

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
28 July 2005 (28.07.2005)

PCT

(10) International Publication Number
WO 2005/068574 A1

(51) International Patent Classification⁷: **C09J 123/20**,
E04B 1/76, E04D 13/16, C08K 7/04

(21) International Application Number:
PCT/EP2005/000488

(22) International Filing Date: 19 January 2005 (19.01.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
P-364452 19 January 2004 (19.01.2004) PL
P-366319 16 March 2004 (16.03.2004) PL

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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO,
SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,
GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

*For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.*

(54) Title: PROCESS FOR MANUFACTURING PANELS OF MINERAL WOOL

(57) Abstract: The present invention relates to a process for manufacturing panels of lamellar mineral wool, for use as sound, thermal and fireproof insulation of external walls of buildings, as well as ceilings of garages over which heated rooms are located. In the invention elements are bonded together using a hot melt adhesive. Preferably the elements are formed by cutting a web of mineral fibre, preferably of high thickness such as about 20 cm, transversely, rotating the elements by 90° and bonding them at their largest surfaces. Preferably the hot melt and adhesive is a polyolefin-based hot melt adhesive having melting point about 100°C and viscosity at 170°C of from 2600 to 3000 mPa.s.



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Process for manufacturing panels of mineral wool

The present invention relates to processes for manufacturing panels of lamellar mineral wool, for use as sound, thermal and fireproof insulation of external walls of buildings, as well as ceilings of garages over which heated rooms are located.

5 Some methods for manufacturing panels of mineral wool are known. Technologies currently in use are based on the ascertainment that, most preferably, mineral wool fibres should be arranged perpendicularly to the surface of an insulated wall. Such an arrangement of fibres increases by many times the tensile strength when the tension is perpendicular to the panel surface, at a density lower than in other
10 panels manufactured by traditional methods and with good (the best) thermal insulation, and at the same time it comprises the most ecological solution – lamellar panels may be fastened only with the use of gluing mortars, and they do not require the use of mechanical fasteners on carrying surfaces of the buildings which are up to 20 m high. Fibres arranged parallel to the wall plane tend to be torn off the panel
15 surface under the influence of atmospheric conditions, and such panels must always be bonded to the walls both mechanically and with gluing mortars.

In the course of development of panel manufacturing systems various solutions have been proposed, aimed either at providing a better thermal insulation, or at obtaining more rigid panels.

20 US 4,025,680 discloses a multilayer panel composed of layers arranged in such a way that the arrangement of fibres within the layers is alternately parallel or perpendicular to the surface. Layers may have different densities.

DE 31 36 935 discloses mineral wool panels or webs composed of layers, wherein within a given web or panel said layers and fibres forming them run uniformly
25 at an angle of 10° to 60° in relation to the panel or web plane.

EP 0 017969 discloses a method wherein from a continuous web of mineral non-woven fabric, having fibres running mainly parallel to the web surface, strips or layers are cut off crosswise to the web, then said strips or layers are rotated by 90° and said layers are bonded to a fabric mesh with adhesive. *This way mineral fibres*

run mainly vertically in relation to the surface of manufactured insulating layer.

EP 0 560 878 (WO92/10602) discloses a process for manufacturing insulating panels composed of elements made of mineral fibres bonded together in the form of rods. In this process one mainly aims at obtaining a secondary non-woven fabric by doubling a primary non-woven fabric which in turn is obtained by arranging it in a series of layers running crosswise to the length of said secondary non-woven fabric, cutting the secondary non-woven fabric lengthwise in lamellae, cutting said lamellae to desired length, rotating said lamellae by 90° about their longitudinal axis, bonding them together to form a panel and subjecting said lamellae to compression by a force acting perpendicularly to the surface, whereby longitudinal compression occurs, before or after the mineral non-woven fabric has been cut into lamellae. That invention was based on the discovery that a panel wherein both folds (made by longitudinal compression of non-woven fabric to be cut into lamellae) and individual fibres are arranged perpendicularly to the panel plane, is characterised by higher strength and rigidity than a panel wherein folds are arranged perpendicularly to the panel surface. In the course of manufacturing mineral wool panels a fibre melt is applied onto the external surface of spinning wheels and simultaneously a fibre bonding agent is sprayed thereon. Generally heat-curable bonding agents are used, such as a phenol-formaldehyde resin. Said resin, contained in the mineral wool mass, serves also for bonding rods together to form a panel.

