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(54) **MULTILAYER ROLLABLE FAÇADE CLADDING AND METHOD FOR INSTALLING A MULTILAYER ROLLABLE FAÇADE CLADDING**

(57) The invention discloses a façade cladding for insulating a façade of a building comprising a multilayer panel (1) configured for being rolled along a longitudinal direction. The multilayer panel (1) comprises: an inner insulation layer (11) comprising a sheet of a thermally insulating material; an outer aesthetical layer (12) coupled to the insulation layer (11); and a plurality of connection means (13) configured for connecting the insu-

lation layer (11) and the aesthetical layer (12), where the connection means (13) are configured for separating the insulation layer (11) and the aesthetical layer (12) such that a ventilation layer (17) allowing the passage of air is provided therebetween, and such that the insulation layer (11) can slide longitudinally with respect to the aesthetical layer (12).

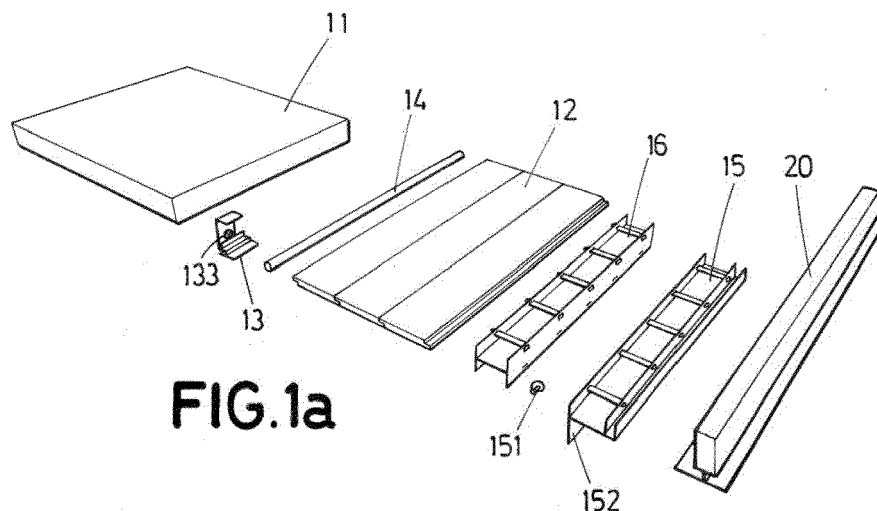


FIG. 1a

EP 3 438 373 A1

Description

TECHNICAL FIELD

[0001] The present invention belongs to the field of building construction, and more particularly to the application of an insulation cladding onto the façade of a building.

[0002] A first object of the invention is a façade cladding comprising a multilayer rollable panel that includes a ventilation layer.

[0003] A second object of the invention is a method for installing the façade cladding disclosed above.

STATE OF THE ART

[0004] The energy efficiency of a building is the extent to which the energy consumption per square metre of floor area of the building measures up to established energy consumption benchmarks for that particular type of building under defined climatic conditions. Building energy consumption benchmarks are representative values for common building types against which a building's actual performance can be compared. Energy efficiency refers to the use of energy more effectively, and measures differences in how much energy is used to provide the same level of comfort, performance or convenience by the same type of buildings. More particularly, the energy demand of a building shall be determined on the basis of the calculated actual annual energy that is consumed in order to meet the different needs associated with its typical use and shall reflect the heating and cooling energy demands to maintain the comfort conditions in the interior of the building, and supply domestic hot water needs.

[0005] Currently, the building sector represents 40% of the overall energy consumption and 36% of CO₂ emissions in Europe. Furthermore in Europe more than 70% of the building stock was built before the first energy crisis (70's) without consideration of Energy Efficiency criteria, which involve a poor energy performance. Taking into account these data, by improving the Energy Efficiency of buildings, a reduction of EU energy consumption by 5-6% and CO₂ emissions by about 5% could be achieved. In this scenario the Energy Retrofitting is envisaged as key strategy to reduce the energy impact of the building sector.

[0006] In particular, by means of application of passive measures, regarding basically the building envelope, the energy demand may decrease, since the heating and cooling needs decrease, keeping or improving the comfort conditions.

[0007] A known solution to this problem is the provision of an additional cladding with thermal insulation fixed to the façade of the building, in order to enhance the thermal performance of the existing envelope and consequently the energy efficiency of the building. The cladding may further comprise features for improving the aesthetic ap-

pearance of the building.

[0008] A typical cladding for energy rehabilitation includes a number of layers, such as e.g. insulation layer and aesthetical layer, fixed one by one to the surface of the walls of the building. In the case of a ventilated façade, the cladding includes also a ventilation gap between the insulation layer and aesthetical layer, which improves the thermal performance. Conventionally, the fixation of the cladding to the walls of the building is very time-consuming, since it involves the fixation to the walls of the building of a high number of separate parts for each layer. Furthermore, the fixation of a cladding involves the provision of scaffolding systems for allowing the workers to access the façades of the building in each layer application, which usually takes a long time and causes annoyance to the tenants. In the past years, new claddings for reducing the time required for installation have been envisaged.

[0009] Document ES2578385 discloses a cladding comprising a panel formed by elements in the form of slats longitudinally connected one after the other in a line. A panel can be rolled for transport and, once on site, it can be simultaneously unrolled and installed by hoisting a free end thereof up the walls of the building by means of a pulley temporarily fixed at the top of the building. A pair of rails previously fixed to the walls of the building ensures that the panel is properly positioned. However, this cladding panel does not address the problem of thermal insulation, since it only includes slats intended for improving the aesthetical appearance of the building. Indeed, document ES2578385 specifically discloses that, in case an inner thermal insulation layer is needed, it must be installed in advance.

[0010] Document FR2469519 discloses a cladding for covering the walls of a building comprising a multilayer panel. The layers include basically an insulation layer and an aesthetical layer fixed thereto. The aesthetical layer is formed by elements in the form of slats longitudinally connected one after the other in a line and the insulation layer is a continuous layer formed in an insulating material. In order to achieve ventilation, document FR2469519 proposes providing a separation gap achieved by means of works in-situ, between the walls of the building and the multilayer panel. However, such a separation gap between the walls and the panel would deprive the cladding from any insulating effect.

DESCRIPTION OF THE INVENTION

[0011] The present invention solves the aforementioned drawbacks by means of a novel rollable façade cladding having a multilayer panel comprising an insulation layer, a ventilation layer and an aesthetical layer. This novel multilayer panel is particularly configured for being assembled and rolled in a factory, and then it is stored and subsequently transported in a rolled condition to the relevant building for installation.

[0012] A first advantage of the rollable façade cladding

of the present invention is that, when installing the multilayer panel, the person in charge of the installation does not have to carry out burdensome additional operations such as securing an insulation layer to the façade of the building in advance, or providing for a separation gap between the panel and the wall. The multilayer panel comprising the insulation layer can be directly installed by securing it to the façade of the building, thus saving time and labour.

[0013] A second advantage of the rollable façade cladding of the present invention is that the installation of the multilayer panel does not require the construction of any permanent structure for supporting the workers, such as the scaffolding. More convenient means such as cranes or elevators can be employed.

[0014] A third advantage of the rollable façade cladding of the present invention is that the multilayer panel is rollable. This is advantageous in that the panel is more easily stored, handled and transported. The panel is produced, assembled and rolled in the factory. Once on site, it is unrolled during installation onto the façade of the building.

[0015] In the present document, the term "*longitudinal direction*" makes reference to a direction along which the multilayer panel is rolled. The term "*lateral direction*" refers to a direction perpendicular to the longitudinal direction. Therefore, a multilayer panel according to the invention, which is usually square or rectangular, has two longitudinal ends having a certain width and two lateral sides having a certain length.

[0016] In the present document, the "*first end*" of the multilayer panel refers to a free end thereof when in a rolled condition. Thus, the multilayer panel is unrolled by pulling from this "*first end*". The "*second end*" of the multilayer panel is the innermost end thereof when in a rolled condition.

[0017] In the present document, the expression "*thermally insulating material*" refers to any material having a thermal conductivity of less than about 0.1 W/m°C.

