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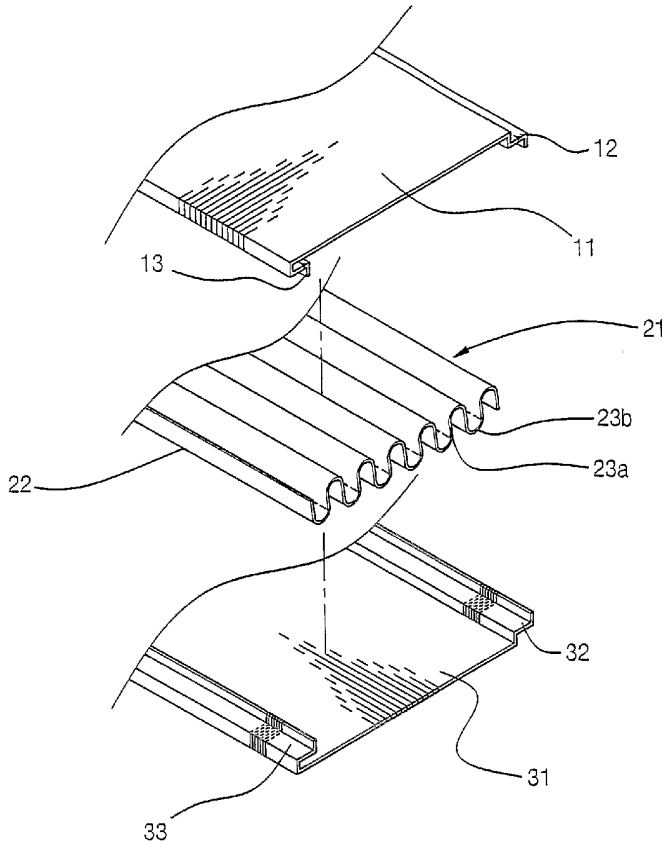

(57) Abstract: A composite panel made of metal and having the strength and structure suitable for use as interior and exterior building materials, and a method and apparatus for manufacturing the same are disclosed. The composite panel includes upper and lower decorative plates (11, 31) having outward flanges (12, 32) along first side edges thereof and inward flanges (13, 33) along second side edges thereof, and a core (21) disposed between the upper and lower decorative plates (11, 31) and having corrugations (22) formed in a continuous wave shape, in which highest and lowest surfaces (23a, 23b) of the corrugations (22) of the core (21) are applied with a hot melt adhesive, and thus, are attached to inner surfaces of the upper and lower decorative plates (11, 31).

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COMPOSITE PANEL, MANUFACTURING METHOD THEREOF AND MANUFACTURING APPARATUS THEREOF

Technical Field

The present invention relates, in general, to composite panels, and methods and apparatuses for manufacturing the same, and more particularly, to a composite panel that is made of metal, has strength and structure suitable for use as interior and exterior building materials, shields the migration of flames, and can be manufactured in commercial quantities at low costs. The present invention also relates to a method and apparatus for manufacturing the composite panel.

Background Art

In the related art, various types of interior and exterior building materials for decoration of the interior and exterior of buildings have been developed and proposed.

As a representative example of conventional interior and exterior building materials, wood panels have been widely used. Conventional wood panels typically comprise front and rear plates made of veneer boards, with a wood frame interposed between the front and rear plates to fix the plates together while maintaining a desired shape and

thickness of a resulting wood frame. The conventional wood frames having the above-mentioned construction can be easily fabricated with materials which are easily purchased, shaped, and handled, so that some users produce required wood panels by assembling veneer boards with wood frames at the locations where buildings to use the wood panels are. However, the conventional wood panels are less likely to be used as the exterior building materials, but are used as only the interior building materials, due to intrinsic properties of the wood panels. Furthermore, the conventional wood panels are flammable, so that use of the wood panels has been gradually reduced by the restriction based on related laws and regulations, such as building code and fire service law.

Thus, to overcome the problems caused by the flammability of the conventional wood panels, gypsum boards made of nonflammable materials, such as gypsum powder or sodium silicate powder, have been developed and used. The gypsum boards are typically marketed in standard sizes by manufacturers, so that a user who purchases the gypsum boards appropriately cuts the gypsum boards into pieces having desired sizes and produces a wall structure having a desired thickness using the cut pieces of the gypsum boards at a location where a building to use the gypsum boards is, and uses the produced wall structure as an interior decorative material for decorating a wall of the building.

However, to produce the interior decorative wall structure using the gypsum boards, the user must make the interior decorative wall structure having a desired thickness at the location where the building to use the interior decorative wall structure is. Furthermore, even though the gypsum boards are made of nonflammable materials to retard flames for a predetermined period, the gypsum boards cannot resist the flames for a desired lengthy period. Furthermore, the strength of the gypsum boards is not sufficient to resist impact. Furthermore, use of the gypsum boards as exterior building materials is hampered by a variety of restrictions.

Disclosure of the Invention

Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a composite panel, which is made of metal, has strength and structure suitable for use as interior and exterior building materials, shields the migration of flames, and can be manufactured in commercial quantities at low costs, and to provide a method and apparatus for manufacturing the composite panel.

In order to accomplish the above object, the present invention provides a composite panel, comprising: an upper

decorative plate and a lower decorative plate each having an outward flange along a first side edge thereof to provide a fitting rail, and an inward flange along a second side edge thereof to provide a fitting groove; and a core having a plurality of corrugations formed in a continuous wave shape, the core being disposed between the upper and lower decorative plates, wherein the core is attached using an adhesive to inner surfaces of the upper and lower decorative plates at highest and lowest surfaces of the corrugations.

In the composite panel, each of the upper decorative plate, the lower decorative plate, and the core may be made of a metal sheet selected from the group consisting of an iron sheet, an aluminum sheet and a stainless steel sheet. Preferably, the metal sheet may be coated on a surface thereof with a synthetic resin selected from the group consisting of a fluorine resin, a silicone resin and a polyester resin.