DE-A-3223246 describes an insulation slab having a core layer and at least one cover layer. The core layer is made in lamellar form from a number of bars bonded together at their side surfaces. The core is firmly bonded on one or both sides to a curable or prefabricated cover layer. A method for making the core is described. This involves providing a number of slabs bonded together at their largest surfaces and having the mineral fibres lying in the plane of the slab. The thus-formed block is cut lengthways and perpendicular to the plane of the bonded mineral-fibre slabs to form a lamellar element of the desired thickness comprising longitudinal bars which are firmly bonded together. After this the lamellar element is firmly bonded to the

cover layer. The layers are bonded together using adhesive which is described generally as being non-flammable and inorganic, such as water glass.

Bonding rods together with the use of a bonding agent has not been employed in practice because the contact area of rods is much larger than the contact area of
5 such a panel with a substrate it is to be laid on. In order to obtain a panel 20 cm wide it is necessary to bond a plurality of so-formed rods together. Our attempts to bond individual rods together with the use of the same bonding agent that was used for bonding fibres did not give the expected results.

In practice rods are bonded together with the use of strips, tapes, non-woven
10 fabric or paper, on one side or on both sides of the panel (as in EP 017,969 above), yet the panel obtained in this manner is not rigid, and thus difficult to place on a building façade, and for this reason in practice such a panel cannot have a large size.

Insulating characteristics of ready made panels additionally depend upon the way in which individual panels are bonded together at a construction site. The bigger
15 the number of small panels necessary to form a requested surface, the bigger the number of edges at which panels are in mutual contact. The bigger the number of contact edges between the panels, the bigger the number of thermal bridges forming on the insulated surface as a result of inaccurate laying, improper adjustment of individual panels, and also as a result of increased risk of soiling contact surfaces with
20 gluing mortars. At the same time the bigger the number of panels used to lay on an insulated surface, the longer the time required for laying the insulation on the building façade, and the costs of work is relatively higher than in case of larger panels.

On the other hand the size of produced panels is determined by the fact that the perpendicular arrangement of fibres in relation to the insulated surface is the most
25 advantageous one, whereas on production lines a non-woven fabric is produced having its fibres arranged parallel to the panel surface. Therefore in order to manufacture a plate with fibres arranged perpendicularly to the insulated surface, it is necessary to cut off a strip from a web of non-woven fabric having a given thickness and to rotate said strip by 90° in order to change the fibre orientation. This in turn

means that the thickness of so-obtained layer of non-woven fabric becomes, after the rotation, the maximum width of the panel.

Therefore the prior art has not sought a non-woven fabric of maximum thickness, but instead attention was focused on increasing the surface area of the obtained panel by cutting it lengthwise into thin rods, rotating these rods and subsequently bonding them together with the use of an additional connecting layer, e.g. made of paper. Besides in practice the size of the obtained panels did not exceed 20 cm x 120 cm, since lamellar panels of larger surface were insufficiently rigid and were not suitable for laying on flat vertical surfaces. A characteristic feature of so obtained panels is that lamellae constituting their elements have considerably smaller width than thickness.

In the process of the invention an attempt was made to reverse the approach to the techniques for manufacturing panels of mineral wool.

In a first aspect of the invention a web of mineral non-woven fabric is obtained having fibres oriented parallel to the surface of the non-woven fabric and a maximal technologically obtainable thickness of 20 cm, then strips are cut off, said strips having a width corresponding to the required final panel length. The so-obtained strips are bonded together, said bonding being effected at the contact area of the largest surfaces of said strips. From such an element, obtained by bonding two or three strips together, strips are cut off having a width corresponding to a final thickness of an insulating layer, said cutting being performed along the dimension being the final panel length.

An important feature of the invention is the selection of the technique used for bonding the obtained strips together, namely the bonding is effected by gluing with the use of a layer of hot adhesive sprayed on one or both surfaces being bonded, at a temperature of 150 to 185°C. A thermofusible polyolefin-based adhesive is used, having fusing point of about 100°C and working viscosity of 2600 to 3000 mPa.s (at 170°C) in the amount of 1.0 to 5.0 g, preferably 2.0 to 3.5 g per one adhesive line 1.2 m long.