[0018] In the present document, the term "*façade*" refers to any of the walls of a building where the cladding of the invention is going to be installed.

[0019] A first aspect of the present invention discloses a rollable façade cladding for insulating a façade of a building. The cladding comprises a multilayer panel configured for being rolled along a longitudinal direction. The multilayer panel mainly comprises:

a) Insulation layer

An inner insulation layer comprises a sheet of a thermally insulating material. Any material capable of providing a substantial thermal insulation, for example having a thermal conductivity of $\lambda < 0,1 \text{ W/m°C}$, can be used for making up the insulation layer. More specifically, the insulation layer is preferably made of at least one of the following materials: flax fiber, hemp fiber, cellulose fiber, aerogel, glass wool, rock wool, mineral wool and polyurethane foam.

The insulation layer can have any configuration provided it is rollable along the longitudinal direction. Normally, since several insulation materials are naturally soft and bendable, a sheet made of such materials is rollable. Otherwise, it is understood herein that the sheet of thermally insulating material would be configured for being rollable. Any configuration similar to those disclosed below in connection with the aesthetical layer would be allowable. In this respect, note that no rolling ability is required in the lateral direction, only in the longitudinal direction.

b) Aesthetical layer

An outer aesthetical layer is coupled to the insulation layer such that, as disclosed below, a ventilation layer is present therebetween. The aesthetical layer can be made of any material, provided it can be secured to the insulation layer and it can withstand the weather conditions the building is subjected to. More specifically, the aesthetical layer is preferably made of at least one of the following materials: aluminum, steel, PVC, wood, ceramics, stone, fabric, or a composite material.

Structurally, the aesthetical layer can have any configuration provided it is rollable along the longitudinal direction. For example, the aesthetical layer may be sufficiently flexible for being rolled. Otherwise, the aesthetical layer may be formed by a plurality of solid parts interconnected by means of flexible joints. For example, regular geometrical parts such as triangles, hexagons, etc. could be employed. In a particular embodiment of the invention, the aesthetical layer comprises a plurality of slats interconnected in a longitudinal direction of the layer.

c) Connection means

A plurality of connection means provided along the lateral sides of the multilayer panel, connect the insulation layer and the aesthetical layer.

[0020] The connection means are configured for separating the insulation layer and the aesthetical layer such that a ventilation layer allowing the passage of air is provided therebetween. In this context, the ventilation layer refers to an essentially continuous separation (such as an air gap) between the insulation layer and the aesthetical layer such that they do not touch each other. The provision of the insulation layer in the finished and rolled multilayer panel eliminates the need to make an insulation layer on site. The person in charge of the installation needs only to unroll the multilayer panel and secure it to the façade of the building. This is very advantageous in that it saves time and labour.

[0021] Further, the connection means are preferably configured such that the insulation layer is longitudinally slidable in relation with the aesthetical layer. This feature is important in that a relative longitudinal displacement between the insulation layer and the aesthetical layer may appear when the multilayer panel of the invention is rolled/unrolled. The connection means may therefore

allow for the insulation layer to slide longitudinally with respect to the aesthetical layer, thereby ensuring that the multilayer panel can be properly rolled. Otherwise, the multilayer panel could not be rolled/unrolled properly because some or all of the layers, at least the insulation layer, would deform.

[0022] The connection means between the insulation layer and the aesthetical layer could adopt any configuration provided the above conditions are met.

[0023] In a particular embodiment of the invention, each connection means comprises a first connector or first connecting portion slidably connected to the insulation layer and a second connector or second connecting portion rigidly connected to the aesthetical layer, where said first and second connectors are separated a distance corresponding to a thickness of the ventilation layer.

[0024] In a more particular embodiment of the invention, the first connector or first connecting portion comprises a first flange and a support element stemming from a common plate, said first connector slidably sandwiching a lateral side edge of the insulation layer. Therefore, the distance between the first flange and the support element corresponds essentially to the thickness of the insulation layer. The second connector or second connecting portion comprises a second flange stemming from the common plate and rigidly fixed to a lateral side of the aesthetical layer. As mentioned above, a distance corresponding to the thickness of the ventilation layer separates the support element from the second flange. The connection means accordingly has an essentially U-shape where the common plate makes up the central portion of the U and the respective first and second flanges make up the legs of the U. The support element protrudes from the central portion of the U in a position between the first and second flanges.

[0025] Note that the separation distance between the first flange and the support element could be slightly smaller than the thickness of the insulation layer. This feature aids the inner surface of the insulation layer to more firmly abut against the façade of the building without leaving any hollow spaces, thus increasing the insulating capability of the multilayer panel of the invention. Note also that both the first flange and the support element must be configured for allowing the insulation layer to slide longitudinally. Therefore, no pointed parts or rough surfaces are allowed in the first connector.

[0026] On the other hand, in a particular embodiment the second flange making up the second connector is rigidly fixed to a lateral side of the aesthetical layer by any suitable means. Any fixation means, such as screws, bolts, pins, etc. could be employed for this purpose.

[0027] A plurality of connection means of this type are provided along the lateral sides of the multilayer panel. Therefore, when assembling the multilayer panel of the present invention, the person in charge of the installation needs only to rigidly secure the second flange of a plurality of connection means to the lateral side of the aesthetical layer, and then slidably introduce the lateral side edge of the insulation layer between the first flange and the support element of the plurality of connection means. This method is disclosed in more detail below in the present document.

[0028] The multilayer panel disclosed above therefore eliminates the need to perform additional operations during the installation of the façade cladding for providing a ventilation layer or an insulation layer. All three layers, insulation layer, ventilation layer and aesthetical layer, are included in a rollable panel that can be easily transported, unrolled and installed.

[0029] In embodiments of the present invention, the multilayer panel further comprises additional separation means provided between the insulation layer and the aesthetical layer. These additional separation means aid the support elements of the first connector in providing support for the insulation layer. This is particularly useful in a central surface portion of the insulation layer which could otherwise bend or flex towards the aesthetical layer and thereby affect the ventilation layer. Note that the insulation layer normally is not a completely rigid sheet. The additional separation means prevent the insulation layer from bending towards the aesthetical layer, thus ensuring a continuous ventilation layer between the insulation layer and the aesthetical layer. Further, the additional separation means push the insulation layer towards the façade of the building, aiding the insulation layer to firmly abut against the façade of the building. This feature ensures that no hollow spaces appear between the insulation layer and the façade, since that would affect negatively the thermal performance of the rollable panel.

[0030] In further embodiments of the invention, the additional separation means comprise a plurality of longitudinally rolling devices ("longitudinally" referring to the direction along which the multilayer panel is rolled). Implementing the separation means as longitudinally rolling devices is further particularly useful during assembly of the multilayer panel, as it makes the introduction of the insulation layer between the first flange and the support element of the first connectors much easier.

[0031] In still another embodiment of the present invention, the rolling devices comprise rolling rods coupled between the support elements of pairs of opposite connection means. Indeed, as mentioned above, the connection means are arranged between the insulation layer and the aesthetical layer along the lateral sides thereof. Particularly, pairs of laterally opposite connection means are provided. The rolling rods are thus coupled between the support elements of opposite connection means.

[0032] In another embodiment of the present invention, the connection means further comprise a laterally outward longitudinal groove adjacent the second flange for receiving a rail secured to the façade of the building for guiding the multilayer panel. Indeed, a pair of rails is secured onto the façade of the building for guiding the multilayer panel. The pair of rails are separated a distance

matching the width of the multilayer panel. The multilayer panel can then be positioned such that the grooves of the corresponding connection means provided on either lateral side of the multilayer panel enter into the corresponding rails. Thereafter, the multilayer panel is pulled along the rails until it is completely positioned over the wall. Note that the rails need not be arranged vertically, i.e. they could be oriented in any direction on the wall provided they are parallel and separated a distance corresponding to the width of the multilayer panel.

[0033] In embodiments of the invention, the multilayer panel further comprises an end coupling means configured for rigidly coupling the insulation layer to the aesthetical layer at a first end of the multilayer panel. That is, the end coupling means anchors the insulation layer to the aesthetical layer at the first end, which is the free end when the multilayer panel is in a rolled condition.