In another aspect, the present invention provides a method of manufacturing a composite panel, comprising: an upper decorative plate forming step of longitudinally feeding a first metal sheet while continuously unwinding the first metal sheet of a predetermined width from a first coil and forming outward and inward flanges along both side edges of the first metal sheet to provide an upper decorative plate; a core forming step of longitudinally feeding a second metal

sheet at a predetermined position under the upper decorative plate provided at the upper decorative plate forming step, while continuously unwinding the second metal sheet of a predetermined width from a second coil and forming a plurality of corrugations of a continuous wave shape on the second metal sheet to provide a core; a lower decorative plate forming step of longitudinally feeding a third metal sheet at a predetermined position under the core provided at the core forming step, while continuously unwinding the third metal sheet of a predetermined width from a third coil and forming outward and inward flanges along both side edges of the third metal sheet to provide a lower decorative plate; an adhesive applying step of applying an adhesive to highest and lowest surfaces of the corrugations of the core; an integrating step of moving and laminating the upper decorative plate and the lower decorative plate to the adhesive-applied upper and lower sides of the core to provide a laminated body, and then, integrating the upper decorative plate, the core and the lower decorative plate of the laminated body together into a composite panel by heating and compressing the laminated body at a temperature of 80 to 150℃ and under a pressure of 1 to 2 kg/m^2; and a post-processing step of cutting the composite panel comprising the integrated laminas, which are the upper decorative plate, the core and the lower decorative plate, into pieces of a predetermined size.

In a further aspect, the present invention provides an apparatus for manufacturing a composite panel, comprising: a first coil supply unit to continuously supply a first metal sheet; an upper decorative plate forming unit to longitudinally feed the first metal sheet, which is supplied from the first coil supply unit, while forming outward and inward flanges along both side edges of the first metal sheet; a second coil supply unit placed at a position in back of the first coil supply unit based on a moving direction of the first metal sheet supplied from the first coil supply unit, and continuously supplying a second metal sheet at a position under the first metal sheet supplied from the first coil supply unit; a core forming unit to longitudinally feed the second metal sheet which is supplied from the second core supply unit, while forming a plurality of corrugations of a continuous wave shape on the second metal sheet to provide a core; a third coil supply unit placed at a position in back of the second coil supply unit based on a moving direction of the second metal sheet supplied from the second coil supply unit, and continuously supplying a third metal sheet at a position under the second metal sheet supplied from the second coil supply unit; a lower decorative plate forming unit to longitudinally feed the third metal sheet which is supplied from the third core supply unit, while forming outward and inward flanges along both side edges of the third metal sheet; an adhesive applying unit placed between the

core forming unit and the lower decorative plate forming unit to apply an adhesive to highest and lowest surfaces of the corrugations of the core which is fed from the core forming unit; an integrating unit to move and laminate the upper and lower decorative plates, respectively fed from the upper and lower decorative plate forming units, to the upper and lower sides of the core applied with the adhesive at the adhesive applying unit, thus providing a laminated body, and then, integrate the upper decorative plate, the core and the lower decorative plate of the laminated body together into a composite panel by heating and compressing the laminated body; and a cutting unit to cut the composite panel comprising the integrated laminas, which are the upper decorative plate, the core and the lower decorative plate, into pieces of a predetermined size.

In the apparatus, the integrating unit may comprise a heating roller that applies a pressure of 1 to 2 kg/m^2 to the laminated body at a temperature of 80 to 150°C.

More preferably, the first, second and third metal sheets may be preheated at a temperature of 170 to 200°C, prior to being carried on a belt conveyer. In the above state, the bonding rate of the adhesive, such as hot melt adhesive, is increased to enhance productivity of the process. Furthermore, the preheating of the metal sheets allows the integrating step to be simply accomplished by only heating the laminated body.

Brief Description of the Drawings

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an exploded perspective view of a composite panel according to a first embodiment of the present invention;

FIG. 2 is a side view of the composite panel according to the first embodiment of the present invention;

FIG. 3 is an exploded perspective view of a composite panel according to a second embodiment of the present invention;

FIG. 4 is a side view of a composite panel according to a further embodiment of the present invention; and

FIG. 5 is a view schematically illustrating the construction of an apparatus for manufacturing the composite panels of the present invention.

Best Mode for Carrying Out the Invention

Herein below, a composite panel according to the present invention will be described with reference to the accompanying drawings.

As shown in FIGS. 1 through 4, the composite panel according to the present invention comprises upper and lower decorative plates 11 and 31 which have outward flanges 12 and 32 along the first side edges thereof to form a fitting rail if integrated, and inward flanges 13 and 33 along the second side edges thereof to form a fitting groove, if integrated. A corrugated core 21, which has corrugations 22 formed in a continuous wave shape, is disposed between the upper and lower decorative plates 11 and 31. The corrugations 22 of the core 21 are attached, using a conventionally marketed adhesive, such as a hot melt adhesive, to inner surfaces of the upper and lower decorative plates 11 and 31 at highest and lowest surfaces of the corrugations 22.

Thus, the core 21, which has the corrugations 22 formed in the continuous wave shape, is interposed between the upper and lower decorative plates 11 and 31, so that a composite panel in which the upper decorative plate 11, the core 21 and the lower decorative plate 31 are sequentially layered from the top to the bottom is produced.

The upper and lower decorative plates 11 and 31 provide an attractive appearance of the composite panel, while the core 21 is firmly attached to the upper and lower decorative plates 11 and 31 using the adhesive, thus constituting the strong composite panel along with the upper and lower decorative plates 11 and 31.

As the number of the corrugations 22 per unit area of

the core 21 is increased or the pitch of the corrugations 22 per unit area of the core 21 is reduced, the mechanical strength of the composite panel is increased. However, the weight of the composite panel is increased in proportion to the number of the corrugations 22, resulting in an increase in the transportation costs of the composite panels and an increase in the load applied to a floor of a building.

In the meantime, as the number of the corrugations 22 per unit area of the core 21 is reduced or the pitch of the corrugations 22 per unit area of the core 21 is increased, the weight of the composite panel is reduced to easily transport or carry the composite panels and the load applied to the floor of the building is reduced. However, in the above case, the mechanical strength of the composite panels is reduced.