Thus in a second aspect of the invention we provide a method of bonding the surfaces of two mineral fibre elements comprising applying to one or both of the surfaces to be bonded a hot melt adhesive. These elements are generally slabs or strips of mineral fibre material cut from a larger web or slab of mineral fibre material.

5 We find that the use of this particular type of adhesive, especially when it has the preferred features set out below, provides particularly durable connections for mineral wool elements, especially when the fibres are oriented predominantly parallel to the surfaces which are bonded, as in the production of lamellar insulation panels.

10 The hot melt adhesive is preferably applied to the surfaces to be bonded by spraying and this spraying preferably lasts no more than 12 seconds.

After application of the adhesive the elements are subjected to pressure during bonding and preferably the total time for spraying and subjection to pressure is not more than 12 seconds.

15 In the process of the invention panels can be moved along stationary nozzles or stationary panels can be sprayed with the use of movable nozzles. Spraying time and adhesive bonding time is 12 seconds maximum. Panels sprayed with the adhesive are pressed together.

The adhesive can be applied to just one of the surfaces to be bonded but preferably it is applied to both.

20 It turned out that it was advantageous to prevent the penetration of the adhesive into deeper layers of the panel, and that such a connection would be more durable than a connection made by another method. Generally the adhesive does not penetrate more than 2 mm into the element.

25 Due to the short setting time of the adhesive, particular attention has to be paid to accurate positioning of strips relative to each other.

The hot melt adhesive is preferably applied at a temperature of from 150 to 185°C. Preferably the hot melt adhesive is a polyolefin-based adhesive. Its melting point is preferably from 50 to 200°C, more preferably from 80 to 120°C, and especially about 100°C. The viscosity of the hot melt adhesive is determined at 170°C and is

preferably in the range 2600 to 3000 mPa.s.

The panel may be made by gluing two or three strips (elements) together, which in case of maximum obtainable thickness of non-woven fabric layer makes it possible to obtain a panel of width of even 60 cm. In comparison with a conventional
5 panel of width not exceeding 20 cm, it is possible to reduce by three times the time of laying insulation on a wall, as well as to reduce by three times the number of formed thermal bridges. The resulting width of so-obtained elements of the final product is always at least equal or greater than their thickness.

These benefits are achieved partly due to the choice of the adhesive used and
10 the resulting strength of the bond between the elements. However, this benefit is also achieved by the method by which the elements are cut from the web and bonded together to form the insulation panel.

Thus according to a third aspect of the invention we provide a method of forming a mineral wool insulation panel comprising
15 providing a web of mineral wool having a top face and a bottom face and two opposing side faces and a longitudinal direction parallel to the top and bottom faces and side faces and a transverse direction parallel to the top and bottom faces and perpendicular to the side faces, and a thickness between the top and bottom faces, cutting at least two elements from the web, the cut being made in the
20 transverse direction, so that the top and bottom faces of each element are formed from the top and bottom faces of the web,

bonding two elements together with the top face of one element being bonded to the bottom face of the other element to form a pre-panel,

and cutting from the pre-panel at least one insulation panel having a
25 predetermined thickness in which the thickness direction of the insulation panel is parallel to the bonded surfaces of the elements forming the pre-panel.

According to a fourth aspect of the invention we provide a method of forming a mineral wool insulation panel comprising providing a web of mineral wool having a top face and a bottom face and two opposing side faces and a first end defining the

width of the web and a longitudinal direction parallel to the top and bottom faces and side faces and a transverse direction parallel to the top and bottom faces and perpendicular to the side faces, and a thickness between the top and bottom faces:

cutting at least two elements from the web, the cut being made in the
5 transverse direction, so that the top and bottom faces of each element are formed from the top and bottom faces of the web,

bonding at least two elements together with the top face of one element being bonded to the bottom face of the other element,

and packaging the resulting insulation panel without performing any further
10 cutting operations.

Thus in this aspect of the invention we cut a mineral wool web transversely so as to provide elements which are then bonded together at their faces and, by insuring that the thickness of the cut element is the desired thickness of the eventual insulation panel, the insulation panel can be packaged and subsequently used after unpacking,
15 without any further cutting operations.