[0034] In another embodiment of the invention, the end coupling means further comprises hook means allowing the multilayer panel to be hoisted up the wall of the building. In this context, a hook means refers to any feature that is suitable for being grasped, coupled, hooked, etc. by the hoisting means. The hook means provided in the end coupling means allows for a hoisting means, such as a crane, or a pulley secured to an upper portion of the building, to pull the multilayer panel upwards or to let it fall downwards in a controlled way. The multilayer panel unrolls as the first end thereof is pulled upwards by the hoisting means.

[0035] In still another embodiment of the invention, the end coupling means further comprises an additional flange configured for being secured to the façade of the building. For example, the additional flange could be provided with holes for screws, bolts, or the like.

[0036] In a further embodiment, the multilayer panel further comprises an intermediate coupling means configured for coupling the insulation layer at a second end of said multilayer panel to a subsequent insulation layer at a first end of a subsequent multilayer panel. The person in charge of the installation can thus couple a plurality of multilayer panels for covering the façade of a high building. Note that this intermediate coupling means only provides for a coupling between the respective insulation layers. This is important for the reasons disclosed above as to the need to allow for the insulation layer to slide with respect to the aesthetical layer during rolling and unrolling operations. A complete coupling between adjacent multilayer panels requires also the use of a connection means of the type disclosed above. This is disclosed in more detail below in the present document.

[0037] A second aspect of the present invention discloses a method for installing a façade cladding for insulating a façade of a building. The façade comprises a pair of rails and the cladding comprises a multilayer panel rolled along a longitudinal direction. The multilayer panel comprises an inner insulation layer comprising a sheet of a thermally insulating material; an outer aesthetical layer coupled to the insulation layer; and a plurality of

connection means provided along the lateral sides of the multilayer panel that connect the insulation layer and the aesthetical layer. The connection means are configured for separating the insulation layer and the aesthetical layer such that a ventilation layer allowing the passage of air is provided therebetween. Further, the connection means are configured such that the insulation layer is longitudinally slidable in relation with the aesthetical layer. The method comprises the following steps:

1) Coupling a first end of the multilayer panel to a hoisting means provided at the top of the wall. The hoisting means could comprise a crane or, more preferably, a pulley anchored to an upper portion of the wall provided with a rope. A lower end of the rope is connected to the first end of the multilayer panel, while an upper end of the rope passes around the pulley and it is pulled from.

2) Positioning the multilayer panel such that respective grooves provided in the connection means receive the pair of rails.

3) Unrolling the multilayer panel by lifting it along the pair of rails by means of the hoisting means.

4) Securing the multilayer panel to the walls of the building. In this context, connecting the multilayer panel to the walls refers to any type of connection, either directly or indirectly, to the walls. That is, the multilayer panel could also be secured to the rails which, in turn, are secured to the walls.

[0038] This installation method therefore eliminates the need to use scaffolding. The final result of the method is that the façade cladding is installed onto the walls of the building. In case a plurality of multilayer panels were needed for covering the wall, the method of the invention further comprises a step of connecting a second end of the multilayer panel to a first end of a subsequent multilayer panel. This connection step can be carried out at ground level, and therefore no scaffolding means is necessary for this step either.

[0039] A third aspect of the present invention is directed to a method for rolling a multilayer panel comprising: an inner insulation layer comprising a sheet of a thermally insulating material; an outer aesthetical layer coupled to the insulation layer; and a plurality of connection means provided along the lateral sides of the multilayer panel that connect the insulation layer and the aesthetical layer. The connection means are configured for separating the insulation layer and the aesthetical layer such that a ventilation layer allowing the passage of air is provided therebetween. Further, the connection means are configured such that the insulation layer is longitudinally slidable in relation with the aesthetical layer. The rolling method comprises the following steps:

1) The aesthetical layer is laid on a horizontal surface.

2) A first plurality of connection means is secured to one lateral side portion of the aesthetical layer.

3) A first end of a plurality of additional separation means, such as rolling devices, is connected to the first plurality of connection means. The rolling devices could be rotatably fixed, for example, to respective support elements of the connection means. Particularly, the rolling devices may have end pins configured for being introduced in corresponding holes provided in the support elements, thus allowing the rolling device to rotate.

4) A second plurality of connection means is secured to another lateral side portion of the aesthetical layer opposite said one lateral side portion, and a second end of the plurality of additional separation means is connected to said second plurality of connection means.

5) The insulation layer is introduced longitudinally between respective first flanges of the plurality of connection means and the separation means by pushing it longitudinally. A distance between a leading end of the insulation layer (subsequently second, inner end of the insulation layer when rolled) and a respective end of the aesthetical layer (second, inner end of the aesthetical layer when rolled) is left. Accordingly, since both the insulation layer and the aesthetical layer have the same length, a distance between the first ends of the insulation layer and the aesthetical layer is present in the finished, but still unrolled, multilayer panel. Said distance is calculated for said first, outer ends of the insulation layer and the aesthetical layer to be flush when the multilayer panel is in a rolled condition.

6) The multilayer panel is rolled with the second end of the insulation layer and the aesthetical layer on the inside of the roll. The first end of the insulation layer progressively slides while the multilayer panel is rolled, and at the end of the rolling process said first, outer ends of the insulation layer and the aesthetical layer are flush.

7) An end coupling means is secured to the first, outer ends of the insulation layer and the aesthetical layer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0040] To complete the description and in order to provide for a better understanding of the invention, a set of drawings is provided. Said drawings form an integral part of the description and illustrate an embodiment of the

invention, which should not be interpreted as restricting the scope of the invention, but just as an example of how the invention can be carried out. The drawings comprise the following figures:

Figs. 1 a and 1 b respectively show a perspective view of the parts forming the façade cladding of the invention in a disassembled condition and a perspective view of a connection means of the invention

Fig. 2 shows a perspective view of an aesthetical layer of a multilayer panel according to the invention.

Fig. 3 shows a perspective view of an aesthetical layer having a plurality of connection means fixed to one side thereof.

Fig. 4 shows a perspective view of an aesthetical layer having a plurality of connection means fixed to one side thereof and a plurality of additional separation means.

Fig. 5 shows a perspective view of an aesthetical layer having a plurality of connection means fixed to both sides thereof and a plurality of additional separation means.

Fig. 6 shows a perspective view of a multilayer panel according to the invention comprising a partially introduced insulation layer connected by means of a plurality of connection means to an aesthetical layer.

Fig. 7 shows a perspective side view of a multilayer panel according to the invention showing the ventilation layer present between the insulation layer and the aesthetical layer.

Figs. 8a and 8b respectively show a perspective view and a cross-section view of a multilayer panel according to the invention in a rolled condition.

Fig. 9 shows a perspective view of a rolled multilayer panel being hoisted up along the rails by means of a hoisting means and another multilayer panel already installed on the façade of the building.

Fig. 10 shows a close perspective view of the hoisting means pulling from the hook means provided at the end coupling means fixed to the first end of the multilayer panel.

Fig. 11 shows a perspective view of the grooves of a plurality of connection means with a rail introduced therein.

Fig. 12 shows a close perspective view of the first end of a multilayer panel secured to the wall of the building by means of the end coupling means.

Fig. 13 shows a perspective view of two multilayer panels about to be interconnected.

Fig. 14 shows a closer perspective view of the inter-connection between a second end of a first multilayer panel and a first end of a second multilayer panel.

Fig. 15 shows a perspective view of an alternative configuration of the connection means.

DESCRIPTION OF A WAY OF CARRYING OUT THE INVENTION

[0041] Fig. 1 a shows a disassembled perspective view of the parts forming an exemplary façade cladding according to the invention.