Thus, the weight and mechanical strength of the composite panel may vary according to the thickness of the composite panel. In the present invention, it is preferred to design the core 21 such that the core 21 has seven to hundred corrugations 22 per unit area of 1 m^2 while considering the weight and mechanical strength of the composite panel.

Furthermore, the weight and mechanical strength of the composite panel can be appropriately controlled by controlling the thickness of the composite panel. In the present invention, it is preferred to determine the

thickness of the composite panel to 6 to 75 mm. When the thickness of the composite panel is less than 6 mm, the composite panel is too thin, thus reducing the durability and mechanical strength of the composite panel. On the contrary, when the thickness of the composite panel exceeds 75 mm, the composite panel is too heavy, thus reducing the practicability thereof and being difficult to move or handle the panel.

The corrugations 22 of the core 21 may have a smoothly waved cross-section as shown in FIGS. 1 and 2. Alternatively, the corrugations 22 of the core 21 may have a rapidly waved cross-section with straight sides as shown in FIG. 4. In the composite panel of the present invention, the shape of the corrugations 22 of the core 21 is not limited, but the shape and the pitch of the corrugations 22 are determined while considering the weight and mechanical strength of the composite panel as described above.

The direction of the corrugations 22 of the core 21 may be freely determined. That is, as shown in FIG. 1, the core 21 may be securely interposed between the upper and lower decorative plates 11 and 31 such that the corrugations 22 extend in parallel to both a junction line of the outward flanges 12 and 32 and a junction line of the inward flanges 13 and 33. Alternatively, as shown in FIG. 3, the core 21 may be securely interposed between the upper and lower decorative plates 11 and 31 such that the

corrugations 22 extend to be perpendicular to both the junction line of the outward flanges 12 and 32 and the junction line of the inward flanges 13 and 33.

Furthermore, the outward flanges 12 and 32 and the inward flanges 13 and 33 are shaped and sized such that the fitting rail formed by the outward flanges 12 and 32 of one composite panel is securely fitted into the fitting groove formed by the inward flanges 13 and 33 of another composite panel to produce a continuous wall structure. In the above state, the composite panels, which constitute the continuous decorative wall structure by the fitting of the fitting rails formed by the outward flanges 12 and 32 into the fitting grooves formed by the inward flanges 13 and 33, are aligned on the same plane. In a brief description, the composite panels of the present invention are designed such that a continuous wall structure is fabricated by securely fitting the fitting rail formed by the outward flanges 12 and 32 of each composite panel into the fitting groove formed by the inward flanges 13 and 33 of adjacent composite panel.

The upper and lower decorative plates 11 and 31 are preferably made of metal sheets, such as iron sheets, aluminum sheets and stainless steel sheets.

Furthermore, the adhesive may be selected from conventionally marketed adhesives, such as hot melt adhesive. Various types of hot melt adhesives have been

produced and marketed by adhesive manufacturers in the world, so that users can easily purchase the hot melt adhesives. Dupon of U.S.A. first proposed ethyl vinyl acetate (EVA) as a hot melt adhesive in 1960s, and thereafter, the EVA has been highly developed to provide high productivity due to manufacturing automation, and excellent properties, such as environmental affinitive properties, wide applicability, and possibility of reuse. The hot melt adhesive may further include polyacetal (PA) and polyethylene (PE) to provide high thermal resistance and high cold resistance, as well as the above-mentioned EVA. Furthermore, the hot melt adhesive may include a tackifier, such as rosin and hydrocarbon resin, to provide a high meltability, a reduction of viscosity, and improved working efficiency during the application of the adhesive. The hot melt adhesive may further include a wax, such as paraffin wax, microcrystalline, and low molecular weight polyethylene, to control the properties of the adhesive. Furthermore, the hot melt adhesive may include a stabilizer to provide thermal stability and resistances against viscosity variation, discoloration and carbonization, in addition to other additives.

The composite panel of the present invention is manufactured through the following method. The method of manufacturing the composite panel comprises an upper decorative plate forming step of longitudinally feeding a

first metal sheet while continuously unwinding the first metal sheet of a predetermined width from a first coil and forming outward and inward flanges 12 and 13 along both side edges of the first metal sheet to provide an upper decorative plate 11. Thereafter, a core forming step is executed to longitudinally feed a second metal sheet at a predetermined position under the upper decorative plate 11, while continuously unwinding the second metal sheet of a predetermined width from a second coil and forming a plurality of corrugations 22 of a continuous wave shape on the core metal sheet to provide a core 21. Thereafter, a lower decorative plate forming step is executed to longitudinally feed a third metal sheet at a predetermined position under the core 21, while continuously unwinding the third metal sheet of a predetermined width from a third coil and forming outward and inward flanges 32 and 33 along both side edges of the third metal sheet to provide a lower decorative plate 31. Thereafter, an adhesive applying step is executed to apply an adhesive to the highest and lowest surfaces of the corrugations 22 of the core 21. Thereafter, an integrating step is executed to move and laminate the upper decorative plate 11 and the lower decorative plate 31 to the adhesive-applied upper and lower sides of the core 21 to provide a laminated body, and then, integrate the upper decorative plate 11, the core 21 and the lower decorative plate 31 of the laminated body together into a continuous

composite panel by heating and compressing the laminated body at a temperature of 80 to 150°C and under a pressure of 1 to 2 kg/m^2. Thereafter, a post-processing step is executed to cut the continuous composite panel comprising the integrated laminas, which are the upper decorative plate 11, the core 21 and the lower decorative plate 31, into pieces of a predetermined size, thus providing the composite panels of the present invention.

In the upper decorative plate forming step of the above-mentioned method, the first metal sheet is longitudinally fed, while the first metal sheet of the predetermined width is continuously unwound from the first coil and the outward and inward flanges 12 and 13 are formed along both side edges of the first metal sheet to provide the upper decorative plate 11.