In both the third and fourth aspects of the invention it is preferred that the bonding between the elements is carried out in accordance with the second aspect of the invention, namely with hot melt adhesive, preferably using the preferred aspects set out in connection with the second aspect of the invention.

20 In a fifth aspect of the invention we provide a method of forming a mineral wool insulation panel comprising

providing a web of mineral wool having a top face and a bottom face and two opposing side faces and a first end defining the width of the web and a longitudinal direction parallel to the top and bottom faces and side faces and a transverse direction
25 parallel to the top and bottom faces and perpendicular to the side faces, and a thickness between the top and bottom faces,

cutting at least two elements from the web, the cut being made substantially in the transverse direction, so that the top and bottom faces of each element are formed from the top and bottom faces of the web,

bonding the at least two elements together with the top face of one element being bonded to the bottom face of the other element,

wherein bonding is carried out using a hot melt adhesive.

5 In this aspect the hot melt adhesive and its application are preferably as described above.

In a sixth aspect we provide a process for manufacturing panels of mineral wool comprising a step of producing a web of mineral non-woven fabric in which fibres are arranged parallel to the plane of the non-woven fabric, cutting off elements therefrom, rotating them by 90°, and then bonding the so-obtained elements together,
10 **characterized in that** a web of mineral non-woven fabric is obtained having a maximal technologically obtainable width of 20 cm, then a strip is cut off therefrom lengthwise, said strip having a width corresponding to a required final panel length, the so-obtained strip is rotated in horizontal plane by 90°, and strips are cut off therefrom, said strips having a width corresponding to a final thickness of insulating
15 layer, the so-obtained strips are rotated again by 90°, said rotation being effected about the longitudinal axis of the cut-off strip, and then the strips are bonded together, the bonding being effected by gluing with the use of a layer of hot adhesive sprayed on one or all bonded surfaces, at a temperature of 150-185°C, said adhesive being a thermofusible polyolefin-based adhesive having fusing point of about 100°C and
20 working viscosity of 2600-3000 mPa.s (at 170°C), used in the amount of 2.0-3.5 g per one glue line 1.2 m long, and then the panels sprayed with the adhesive are pressed together, the maximum time of spraying and adhesive setting being 12 seconds.

In all aspects of the invention the final panel preferably does not include a cover layer but instead consists essentially of the mineral wool elements and the
25 adhesive used to bond them together.

In all aspects of the invention, two or three (and in some cases more) elements can be bonded together to form the insulation panel. In this case they are bonded together at their largest surfaces. That is, the bottom surface of the first element is bonded to the top surface of the second element and the bottom surface of the

second element is bonded to the top surface of the third element.

The insulation panels provided are useful for insulating various surfaces, including external walls of buildings and ceilings of garages over which heated rooms are located. They may be used as sound, thermal or fire insulation.

5 The insulation panel is applied to the surface to be insulated so that the bonded surfaces are perpendicular to the insulated surface. In the case where the web from which the elements are cut is formed so that the mineral fibres are predominantly parallel to the top and bottom surfaces of the web then this means that the fibres in the insulation panel are predominantly perpendicular to the surface to be
10 insulated, as is preferred as indicated above.

The web from which the elements are cut can be formed in known manner. Generally it is produced by providing a mineral charge in a furnace, melting the mineral charge to form a mineral melt and forming the mineral melt into fibres. These fibres are collected as a web on a conveyer.

15 Fiberisation can be carried out for instance using rotors having a solid surface which are mounted about a substantially horizontal axis. The melt is applied to the surface of a rotor and flung from it to form fibres. Generally a series of rotors is used so that fibres are flung from a first rotor to a second rotor and from a second rotor to a third and optionally subsequent rotor(s). This system is known as a cascade
20 spinner.

Alternatively, the fibres can be made using the well known spinning cup system in which fibres are thrown through apertures in a rotating cup and collected.

After collection on the conveyer the fibres can be treated, for instance by cross-lapping and/or compression. Generally they are formed into slabs which form
25 the web from which elements can be cut in the invention.