[0042] The façade cladding disclosed herein comprises an essentially rectangular multilayer panel (1) which is longer in a longitudinal direction along which it is rollable. The multilayer panel (1) includes an insulation layer (11) and an aesthetical layer (12). Consequently, both the insulation layer (11) and the aesthetical layer (12) included in the multilayer panel (1) are also rectangular. The insulation layer (11) is mainly made of a sheet of a thermally insulating material which is flexible in the longitudinal direction. The aesthetical layer (12) is formed by a plurality of slats (121) interconnected along their long sides. The slats (121) may be wooden slats. The connection between adjacent slats (121) allows for a certain angle of rotation between said adjacent slats (121), in such a way that the aesthetical layer (12) formed by the plurality of slats (121) can be rolled. This configuration is generally known in the art, and therefore it is not further disclosed in the present document.

[0043] Fig. 1 a also shows the connection means (13) designed for connecting the insulation layer (11) to the aesthetical layer (12). The connection means (13), as shown in greater detail in the perspective side view of Fig. 1b, comprises a first connector (131) configured for slidable connection with the insulation layer (11) and a second connector (135) configured for connection with the aesthetical layer (12). The first connector (131) is formed by a first flange (132) and a support element (133), both stemming perpendicularly from a common plate (134). A lateral side edge of the insulation layer (11) can be sandwiched between flange (132) and support element (133) in such a way that the insulation layer (11) can slide longitudinally. On the other hand, the second connector (135) comprises a second flange also stemming perpendicularly from the common plate (134) and having means for a rigid connection with a lateral side portion of the aesthetical layer (12). For example, bolts, screws, pins, or any similar element could be used for said rigid connection. The second flange (135) is separated from the support element (133) a certain distance along the common plate (134), thereby allowing for a ventilation layer (17) having a thickness (d) substantially corresponding to the distance between the second flange

(135) and the distal end of the support element (133) with respect to the second flange (135), as shown in Fig. 1b. Fig. 15 shows an alternative configuration of the connection means (13). This configuration shows an upper flange and a support element, both making up the first connector for slidable connection with the insulation layer (11); and a pair of flanges making up the second connector for rigid connection with the aesthetical layer (12). The upper flange, support element and pair of flanges stem perpendicularly from a common plate. A distance corresponding to the thickness of the ventilation layer separates the flange closest to the support element, of the pair of flanges constituting the second connector, and the proximal end of the support element.

[0044] An additional separation means (14) is also shown in Fig. 1a. In this specific example, the additional separation means (14) is configured as a rolling rod (14) for connection to a pair of opposite connection means (13). That is, the ends of the rod (14) are configured for being connected to the respective support elements (133) of two laterally opposite connection means (13). With this configuration, the rolling direction of the rod (14) is the longitudinal direction of the multilayer panel (1). A plurality of such rolling rods (14) are arranged along the length of the multilayer panel (1), thus providing support to the insulation layer (11). The rolling rods (14) promote a relative longitudinal displacement between the insulation layer (11) and the aesthetical layer (12) during rolling and unrolling of the multilayer panel (1).

[0045] Note that promoting the relative longitudinal displacement between the insulation layer (11) and the aesthetical layer is important not only for rolling and unrolling the panel (1), but also for producing the panel. Indeed, the rolling rods (14) are important during production in that the insulation layer (11) can abut against the rolling rods (14) while introduced longitudinally between the first flange (132) and the support element (133) of respective pluralities of opposite connection means (13). Additionally, these rods (14) are also conceived for pushing the insulation layer (11) toward the existing façade once the multilayer panel (1) is installed, thus preventing hollow spaces between the surface of the insulation layer (11) and the façade of the building.

[0046] Fig. 1 a further shows an end coupling means (15) specifically designed for being coupled to a first end (1 a) of the panel (1) of the invention and to the façade of the building. In the present example, the end coupling means (15) is configured such that its cross-section is similar to that of the connection means (13) shown in Fig. 1b, except for certain differences: first, the end coupling means (15) has a length which is essentially coincident with the width of the multilayer panel (1); second, the end coupling means (15) lacks any support element and instead a third flange is provided stemming from the common plate. Therefore, the end coupling means (15) also comprises a first flange, a second flange, and a third flange stemming perpendicularly from a common plate, where the third flange is provided between the first and

second flanges. The distance between the first flange and the third flange corresponds essentially to the thickness of the insulation layer. The distance between the third flange and the second flange corresponds essentially to the thickness of the ventilation layer. A number of elongated fixation elements is provided between the first flange and the third flange for passing through the first end of the insulation layer (11) in order to provide for a strong connection therewith. The second flange may be rigidly connected to the aesthetical layer (12) by means of bolts, screws or the like.

[0047] Further, the end coupling means (15) is also designed for being grasped by a hoisting means (100) (see for example Fig. 9) in order to pull the multilayer panel (1) up the façade of the building. Indeed, the end coupling means (15) comprises, on the side of the common plate opposite the flanges for connection with the insulation layer (11) and the aesthetical layer (12), a couple of hook means (151). The hook means (151), which are shown separated from the end coupling means (15) in Fig. 1a, allows for a crane or any similar hoisting means (100) to pull the first end (1 a) of the multilayer panel (1) upwards during installation. The multilayer panel (100) is thus unrolled and at the same time lifted up the walls of the façade of the building.

[0048] The end coupling means (15) also has an additional flange (152) stemming perpendicularly from the common plate in a direction opposite the first to third flanges which is configured for being secured to the façade of the building once the multilayer panel (1) is correctly positioned. The end coupling means (15) could be provided with holes for securing the multilayer panel (1) to the wall by means of bolts, screws, or the like.

[0049] Fig. 1a further shows an intermediate coupling means (16) configured for connecting a second end (1 b) of a multilayer panel (1) of the present invention with a first end (1'a) of an adjacent multilayer panel (1'). In the present example, the intermediate coupling means (16) is configured as an H-shaped cross-section beam having a length which is essentially coincident with the width of the multilayer panel (1) and a separation between arms, i.e. flanges, which is essentially coincident with the thickness of the insulation layer (11). That is, the intermediate coupling means (16) essentially serves for connecting the respective insulation layers (11) corresponding to the two adjacent multilayer panels (1, 1'). This configuration allows for the insulation layers (11, 11') to longitudinally slide with respect to the aesthetical layers (12, 12') as the panels (1, 1') are rolled or unrolled. The intermediate connector (15) further comprises a number of elongated fixation elements provided between the flanges which are configured for passing respectively through the second end (11 b) of an insulation layer (11) and through a first end (11 a') of an adjacent insulation layer (11') in order to provide for a strong connection therewith.

[0050] Finally, Fig. 1a shows an exemplary rail (20) configured for being secured to the façade cladding. The rail (20) in this example comprises a beam having a first

longitudinal side configured for being secured to the façade of the building and an opposite second longitudinal side configured for slidable connection with the multilayer panel (1). More specifically, the second longitudinal side has a plate protruding laterally for being received by the grooves (136) of a plurality of connection means (13) when a multilayer panel (1) is pulled along the rails (20). A multilayer panel (1) according to the invention can therefore slide between two such rails (20) secured to the façade of the building and separated a distance corresponding to the width of the panel (1).

[0051] Figs. 2-6 show a method for producing a multilayer panel (1) according to the invention. As mentioned above in the present document, the multilayer panel (1) can be produced and rolled in a factory. Subsequently, it can be transported to the building having a façade to be coated, where it is unrolled and installed.

[0052] Fig. 2 shows an aesthetical layer (12) corresponding to a rectangular multilayer panel (1). As mentioned above, the aesthetical layer (12) of the present example is formed by slats (121) interconnected along a longitudinal direction (L). This aesthetical layer (12) is rollable along said longitudinal direction (L). In a first step shown in Fig. 3, a first plurality of connection means (13) are fixed to lateral side portions of the slats (121) making up the aesthetical layer (12). More specifically, second flange (135) of each connection means (13) is rigidly secured by means of bolts or screws to respective lateral side portions of a number of slats (121).

[0053] Next, as shown in Fig. 4, a first end of a rolling rod (14) is connected to the support element (133) of each of the connection means (13). The rolling rods (14) are arranged in perpendicular to the longitudinal direction (L). The rolling direction of the rolling rods (14) is parallel to the longitudinal direction (L).