In the above-mentioned method, the upper decorative plate 11 and the lower decorative plate 31 are appropriately laminated to and integrated with the core 21 by appropriately arranging the first and third coils at predetermined precise positions. Furthermore, the outward flange 12, 32 and the inward flange 13, 33 may be preferably formed along both side edges of each of the metal sheets by bending the side edges of the metal sheets through a conventional cold rolling process.

In the core forming step, the second metal sheet is longitudinally fed at the predetermined position under the

upper decorative plate 11, while the second metal sheet of the predetermined width is continuously unwound from the second coil and the plurality of corrugations 22 of the continuous wave shape are formed on the second metal sheet to provide the core 21.

Thus, the core 21 is produced. The core 21 is securely interposed between the upper decorative plate 11 that was produced in the upper decorative plate forming step and the lower decorative plate 31 that will be produced later, so that the continuous composite panel is produced. The corrugations 22 of the core 21 may be provided by continuously bending the second metal sheet through a conventional cold rolling process.

In the lower decorative plate forming step, the third metal sheet is longitudinally fed at the predetermined position under the core 21, while the third metal sheet of the predetermined width is continuously unwound from the third coil and the outward and inward flanges 32 and 33 are formed along both side edges of the third metal sheet to provide the lower decorative plate 31, in the same or similar manner as that described for the upper decorative plate forming step.

In the adhesive applying step, the adhesive is applied to the highest and lowest surfaces of the corrugations 22 of the core 21. Due to the adhesive, the inner surfaces of the upper and lower decorative plates 11 and 31 are securely

attached to the highest and lowest surfaces 23a and 23b of the corrugations 22 of the core 21.

In the integrating step, the upper decorative plate 11 and the lower decorative plate 31 are moved and laminated to the adhesive-applied upper and lower sides of the core 21 to provide the laminated body. Thereafter, the upper decorative plate 11, the core 21 and the lower decorative plate 31 of the laminated body are integrated together into the continuous composite panel by heating and compressing the laminated body at the temperature of 80 to 150°C and under the pressure of 1 to 2 kg/m^2.

That is, the laminated body, in which the upper decorative plate 11, the core 21 and the lower decorative plate 31 are sequentially laminated, is heated and compressed at an appropriate temperature and pressure according to the properties of the adhesive, thus providing the continuous composite panel.

When the temperature during the integrating step is lower than 80°C, the adhesive is not sufficiently melted, thus reducing the adhesive force. In the meantime, when the temperature during the integrating step exceeds 150°C, some of the adhesive may be burnt or lost, thus causing an economical problem. Furthermore, when the pressure during the integrating step is less than 1 kg/m^2, the laminated body is not sufficiently compressed, so that a desired adhesive force is not provided. In the meantime, when the

pressure during the integrating step exceeds 2 kg/m^2, the core 21 may be deformed. Furthermore, to provide such a pressure exceeding 2 kg/m^2, a large amount of energy must be consumed and the size of a press machine to compress the laminated body must be increased to reduce productivity.

Thereafter, the post-processing step is executed to cut the continuous composite panel into pieces of a predetermined size, thus providing the composite panels of the present invention. In the above state, the continuous composite panel may be cut into pieces of 1m x 1m, which are easily transported and stored. Furthermore, the continuous composite panel may be cut into pieces of 4m x 8m, which is equal to the size of conventional veneer boards.

The apparatus for manufacturing the composite panels comprises a first coil supply unit 51 to continuously supply a first metal sheet 52; and an upper decorative plate forming unit 53 to longitudinally feed the first metal sheet 51, which is supplied from the first coil supply unit 51, while forming outward and inward flanges 12 and 13 along both side edges of the first metal sheet 52. The apparatus further comprises a second coil supply unit 61 which is placed at a position in back of the first coil supply unit 51 based on a moving direction of the first metal sheet 52 supplied from the first coil supply unit 51, and continuously supplies a second metal sheet 62 at a position under the first metal

sheet 52 supplied from the first coil supply unit 51; and a core forming unit 63 to longitudinally feed the second metal sheet 62 which is supplied from the second core supply unit 61, while forming a plurality of corrugations 22 of a continuous wave shape on the second metal sheet 62 to provide a core 21. The apparatus further comprises a third coil supply unit 81 which is placed at a position in back of the second coil supply unit 61 based on a moving direction of the second metal sheet 62 supplied from the second coil supply unit 61, and continuously supplies a third metal sheet 82 at a position under the second metal sheet 62 supplied from the second coil supply unit 61; and a lower decorative plate forming unit 83 to longitudinally feed the third metal sheet 82 which is supplied from the third core supply unit 81, while forming outward and inward flanges 32 and 33 along both side edges of the third metal sheet 82. The apparatus further comprises an adhesive applying unit 71 which is placed between the core forming unit 63 and the lower decorative plate forming unit 83 to apply an adhesive to the highest and lowest surfaces 23a and 23b of the corrugations 22 of the core 21 which is fed from the core forming unit 63. The apparatus further comprises an integrating unit 91 which moves and laminates the upper and lower decorative plates 11 and 31, respectively fed from the upper and lower decorative plate forming units 53 and 83, to the upper and lower sides of the core 21 applied with the adhesive at the adhesive

applying unit 71, thus providing a laminated body, and then, integrates the upper decorative plate 11, the core 21 and the lower decorative plate 31 of the laminated body together into a continuous composite panel by heating and compressing the laminated body. The apparatus further comprises a cutting unit 93 to cut the continuous composite panel comprising the integrated laminas, which are the upper decorative plate 11, the core 21 and the lower decorative plate 31, into pieces of a predetermined size.

In the apparatus, the coil supply units are devices to continuously supply metal sheets while unwinding the metal sheets from coils. In the present invention, the composite panel manufacturing apparatus uses at least three metal sheets, which are the first metal sheet 52, the second metal sheet 62, and the third metal sheet 82. The first coil supply unit 51 is a device to continuously supply the first metal sheet 52 while unwinding the first metal sheet 52 from a first coil. In the same manner as that described for the first coil supply unit 51, the second and third coil supply units 61 and 81 are devices to continuously supply the second and third metal sheets 62 and 82 while unwinding the second and third metal sheets 62 and 82 from second and third coils, respectively.