Generally binder material is applied to the fibres before they are collected on the conveyer. This binder is usually heat-curable binder and the web of fibres is passed through a curing oven to cure the binder.

In all aspects of the invention the web from which elements are cut is

preferably of unusually large thickness (ie the dimension between the top and bottom surfaces of the web). This thickness is preferably at least 100 mm, more preferably at least 150 mm and often at least 180 mm, in particular around 200 mm.

In all aspects of the invention the mineral wool material preferably has a
5 density from 50 to 200 kg/m³, more preferably 75 to 130 kg/m³, in particular from 80 to 100 kg/m³, for instance around 90 kg/m³.

In all aspects of the invention cutting of the elements can be done in a conventional manner, for instance using saws.

Example I

10 From a web of non-woven fabric leaving the production line, said web being 20 cm thick and 2 m wide and having fibres oriented parallel to the plane of the non-woven fabric, strips 1.2 m wide were cut off crosswise. Said strips, 1.2 m long, 20 cm wide and 20 cm thick, were glued together by two at their largest surfaces. A thermofusible polyolefin-based adhesive was used, having fusing point of about 100°C
15 and working viscosity of 2700 mPa.s at 170°C. The adhesive was sprayed for 2.4 seconds with the use of stationary nozzles onto the opposite moving strips of non-woven fabric. Fifty spraying nozzles were used per each glued surface. The distance between nozzles and moving strips was 55 mm. Adhesive consumption amounted to 3.36 g of adhesive per one glue line 1.2 m long. The obtained panels were pressed
20 together for 6 seconds. From the obtained panels strips 8 cm thick were cut off, said cutting being performed along the dimension of 1.2 m, and further sent for packing. The panel had the following dimensions: width - 40 cm, thickness - 8 cm, length - 1.2 m, and its fibres were arranged vertically to the insulated surface. A façade insulation made of the above mentioned panels was laid twice as quickly as in the case of
25 traditional façade of single panels, and at the same time the panels bonded this way did not break at connection area, and could be lifted by one edge by a single worker, thus the obtained connection was durable. The amount of thermal bridges was reduced by half.

Example II

From a web of non-woven fabric leaving the production line, said web being 20 cm thick and 2 m wide and having fibres oriented parallel to the plane of the non-woven fabric, strips 1.2 m wide were cut off crosswise. The procedure was as in Example I, but three strips were glued together. A thermofusible polyolefin-based adhesive was used having fusing point of about 100°C and working viscosity of 2700 mPa.s at 170°C. The adhesive was sprayed for 2.4 seconds with the use of nozzles onto the opposite strips of non-woven fabric. Fifty spraying nozzles were used per each of the four glued surfaces. The distance between nozzles and strips was 55 mm. Adhesive consumption amounted to 2.36 g of adhesive per one glue line 1.2 m long. The obtained panels were pressed together for 8 seconds. From the obtained panels strips 8 cm wide were cut off, said cutting being performed along the dimension of 1.2 m, and further sent for packing. The panel had the following dimensions: width - 60 cm, thickness - 20 cm, length - 1.2 m, and its fibres were arranged vertically to the insulated surface. A façade made of the above mentioned panels was laid three times as quickly as in the case of traditional façade of single panels, and at the same time the panels bonded this way did not break at connection area, and could be lifted by one edge by a single worker, thus the obtained connection was durable.

Example III

From a web of non-woven fabric leaving the production line, said web being 20 cm thick, 1.2m wide and 2 m long and having fibres oriented parallel to the plane of the non-woven fabric, strips 1.2 m wide were cut off crosswise. Said strips, 1.2 m long, 20 cm wide and 8 cm thick, were glued together by two at their largest surfaces. A thermofusible polyolefin-based adhesive was used, having fusing point of about 100°C and working viscosity of 2700 mPa.s at 170°C. The adhesive was sprayed for 2.4 seconds with the use of stationary nozzles onto the opposite moving strips of non-woven fabric. Fifty spraying nozzles were used per each glued surface. The distance between nozzles and moving strips was 55 mm. Adhesive consumption amounted to 3.36 g of adhesive per one glue line 1.2 m long. The obtained panels were pressed together for 6 seconds. The obtained panels were sent for packing. The panel had

the following dimensions: width - 40 cm, thickness - 8 cm, length – 1.2 m, and its fibres were arranged vertically to the insulated surface. A façade insulation made of the above mentioned panels was laid twice as quickly as in the case of traditional façade of single panels, and at the same time the panels bonded this way did not break at connection area, and could be lifted by one edge by a single worker, thus the obtained connection was durable. The amount of thermal bridges was reduced by half.