[0054] Then, as shown in Fig. 5, a second plurality of connection means (13) is connected to the opposite lateral side portion of the aesthetical layer (12). Each of the second plurality of connection means (13) is placed opposite each of the first plurality of connection means (13). Again, screws, bolts, pins or the like are used for rigidly coupling the second flange (135) of the respective second connection element (132) of each of the second plurality of connection means (13) to the slats (121) of the aesthetical layer (12). A second end of the rolling rods (14) is then connected to the respective support elements (133) of the second plurality of connection means (13).

[0055] Finally, as shown in Fig. 6, the multilayer panel (1) is finished by means of the introduction in a sliding manner of the insulation layer (11) between the first flange (132) of the first connection element (131) of each pair of opposite connection means (13) and the rolling rods (14). The insulation layer (11) is laid on the plurality of rolling rods (14) and pushed longitudinally, ensuring that the lateral side edges thereof pass between said rods (14) and the respective first flanges (132). A ventilation layer (17) is generated between the rolling rods (14) supporting the insulation layer (11) and the aesthet-

ical layer (12). The rolling rods (14) prevent the insulation layer (11) from bending towards the aesthetical layer (12), thus ensuring a continuous ventilation layer (17). Further, the rolling rods (14) exert a pushing action on the insulation layer (11) that, when the multilayer panel (1) is installed, prevents any hollow spaces between the insulation layer (11) and the façade of the building.

[0056] While not shown in the figures, note that it would be possible to configure the first connector (131) such that the distance between the first flange (132) and the support element (133) is slightly smaller than the thickness of the sheet of insulating material making up the insulation layer (11). For example, the thickness of an insulation layer (11) of this type could be between 2 cm and 30 cm. The distance between the parallel flanges making up the first connection element (131) could then be between 0.5 cm to 2 cm smaller than the thickness of the insulation layer (11). The insulation layer (11) would then have to be slightly compressed for introducing its lateral side edges in the first connector (131). This configuration, added to the action of the rolling rods (14), is advantageous in that it would promote a closer contact between the surface of the insulation layer (11) and the façade of the building.

[0057] Once the multilayer panel (1) is assembled, it may be rolled for facilitating storage and transport operations. In the present example, the multilayer panel (1) is rolled around a drum with the aesthetical layer (12) on the inside. A relative longitudinal displacement between the insulation layer (11) and the aesthetical layer (12) may appear during the rolling operation. This can be compensated by providing a longitudinal offset distance between the second, inner ends of the aesthetical layer (12) and the insulation layer (11) such that, once completely rolled, the first, outer ends thereof are longitudinally coincident, as shown in Fig. 7a. These first, outer ends are then coupled to an upper connector (15). The end coupling means (15) impedes any relative longitudinal displacement between the aesthetical layer (12) and the insulation layer (11) at the first, outer end (1 a) of the multilayer panel (1).

[0058] Fig. 7 shows a side view of the ventilation layer (17) generated between the rolling rods (14) supporting the insulation layer (11) and the aesthetical layer (12). As shown, the thickness (d) of the ventilation layer (17) is coincident with the distance between the support element (133) and the surface of the aesthetical layer (12).

[0059] Fig. 8a shows a multilayer panel (1) in a partially rolled condition. An end coupling means (15) is coupled to the first end (1a) of the multilayer panel (1). Therefore, the insulation layer (11) and the aesthetical layer (12) are rigidly connected in this first end (1a) of the panel (1). The end coupling means (15) show a couple of hook means (151) and an additional flange (152) intended for securing the multilayer panel (1) to the façade of the building.

[0060] Fig. 8b shows a cross-section of a multilayer panel (1) in a rolled condition. The connection means

(13) and the end coupling means (15) are not shown in the figure for the sake of simplicity. Note that, at the first, outer end (1 a) of the multilayer panel (1), the first, outer ends of the insulation layer (11) and the aesthetical layer (12) are coincident, i.e. flush. However, at the second, inner end of the multilayer panel (1), the end of the insulation layer (11) is not coincident, i.e. flush, with the end of the aesthetical layer (12). This position difference is arranged during the rolling operation of the multilayer panel (1), and the distance between the respective second, inner ends is chosen before rolling the multilayer panel (1) for causing the first ends to be flush when rolling operation is finished. The sliding connection of the insulation layer (11) to the connection means (13) and to the rolling rods (14) allows first, outer end of the insulation layer (11) to progressively slide while the multilayer panel (1) is rolled until it becomes flush with the first end of the aesthetical layer (12) at the end of the rolling process.

[0061] Finally, Figs. 9-14 schematically show a method for installing a façade cladding according to the invention comprising a multilayer panel (1). Fig. 9 shows a building having a façade that must be further insulated. A plurality of pairs of rails (20) are already secured to the façade of the building. The pairs or rails (20) are vertically oriented and arranged in parallel such that most of the surface of the façade will be covered by the corresponding multilayer panels (1). A multilayer panel (1) according to the invention is already secured to the façade. Another multilayer panel (1) according to the invention is being lifted by means of hoisting means (100). The hoisting means (100), comprising a pulley fixed to an upper portion of the building, includes one or more ropes fixed to the hook means (151) provided on the end coupling means (15) fixed to the first end (1a) of the multilayer panel (1). Fig. 10 shows a closer view of this step of the installation method.

[0062] Fig. 11 shows a detailed view of a rail (20) introduced in the grooves (136) of a plurality of connection means (13) provided forming a line along a lateral side of the multilayer panel (1) of the invention. The multilayer panel (1) is pulled up along the façade of the building by the hoisting means (100) along a parallel pair of rails (20).

[0063] Fig. 12 shows a closer view of the upper portion of the building where the pulley forming part of the hoisting means (100) is installed. Also, Fig. 12 shows how the previously installed multilayer panel (1) is fixed to the wall of the building at a first end (1 a) thereof by means of bolts or screws coupling the corresponding additional flange (152) of the end coupling means (15) to the façade.

[0064] Figs. 13-14 show how an intermediate coupling means (16) and a couple of connection means (13) are used for connecting a second end (1b) of a multilayer panel (1) with a first end (1'a) of an adjacent multilayer panel (1'). An intermediate coupling means (16) is placed between said second end (1b) and first end (1'a) for rigidly connecting the insulation layer (11) of the first multilayer panel (1) with the adjacent insulation layer (11') of the adjacent multilayer panel (1'). Specifically, a first pair of

flanges of the H-shaped intermediate coupling means (16) are coupled to a second end of the insulation layer (11) by means of elongated fixation elements, and a second pair of arms of the H-shaped intermediate coupling means (16) are coupled to a first end of the adjacent insulation layer (11') by means of elongated fixation elements. Once connected, a pair of opposite connection means (13) is provided at the connection site for rigidly coupling the respective ends of the aesthetical layer (12) of the multilayer panel (1) and the adjacent aesthetical layer (12') of the adjacent multilayer panel (1'). The final result of this step is that the aesthetical layers (12, 12') are rigidly interconnected and the insulation layers (11, 11') are rigidly interconnected. However, the interconnected insulation layers (11, 11') can still slide with respect to the interconnected aesthetical layers (12, 12').

[0065] In this text, the term "*comprises*" and its derivations (such as "*comprising*", etc.) should not be understood in an excluding sense, that is, these terms should not be interpreted as excluding the possibility that what is described and defined may include further elements, steps, etc.

[0066] On the other hand, the invention is obviously not limited to the specific embodiment(s) described herein, but also encompasses any variations that may be considered by any person skilled in the art (for example, as regards the choice of materials, dimensions, components, configuration, etc.), within the general scope of the invention as defined in the claims.

Claims

1. Multilayer rollable façade cladding for insulating a façade of a building, comprising a multilayer panel (1) configured for being rolled along a longitudinal direction, said multilayer panel (1) comprising:

an inner insulation layer (11) comprising a sheet of a thermally insulating material;
an outer aesthetical layer (12) connected to the insulation layer (11); and
a plurality of connection means (13) provided along the lateral sides of the multilayer panel (1), said plurality of connection means (13) connecting the insulation layer (11) and the aesthetical layer (12),

characterized in that:

the connection means (13) are configured for separating the insulation layer (11) and the aesthetical layer (12) such that a ventilation layer (17) allowing the passage of air is provided therebetween.