The upper decorative plate forming unit 53 is a device to longitudinally feed the first metal sheet 51, supplied from the first coil supply unit 51, while forming

the outward and inward flanges 12 and 13 along both side edges of the first metal sheet 52. In the above case, the formation of the outward flange 12, 32 and the inward flange 13, 33 may be accomplished by use of a conventional cold rolling press machine which presses and bends a metal sheet using a roller.

The second coil supply unit 61 is placed in back of the first coil supply unit 51 based on the moving direction of the first metal sheet 52 supplied from the first coil supply unit 51.

The core forming unit 63 longitudinally feeds the second metal sheet 62 which is supplied from the second core supply unit 61, while forming the corrugations 22 of the continuous wave shape on the second metal sheet 62 to provide the core 21 which maintains a desired mechanical strength of the composite panels of the present invention.

In the above case, the formation of the corrugations 22 on the core 21 may be preferably accomplished by use of a conventional cold rolling press machine which presses and bends a metal sheet using a roller. Furthermore, the lower decorative plate forming unit 83 is a device to longitudinally feed the third metal sheet 82 which is supplied from the third core supply unit 81, while forming the outward and inward flanges 32 and 33 along both side edges of the third metal sheet 82, in the same manner as that described for the upper decorative plate forming unit

53.

The adhesive applying unit 71 is a device that is placed between the core forming unit 63 and the lower decorative plate forming unit 83 to apply the adhesive to the highest and lowest surfaces 23a and 23b of the corrugations 22 of the core 21 which is fed from the core forming unit 63. In the present invention, a conventional roll coating machine, powder spraying machine or impregnating machine may be used as the adhesive applying unit 71. The roll coating machine applies the adhesive to the highest and lowest surfaces 23a and 23b of the corrugations 22 of the core 21 by a coating roll.

The powder spraying machine applies a powdered adhesive by spraying the powdered adhesive, while the impregnating machine impregnates the core 21 with a liquid adhesive by inserting the core 21 into an adhesive container which contains the liquid adhesive therein.

The integrating unit 91 is a device that moves and laminates the upper and lower decorative plates 11 and 31, respectively fed from the upper and lower decorative plate forming units 53 and 83, to the upper and lower sides of the core 21 applied with the adhesive at the adhesive applying unit 71, thus providing the laminated body, and then, integrates the upper decorative plate 11, the core 21 and the lower decorative plate 31 of the laminated body together into the continuous composite panel by heating and

compressing the laminated body.

In the integrating unit 91, a press machine with a heater 92 to generate heat may be used as a means for heating and compressing the laminated body.

The cutting unit 93 is a device to cut the continuous composite panel comprising the integrated laminas, which are the upper decorative plate 11, the core 21 and the lower decorative plate 31, into the pieces of the predetermined size. A cutter may be used as the cutting unit 93.

In the present invention, the integrating unit 91 may comprise a heating roller that applies a pressure of 1 to 2 kg/m^2 to the laminated body at a temperature of 80 to 150°C.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Industrial Applicability

As described above, the present invention provides a composite panel that is made of metal, has desired strength and structure, shields the migration of flames, and can be manufactured in commercial quantities at low costs. The

composite panel is suitable for use as interior and exterior building materials.

Claims

1. A composite panel, comprising:

an upper decorative plate and a lower decorative plate each having an outward flange along a first side edge thereof to provide a fitting rail, and an inward flange along a second side edge thereof to provide a fitting groove; and

a core having a plurality of corrugations formed in a continuous wave shape, the core being disposed between the upper and lower decorative plates,

wherein the core is attached using an adhesive to inner surfaces of the upper and lower decorative plates at highest and lowest surfaces of the corrugations.

2. The composite panel according to claim 1, wherein each of the upper decorative plate, the lower decorative plate, and the core is made of a metal sheet selected from the group consisting of an iron sheet, an aluminum sheet and a stainless steel sheet.

3. The composite panel according to claim 1, wherein each of the upper and lower decorative plates is made of a metal sheet selected from the group consisting of an iron sheet, an aluminum sheet and a stainless steel sheet each of which is coated on a surface thereof with a synthetic

resin selected from the group consisting of a fluorine resin, a silicone resin and a polyester resin.

4. The composite panel according to claim 1, wherein the core is made of a metal sheet selected from the group consisting of an iron sheet, an aluminum sheet and a stainless steel sheet each of which is coated on a surface thereof with a synthetic resin selected from the group consisting of a fluorine resin, a silicone resin and a polyester resin.

5. A method of manufacturing a composite panel, comprising:

an upper decorative plate forming step of longitudinally feeding a first metal sheet while continuously unwinding the first metal sheet of a predetermined width from a first coil and forming outward and inward flanges along both side edges of the first metal sheet to provide an upper decorative plate;

a core forming step of longitudinally feeding a second metal sheet at a predetermined position under the upper decorative plate provided at the upper decorative plate forming step, while continuously unwinding the second metal sheet of a predetermined width from a second coil and forming a plurality of corrugations of a continuous wave shape on the second metal sheet to provide a core;

a lower decorative plate forming step of longitudinally feeding a third metal sheet at a predetermined position under the core provided at the core forming step, while continuously unwinding the third metal sheet of a predetermined width from a third coil and forming outward and inward flanges along both side edges of the third metal sheet to provide a lower decorative plate;

an adhesive applying step of applying an adhesive to highest and lowest surfaces of the corrugations of the core;

an integrating step of moving and laminating the upper decorative plate and the lower decorative plate to the adhesive-applied upper and lower sides of the core to provide a laminated body, and then, integrating the upper decorative plate, the core and the lower decorative plate of the laminated body together into a composite panel by heating and compressing the laminated body at a temperature of 80 to 150°C and under a pressure of 1 to 2 kg/m^2; and

a post-processing step of cutting the composite panel comprising the integrated laminas, which are the upper decorative plate, the core and the lower decorative plate, into pieces of a predetermined size.