Example IV

From a web of non-woven fabric leaving the production line, said web being 20 cm thick, 1.2m wide and 2 m long and having fibres oriented parallel to the plane of the non-woven fabric, strips 1.2 m wide were cut off crosswise. The procedure was as in Example I, but three strips were glued together. A thermofusible polyolefin-based adhesive was used having fusing point of about 100°C and working viscosity of 2700 mPa.s at 170°C. The adhesive was sprayed for 2.4 seconds with the use of nozzles onto the opposite strips of non-woven fabric. Fifty spraying nozzles were used per each of the four glued surfaces. The distance between nozzles and strips was 55 mm. Adhesive consumption amounted to 2.36 g of adhesive per one glue line 1.2 m long. The obtained panels were pressed together for 8 seconds. The obtained panels were further sent for packing. The panel had the following dimensions: width - 60 cm, thickness - 8 cm, length – 1.2 m, and its fibres were arranged vertically to the insulated surface. A façade made of the above mentioned panels was laid three times as quickly as in the case of traditional façade of single panels, and at the same time the panels bonded this way did not break at connection area, and could be lifted by one edge by a single worker, thus the obtained connection was durable.

Example V

From a web of non-woven fabric leaving the production line, said web being 20 cm thick and 2 m wide and having fibres oriented lengthwise, strips 1.2 m wide were cut off crosswise. Said strips were rotated by 90° in horizontal plane. Then these strips were cut into strips 8 cm wide (this dimension is the final thickness of manufactured insulation) which were rotated by 90° around longitudinal axis thereof.

The so-obtained strips, 1.2 m long, 20 cm wide and 8 cm thick, were glued together, by two. A thermofusible polyolefin-based adhesive was used, having fusion point of about 100°C and working viscosity of 2700 mPa.s at 170°C. The adhesive was sprayed for 2.4 seconds with the use of stationary nozzles onto the opposite moving strips of non-woven fabric. Two spraying nozzles were used, one spraying nozzle per each glued surface. The distance between nozzles and moving strips was 55 mm. Adhesive consumption amounted to 3.36 g of adhesive per one glue line 1.2 m long. The obtained panels were pressed together for 6 seconds. The obtained panels were sent further for packing. The panel had the following dimensions: width - 40 cm, thickness - 8 cm, length - 1.2 m, and its fibres were arranged vertically to the insulated surface. The façade insulation made of the above mentioned panels was laid twice as quickly as in the case of traditional insulation of single panels, and at the same time the panels bonded this way did not break at the area of connection, and could be lifted by one edge by a single worker, thus the obtained connections were durable. The amount of thermal bridges was reduced by half.

Example VI

From a web of non-woven fabric leaving the production line, said web being 20 cm thick and 2 m wide and having lengthwise oriented fibres, strips 1.2 m wide were cut off crosswise. Said strips were rotated by 90° in horizontal plane. Then these strips were cut into strips 20 cm wide (this dimension is a final thickness of manufactured insulation), and rotated by 90° around the longitudinal axis thereof. The so-obtained strips, 1.2 m long, 20 cm wide and 20 cm thick, were glued together by three. A thermofusible polyolefin-based adhesive was used, having fusing point of about 100°C and working viscosity of 2700 mPa.s at 170°C. The adhesive was sprayed for 2.4 seconds with the use of stationary nozzles onto the opposite moving strips of non-woven fabric. Twelve spraying nozzles were used, three spraying nozzles per each of four glued surfaces. The distance between nozzles and moving strips was 55 mm. Adhesive consumption amounted to 3.36 g adhesive per one glue line 1.2 m long. The obtained panels were pressed together for a period of 8 seconds. The

obtained finished panels were sent further for packing. The panel had the following dimensions: width - 60 cm, thickness - 20 cm, length – 1.2 m, and its fibres were arranged vertically to the insulated surface. The façade insulation made of the above mentioned panels was laid three times as quickly as in the case of traditional insulation of single panels, and at the same time the panels bonded this way did not break at the area of connection, and could be lifted by one edge by a single worker, thus the obtained connections were durable.