2. Multilayer rollable façade cladding according to claim 1, where each connection means (13) comprises a first connector (131) slidably connected to

the insulation layer (11) and a second connector (135) rigidly connected to the aesthetical layer (12), where said first and second connectors (131, 135) are separated by a distance (d) essentially corresponding to a thickness of the ventilation layer (17).

3. Multilayer rollable façade cladding according to claim 2, where the first connector (131) comprises a first flange (132) and a support element (133) stemming from a common plate (134) and configured for slidably sandwiching a lateral side edge of the insulation layer (11), and the second connector (135) comprises a second flange (135) stemming from the common plate (134) and configured for being rigidly fixed to a lateral side of the aesthetical layer (12), where the distance (d) essentially corresponding to the thickness of the ventilation layer (17) separates the support element (133) from the second flange (135).

4. Multilayer rollable façade cladding according to any of the previous claims, where the connection means (13) further comprise a laterally outward longitudinal groove (136) adjacent the second flange (135) for receiving a rail (20) secured to the façade of the building for guiding the multilayer panel (1).

5. Multilayer rollable façade cladding according to any of the previous claims, where said multilayer panel (1) further comprises additional separation means (14) provided between the insulation layer (11) and the aesthetical layer (12).

6. Multilayer rollable façade cladding according to claim 5, where the additional separation means (14) comprise a plurality of longitudinally rolling devices (14).

7. Multilayer rollable façade cladding according to claim 6, where the rolling devices (14) comprise rolling rods (14) coupled between the support elements (133) of pairs of opposite connection means (13).

8. Multilayer rollable façade cladding according to any of the previous claims, further comprising an end coupling means (15) configured for rigidly coupling the insulation layer (11) to the aesthetical layer (12) at a first end (1 a) of the multilayer panel (1).

9. Multilayer rollable façade cladding according to claim 8, where the end coupling means (15) further comprises hook means (151) allowing the multilayer panel (1) to be hoisted up the wall of the building.

10. Multilayer rollable façade cladding according to any of claims 8-9, where the end coupling means (15) further comprises an additional flange (152) configured for being secured to the façade of the building

11. Multilayer rollable façade cladding according to any of the previous claims, further comprising an intermediate coupling means (16) configured for coupling the insulation layer (11) at a second end (1b) of the multilayer panel (1) to a subsequent insulation layer (11') at a first end (1'a) of a subsequent multilayer panel (1'). 5
12. Multilayer rollable façade cladding according to any of the previous claims, where the aesthetical layer (12) is made of at least one of the following materials: aluminum, steel, PVC, wood, ceramics, stone, fabric, and a composite material. 10
13. Multilayer rollable façade cladding according to any of the previous claims, where the insulation layer (11) is made of at least one of the following materials: flax fiber, hemp fiber, cellulose fiber, aerogel, glass wool, rock wool, mineral wool and polyurethane foam. 15
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14. Method for installing a multilayer rollable façade cladding for covering a façade of a building, said façade comprising a pair of rails (20) and said cladding comprising a multilayer panel (1) rolled along a longitudinal direction, where said multilayer panel (1) comprises an inner insulation layer (11) comprising a sheet of a thermally insulating material; an outer aesthetical layer (12) coupled to the insulation layer (11); and a plurality of connection means (13) configured for connecting the insulation layer (11) and the aesthetical layer (12), where the connection means (13) are configured for separating the insulation layer (11) and the aesthetical layer (12) such that a ventilation layer (17) allowing the passage of air is provided therebetween, and such that the insulation layer (11) is slidable in relation with the aesthetical layer (12), the method comprising: 25
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- coupling a first end (1a) of the multilayer panel (1) to a hoisting means (100) provided at the top of the wall;
- positioning the multilayer panel (1) such that respective grooves (136) provided in the connection means (13) receive the pair of rails (20);
- unrolling the multilayer panel (1) by lifting it along the pair of rails (20) by means of the hoisting means (100); and
- securing the multilayer panel (1) to the façade of the building. 55
15. Method according to claim 14, further comprising connecting a second end (1 b) of the multilayer panel (1) to a first end (1'a) of a subsequent multilayer panel (1').

