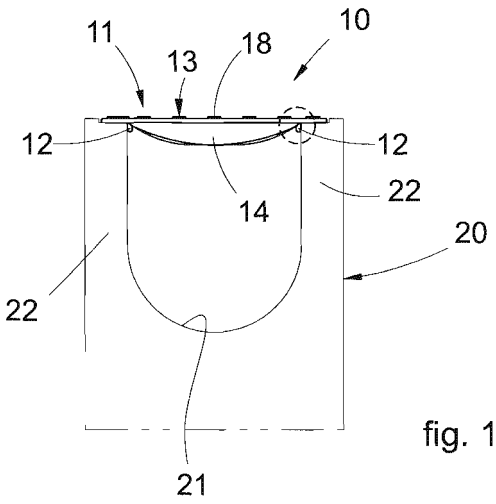

fig. 10

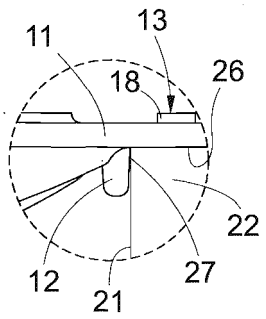

fig. 10a

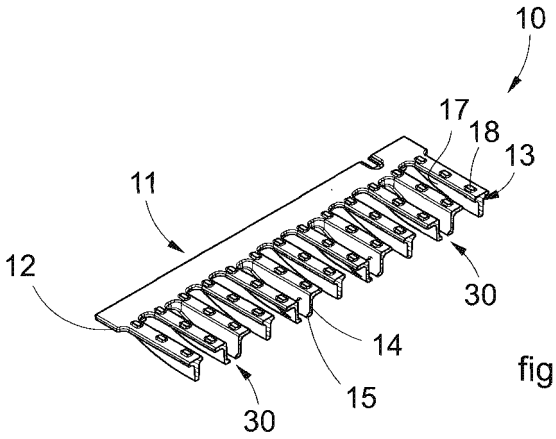

fig. 11

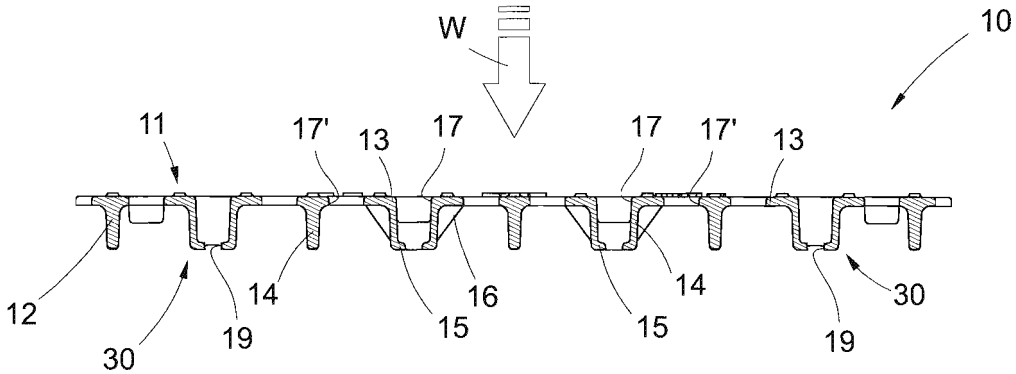

fig. 12

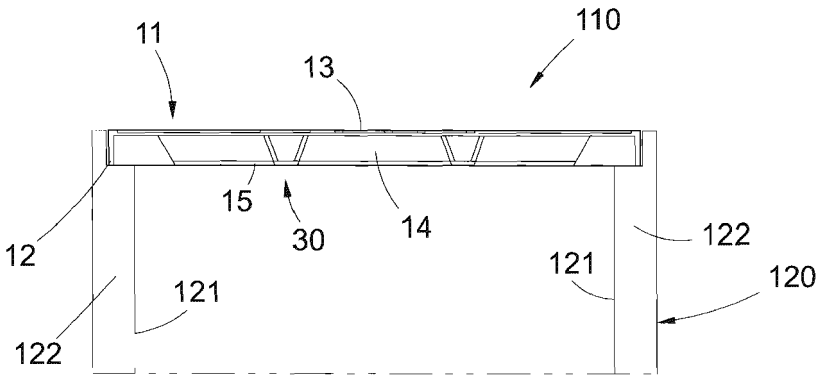

fig. 13

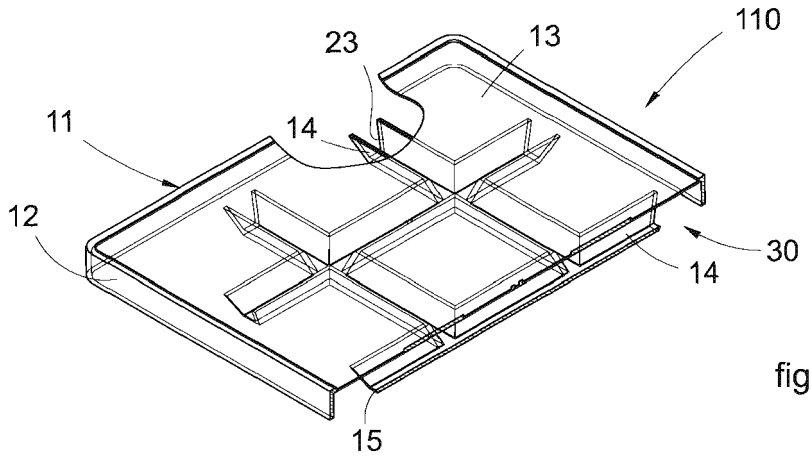

fig. 14

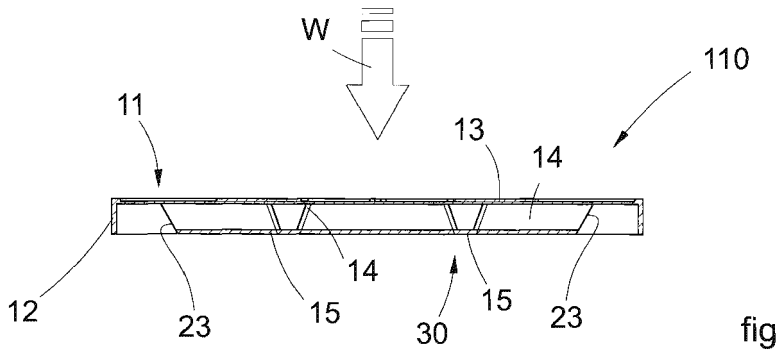

fig. 15

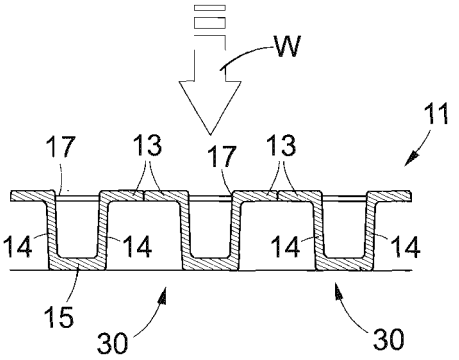

fig. 16

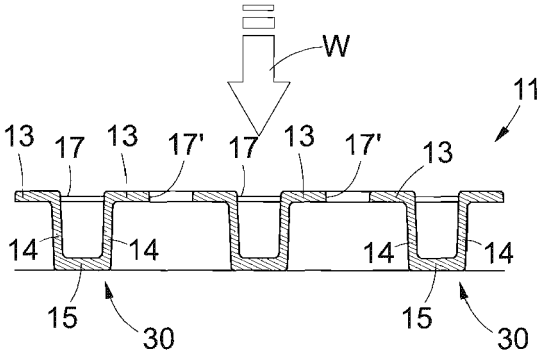

fig. 17

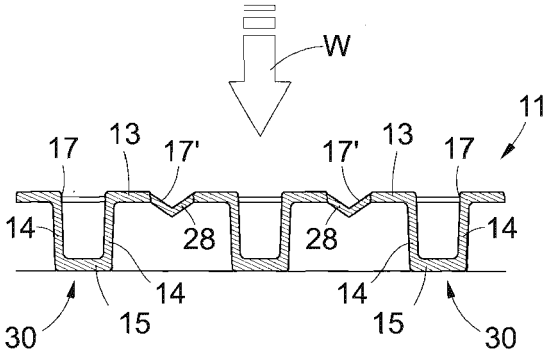

fig. 18

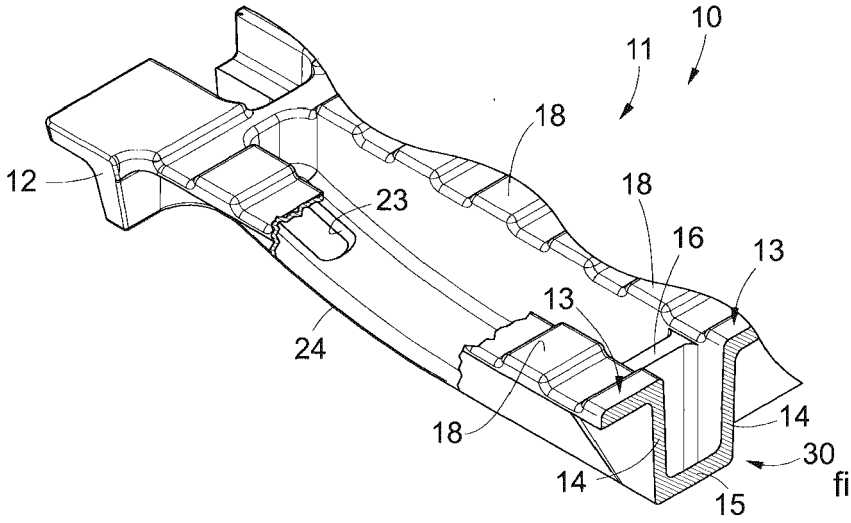

fig. 19

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EUROPEAN SEARCH REPORT

Application Number
EP 23 19 6968

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y A	CN 201 554 117 U (PINGBO WENG; ZHAOMO YANG) 18 August 2010 (2010-08-18) * figures 5, 6 *	1-6,9, 10,15 14 7,8, 11-13	INV. E03F5/06
X,D	KR 102 049 984 B1 (MYS TECH CO LTD [KR]) 28 November 2019 (2019-11-28) * figures 1a, 1b *	1-5	
X,D	KR 102 353 812 B1 (SEOIL CO LTD [KR]) 20 January 2022 (2022-01-20) * figures 7,8 *	1-4	
X,D	CN 213 268 249 U (AEROSPACE ARCHITECTURAL DESIGN AND RES INSTITUTE CO LTD) 25 May 2021 (2021-05-25) * figure 4 *	1-4	
Y,D A	DE 20 2014 102436 U1 (HAURATON GMBH & CO KG [DE]) 30 July 2014 (2014-07-30) * figure 4 *	14 1-13,15	TECHNICAL FIELDS SEARCHED (IPC) E03F
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	31 January 2024	Decker, Robert

CATEGORY OF CITED DOCUMENTS

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31-01-2024

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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