CLAIMS

1. A method of bonding together the surfaces of two elements formed of mineral fibre, comprising applying an adhesive to one or both of the surfaces to be bonded together, wherein the adhesive is a hot melt adhesive.
- 5 2. A method according to claim 1 in which the adhesive is applied to one or both of the surfaces to be bonded by spraying and the spraying time is not more than 12 seconds.
3. A method according to claim 1 or claim 2 in which the adhesive is applied to one or both of the surfaces to be bonded and the two elements are then pressed
10 together to bond the surfaces together, wherein the total time for application of the adhesive and the pressing is not more than 12 seconds.
4. A method according to any preceding claim in which the adhesive is at a temperature of from 150 to 185°C on application.
5. A method according to any preceding claim in which the hot melt adhesive is
15 a polyolefin-based hot melt adhesive.
6. A method according to any preceding claim in which the hot melt adhesive has a melting point of from 50 to 200°C, preferably 80 to 120°C, more preferably about 100°C.
7. A method according to any preceding claim in which the hot melt adhesive has
20 a viscosity of from 2600 to 3000 mPa.s at 170°C.
8. A method according to any preceding claim in which adhesive is applied to both of the surfaces to be bonded.
9. A method according to any preceding claim which is a method of bonding together three mineral fibre elements.
- 25 10. A method according to any preceding claim in which the slabs are provided by being cut from a mineral fibre web such that the mineral fibres forming the elements are oriented predominantly parallel to the surfaces to be bonded.
11. Use of the product of the method of any of claims 1 to 10 as an insulation panel.

12. Use according to claim 11 wherein the insulation panel is applied to a surface to be insulated and the bonded surfaces in the panel are perpendicular to the surface to be insulated, such that the fibres in the panel are predominantly perpendicular to the surface to be insulated.
- 5 13. A method of forming a mineral wool insulation panel comprising
providing a web of mineral wool having a top face and a bottom face and two opposing side faces and a first end defining the width of the web and a longitudinal direction parallel to the top and bottom faces and side faces and a transverse direction parallel to the top and bottom faces and perpendicular to the side faces, and a
10 thickness between the top and bottom faces,
cutting at least two elements from the web, the cut being made substantially in the transverse direction, so that the top and bottom faces of each element are formed from the top and bottom faces of the web,
bonding the at least two elements together with the top face of one element
15 being bonded to the bottom face of the other element,
and packaging the resulting insulation panel without performing any further cutting operations.
14. A method according to claim 13 in which the two elements are bonded together with a hot melt adhesive.
- 20 15. A method according to claim 13 or claim 14 in which bonding is carried out using any of the features recited in claims 2 to 4 and 8.
16. A method according to claim 14 in which the adhesive has any of the features recited in claims 5 to 7.
- 25 17. A method of forming a mineral wool insulation panel comprising providing a web of mineral wool having a top face and a bottom face and two opposing side faces and a first end defining the width of the web and a longitudinal direction parallel to the top and bottom faces and side faces and a transverse direction parallel to the top and bottom faces and perpendicular to the side faces, and a thickness between the top and bottom faces,

cutting at least two elements from the web, the cut being made in the transverse direction, so that the top and bottom faces of each element are formed from the top and bottom faces of the web,

5 bonding two elements together with the top face of one element being bonded to the bottom face of the other element to form a pre-panel,

and cutting from the pre-panel at least one insulation panel comprising parts of at least two elements and having a predetermined thickness in which the thickness direction of the insulation panel is parallel to the bonded surfaces of the elements forming the pre-panel.

10 18. A method of forming a mineral wool insulation panel comprising providing a web of mineral wool having a top face and a bottom face and two opposing side faces and a first end defining the width of the web and a longitudinal direction parallel to the top and bottom faces and side faces and a transverse direction parallel to the top and bottom faces and perpendicular to the side faces, and a
15 thickness between the top and bottom faces,

cutting at least two elements from the web, the cut being made substantially in the transverse direction, so that the top and bottom faces of each element are formed from the top and bottom faces of the web,

20 bonding the at least two elements together with the top face of one element being bonded to the bottom face of the other element,

wherein bonding is carried out using a hot melt adhesive.