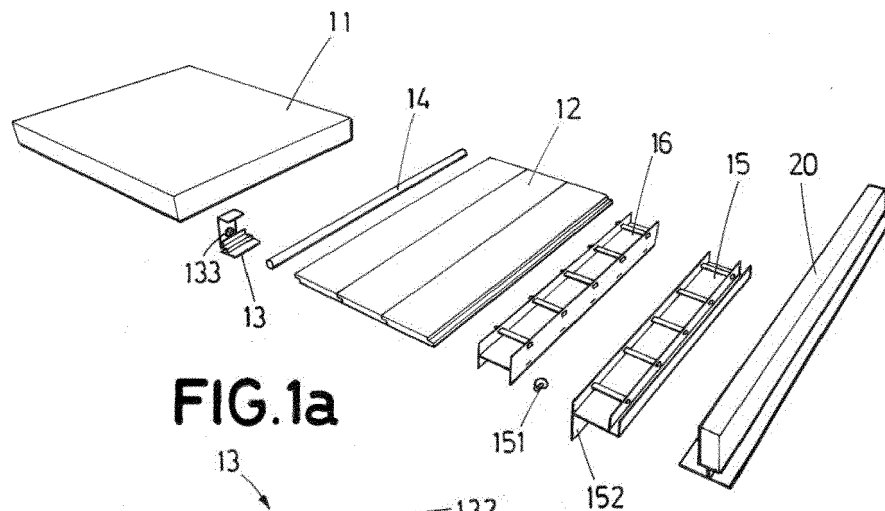


FIG.1a

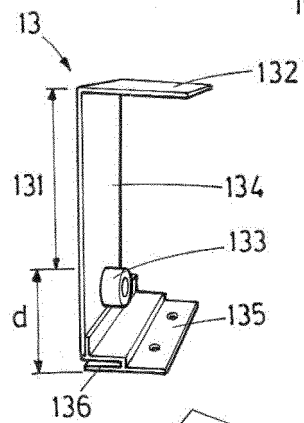


FIG.1b

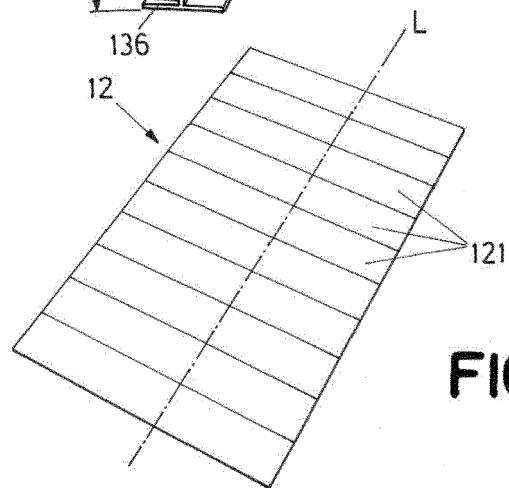


FIG.2

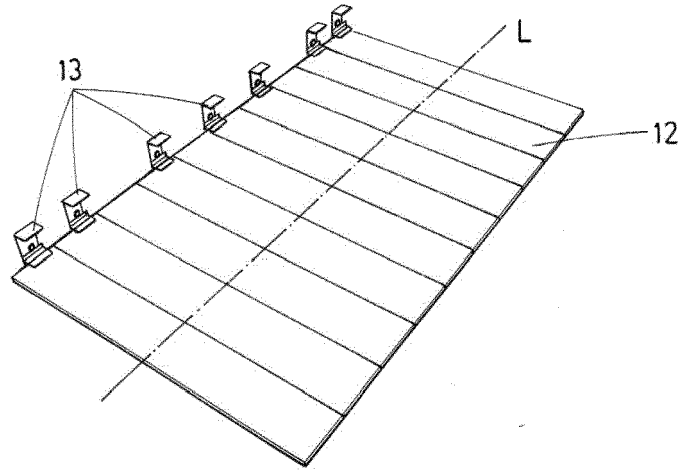


FIG. 3

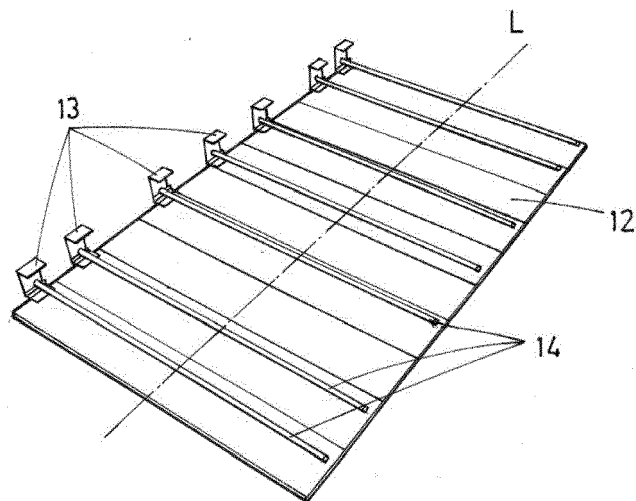


FIG. 4

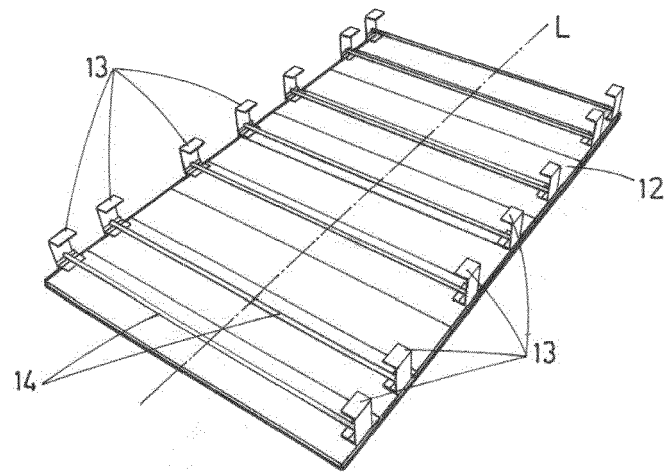


FIG. 5

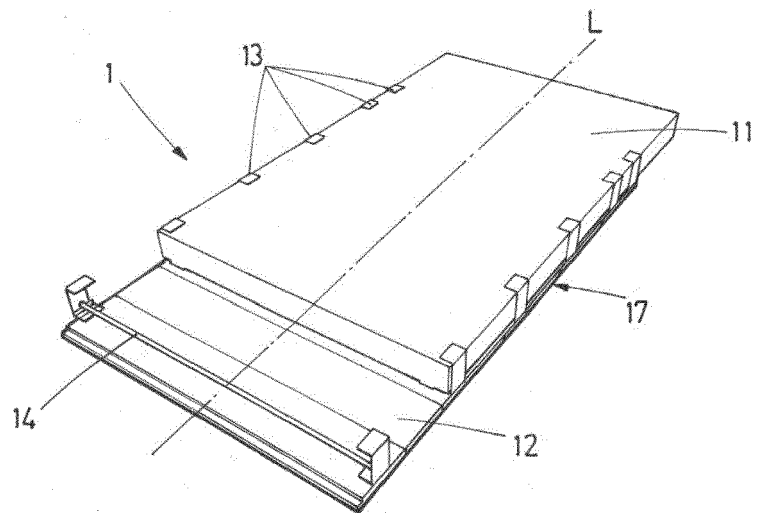


FIG. 6

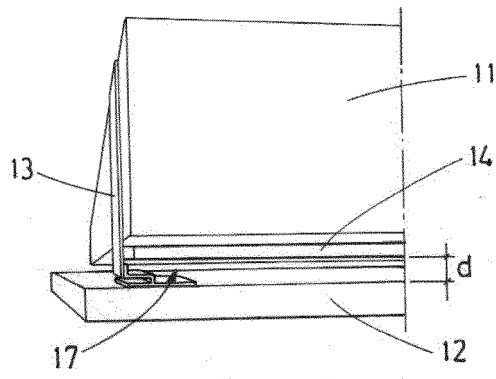


FIG. 7

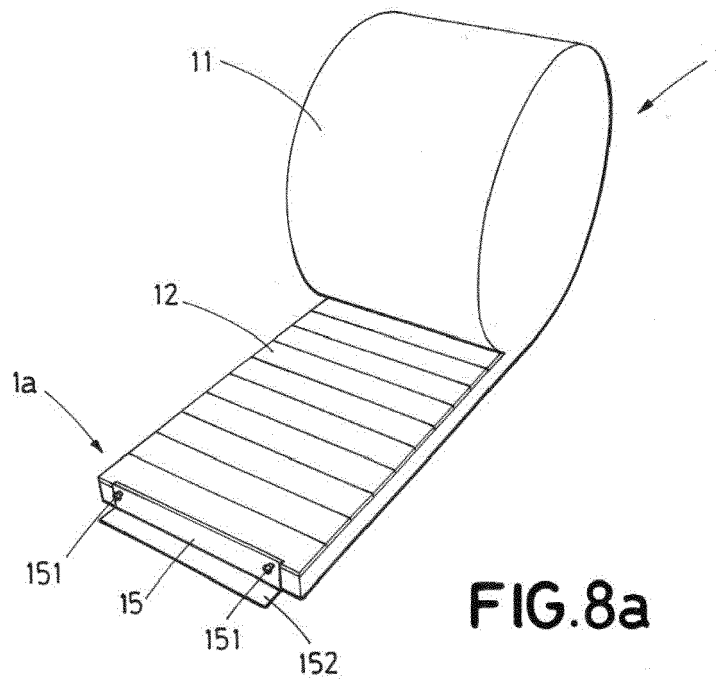


FIG. 8a

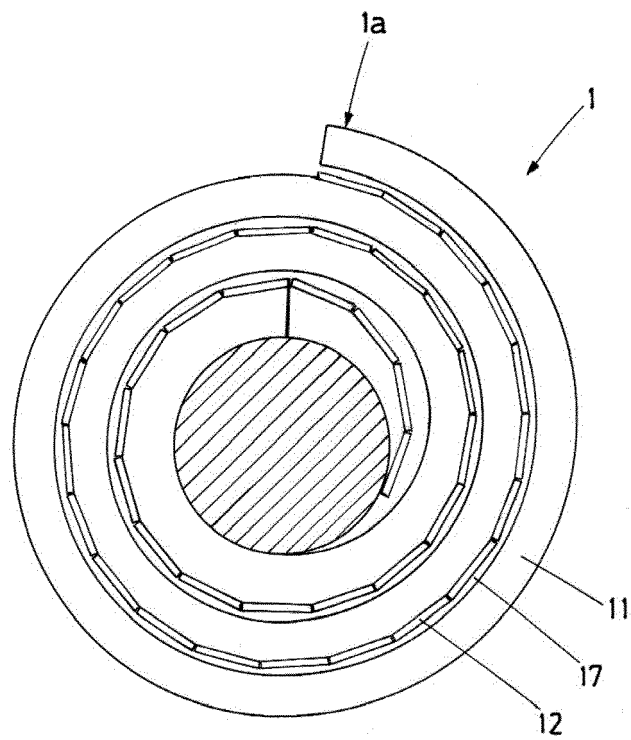


FIG.8b

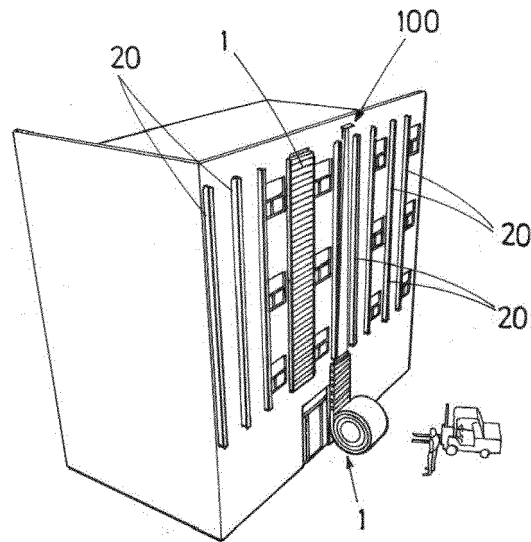


FIG. 9

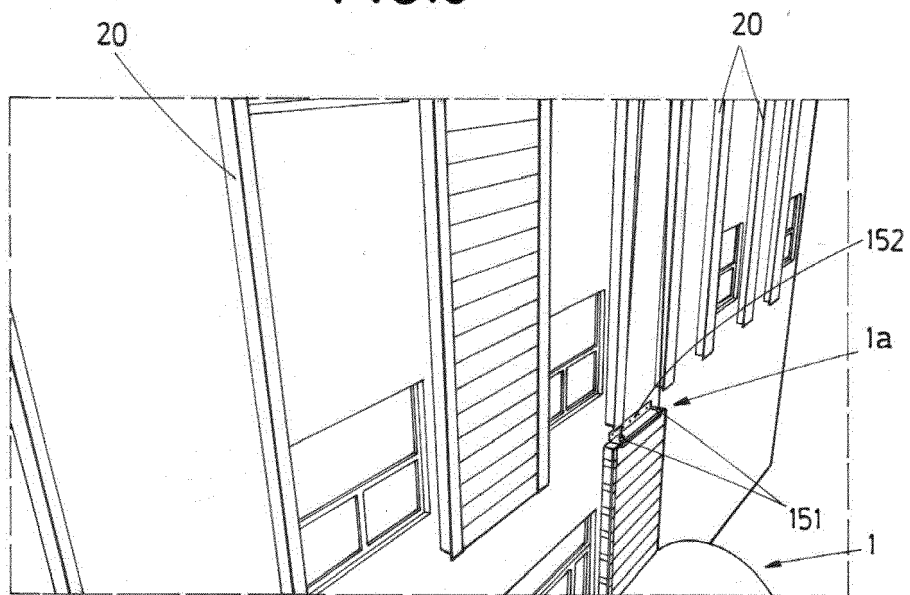


FIG. 10

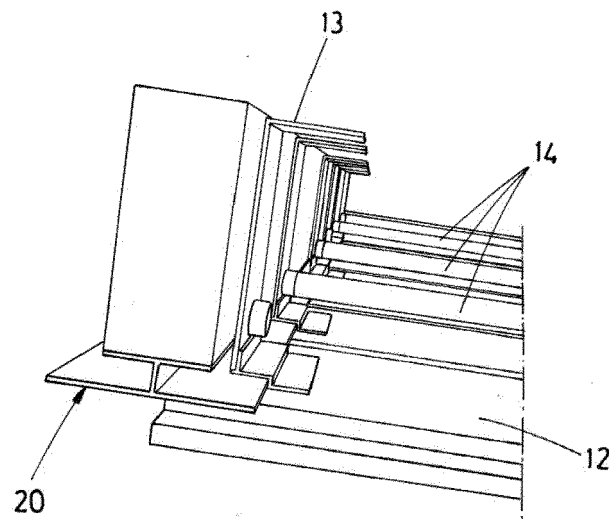


FIG.11

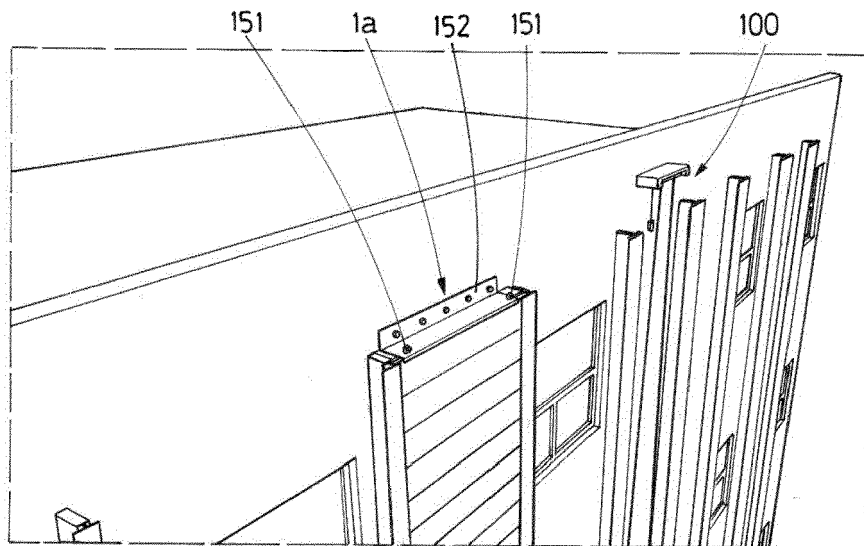


FIG.12