6. An apparatus for manufacturing a composite panel, comprising:

a first coil supply unit to continuously supply a first metal sheet;

an upper decorative plate forming unit to longitudinally feed the first metal sheet, which is supplied from the first coil supply unit, while forming outward and inward flanges along both side edges of the first metal sheet;

a second coil supply unit placed at a position in back of the first coil supply unit based on a moving direction of the first metal sheet supplied from the first coil supply unit, and continuously supplying a second metal sheet at a position under the first metal sheet supplied from the first coil supply unit;

a core forming unit to longitudinally feed the second metal sheet which is supplied from the second core supply unit, while forming a plurality of corrugations of a continuous wave shape on the second metal sheet to provide a core;

a third coil supply unit placed at a position in back of the second coil supply unit based on a moving direction of the second metal sheet supplied from the second coil supply unit, and continuously supplying a third metal sheet at a position under the second metal sheet supplied from the second coil supply unit;

a lower decorative plate forming unit to longitudinally feed the third metal sheet which is supplied from the third core supply unit, while forming outward and inward flanges along both side edges of the third metal

sheet;

an adhesive applying unit placed between the core forming unit and the lower decorative plate forming unit to apply an adhesive to highest and lowest surfaces of the corrugations of the core which is fed from the core forming unit;

an integrating unit to move and laminate the upper and lower decorative plates, respectively fed from the upper and lower decorative plate forming units, to the upper and lower sides of the core applied with the adhesive at the adhesive applying unit, thus providing a laminated body, and then, integrate the upper decorative plate, the core and the lower decorative plate of the laminated body together into a composite panel by heating and compressing the laminated body; and

a cutting unit to cut the composite panel comprising the integrated laminas, which are the upper decorative plate, the core and the lower decorative plate, into pieces of a predetermined size.

7. The apparatus for manufacturing the composite panel according to claim 6, wherein the integrating unit comprises a heating roller that applies a pressure of 1 to 2 kg/m^2 to the laminated body at a temperature of 80 to 150°C.