19. Use of an insulation panel produced according to claim 13 or claim 17 or claim 18 as an insulation panel on a surface to be insulated, wherein the insulation panel is applied to the surface to be insulated so that the bonded surfaces of the elements
25 forming the insulation panel are perpendicular to the surface to be insulated, whereby the mineral fibres in the insulation panel are predominantly perpendicular to the surface to be insulated.

20. A method according to claim 13 or claim 17 or claim 18 in which the insulation panel is formed by bonding three elements.

21. A method according to claim 13 or claim 17 or claim 18 in which the thickness of the web is at least 10 cm, preferably at least 20 cm.

22. A method according to claim 18 in which bonding is carried out using any of the features recited in claims 2 to 4 and 8.

5 23. A method according to claim 18 in which the adhesive has any of the features recited in claims 5 to 7.

24. A process for manufacturing panels of mineral wool comprising a step of producing a web of mineral wool with fibres arranged parallel to the plane of the non-woven fabric, cutting off elements therefrom, and then bonding the so-obtained elements together, characterized in that a web of mineral non-woven fabric is obtained having a maximal technologically obtainable width of 20 cm, then a strip is cut off therefrom, said strip having a width corresponding to a required final panel length, the so-obtained strips are bonded together by the largest surfaces, the bonding being effected by gluing with the use of a layer of hot adhesive sprayed on one or both bonded surfaces at a temperature of 150-185°C, said adhesive being a thermofusible polyolefin-based adhesive having fusing point of about 100°C and working viscosity of 2600-3000 mPa.s (at 170°C), used in the amount of 1.0 – 5.0 g, preferably 2.0-3.5 g per one glue line 1.2 m long, and then the panels sprayed with the adhesive are pressed together, the maximum time of spraying and adhesive setting being 12 seconds, and the so-obtained panels are cut into strips of thickness corresponding to the insulation thickness, said cutting being performed along the dimension corresponding to the length of the panel.

25. A process for manufacturing panels of mineral wool comprising a step of producing a web of mineral non-woven fabric in which fibres are arranged parallel to the plane of the non-woven fabric, cutting off elements therefrom, rotating them by 90°, and then bonding the so-obtained elements together, **characterized in that** a web of mineral non-woven fabric is obtained having a maximal technologically obtainable width of 20 cm, then a strip is cut off therefrom lengthwise, said strip having a width corresponding to a required final panel length, the so-obtained strip is rotated

in horizontal plane by 90°, and strips are cut off therefrom, said strips having a width corresponding to a final thickness of insulating layer, the so-obtained strips are rotated again by 90°, said rotation being effected about the longitudinal axis of the cut-off strip, and then the strips are bonded together, the bonding being effected by gluing with the use of a layer of hot adhesive sprayed on one or all bonded surfaces, at a temperature of 150-185°C, said adhesive being a thermofusible polyolefin-based adhesive having fusing point of about 100°C and working viscosity of 2600-3000 mPa.s (at 170°C), used in the amount of 2.0-3.5 g per one glue line 1.2 m long, and then the panels sprayed with the adhesive are pressed together, the maximum time of spraying and adhesive setting being 12 seconds.

26. A method according to claim 25 or claim 26, characterized in that the panel is formed of three strips.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP2005/000488

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C09J123/20 E04B1/76 E04D13/16 C08K7/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C09J E04B E04D C08K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 415 573 B1 (MOULDER RONALD) 9 July 2002 (2002-07-09)	1-23
Y	column 4, line 19 - column 4, line 35; figure 1	24-26
X	DE 32 23 246 A1 (OESTERREICHISCHE HERAKLITH AG) 13 January 1983 (1983-01-13)	1-23
Y	page 10, line 24 - line 28; figure 2	24-26
X	US 4 025 680 A (BOTSOLAS ET AL) 24 May 1977 (1977-05-24)	1-23
Y	column 3, line 17 - line 23; figure 4	24-26



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

22 March 2005

Date of mailing of the international search report

01/04/2005

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP2005/000488

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