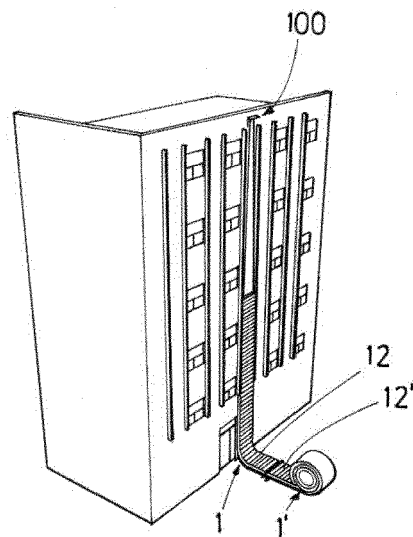


FIG.13

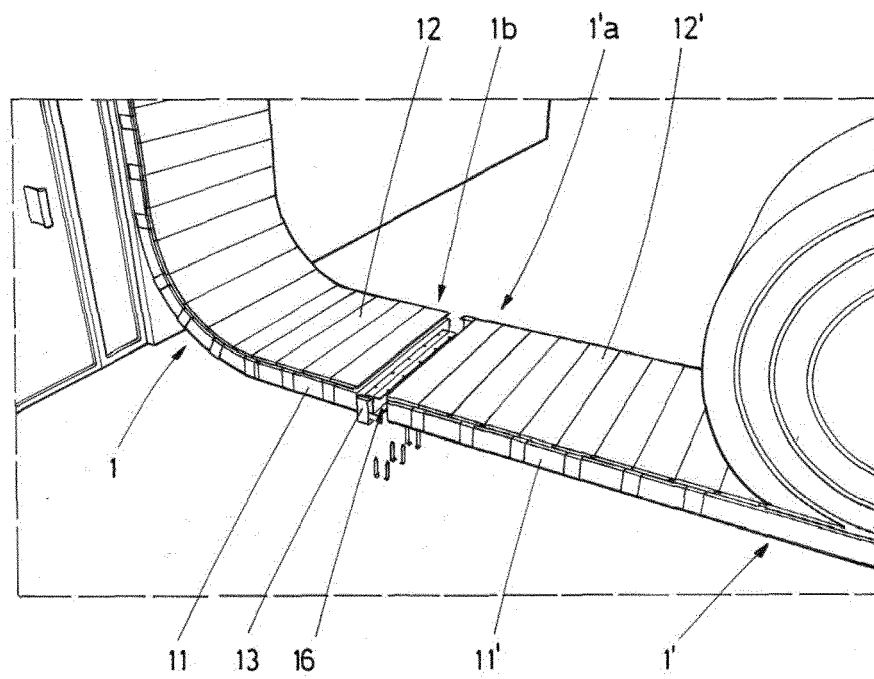


FIG.14

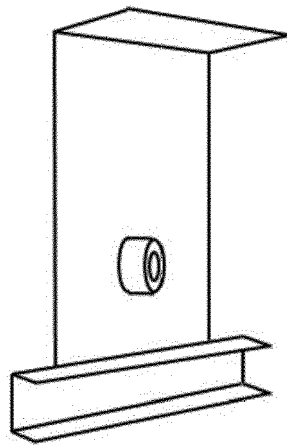


FIG.15



EUROPEAN SEARCH REPORT

Application Number
EP 17 38 2541

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A	* column 1, line 68 - column 3, line 13; figures 1-7 *	2-14	
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A	* figures 1-4 *	2-14	
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Place of search Munich		Date of completion of the search 23 January 2018	Examiner Khera, Daljit
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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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