Fig. 1

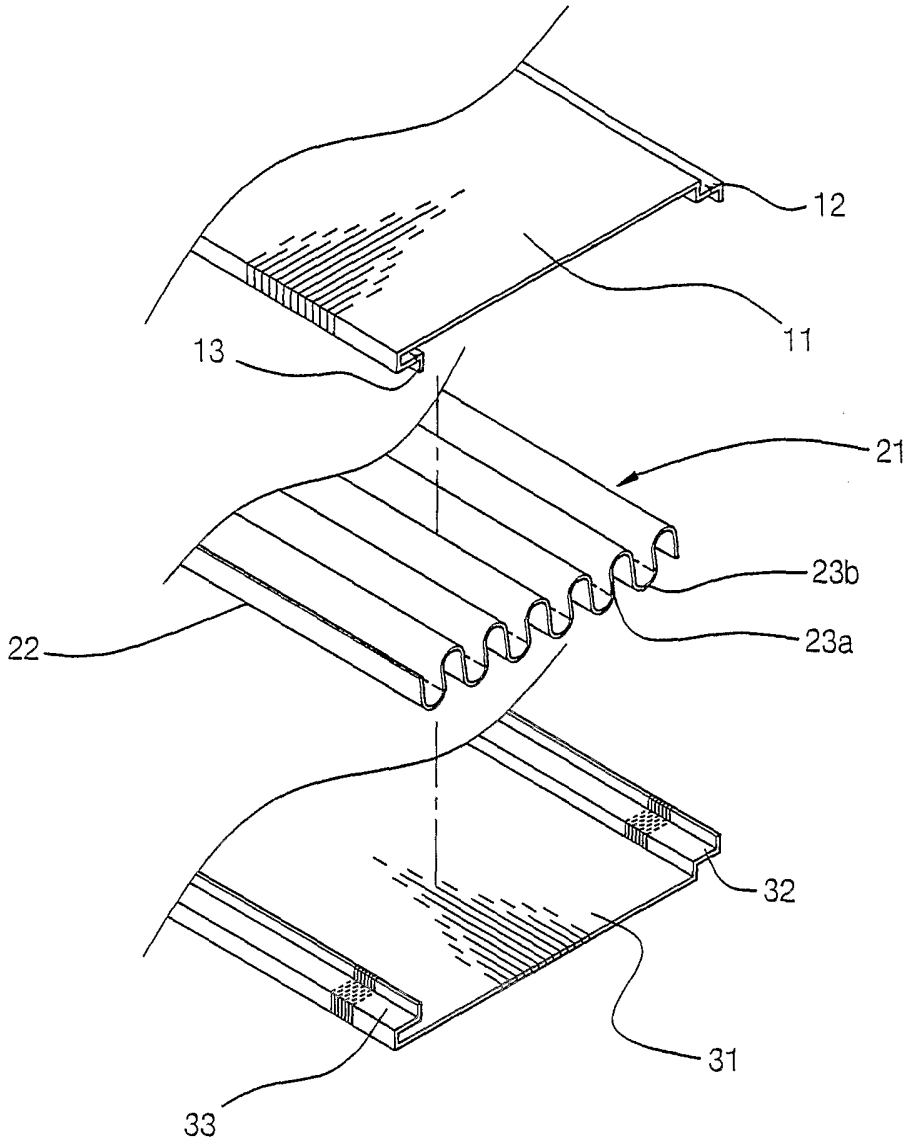


Fig. 2

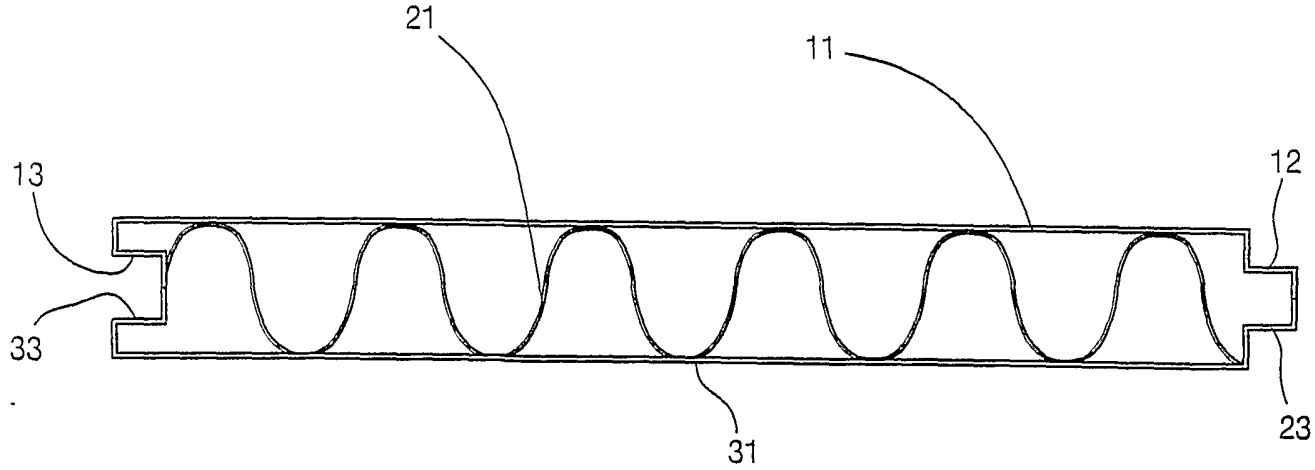


Fig. 3

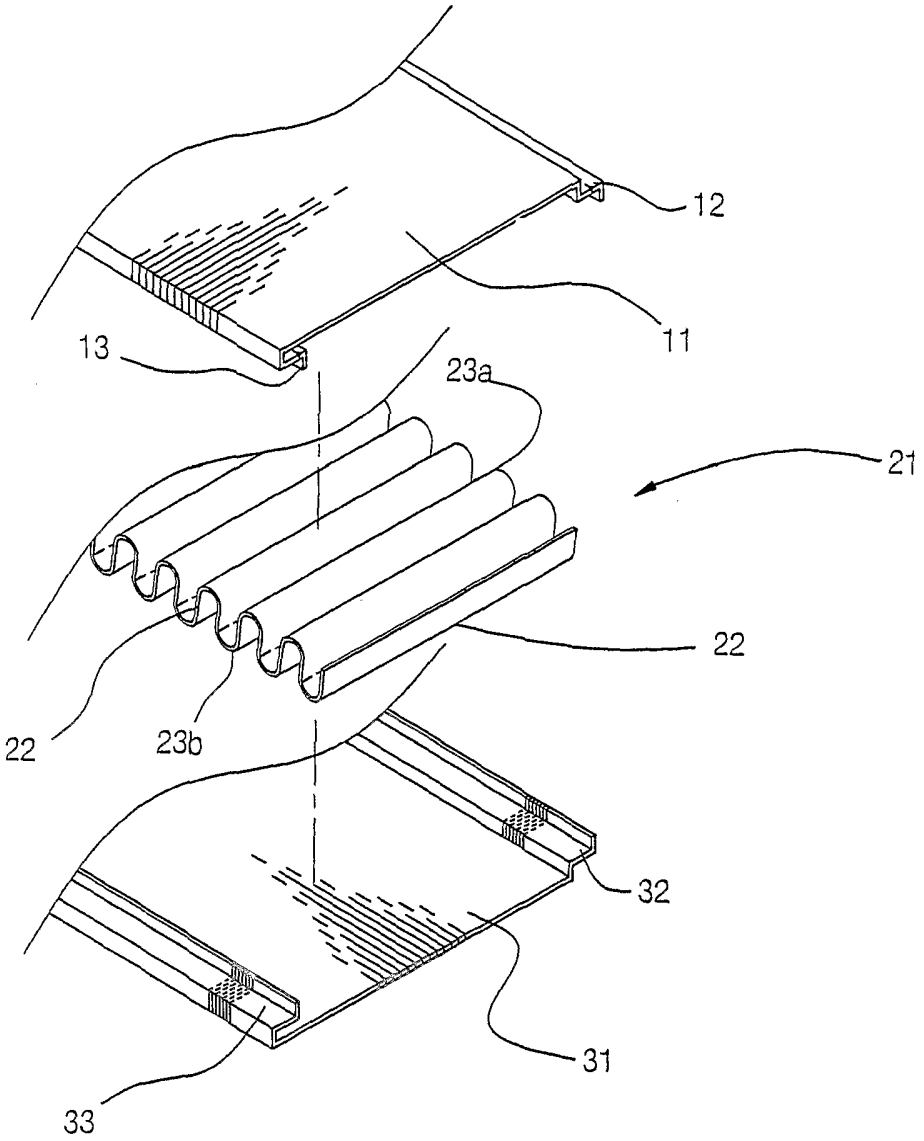


Fig. 4

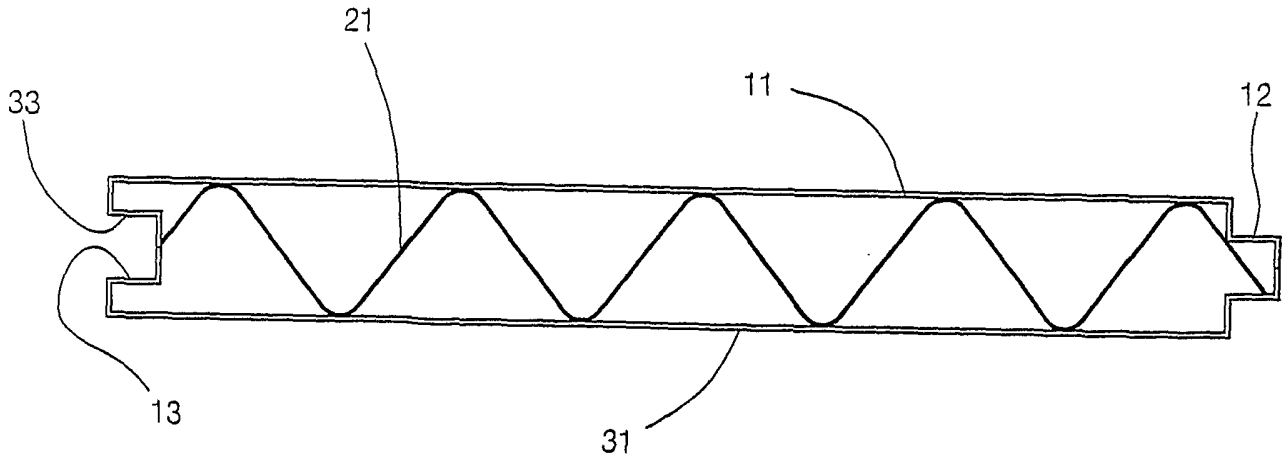
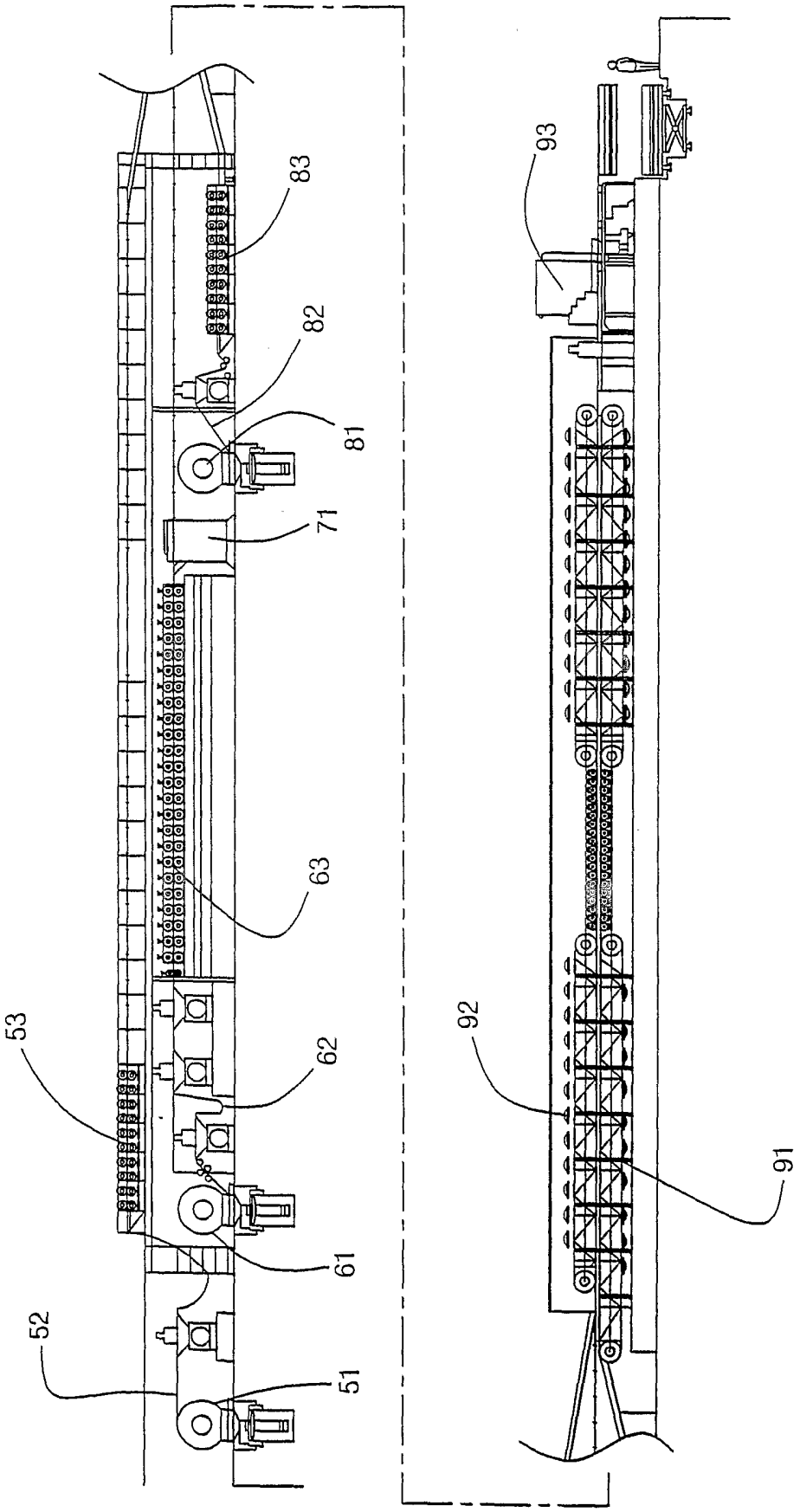


Fig. 5



INTERNATIONAL SEARCH REPORT

national application No.
PCT/KR2004/000405

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 B32B 3/12, E04B 1/08, E04B 2/08, B32B 3/28, B32B 15/00

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)

IPC7 B32B 3/00, 3/12, 3/28, 15/00, 15/01, 15/06, 15/08, 15/20, E04B 1/08, 2/08, E04C 2/08, 2/32, 2/34, 2/36,

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

Korean patents and applications for inventions since 1975.
Korean uitility models and applications for utility models since 1975.

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,290,622 A (TANABE) 01 March 1994 (01-03-1994) See claim 1; column 2, lines 14-54; Fig.1	1
X	US 6,080,495 A (WRIGHT) 27 June 2000 (27-06-2000) See column 3, lines 56 - column 4, line 65; Fig.1	1-2
Y	US 6,497,967 B2 (WITTERBROOD) 24 December 2002 (24-12-2002) See column 9, lines 14-51; Figs 3-6	1-4
Y	US 5,348,810 A (PAGE) 20 September 1994 (20-09-1994) See the whole document	1-4
Y	JP 1-295830 A (MITSUBISHI YUKA BADISCHE CO., LTD.) 29 November 1989 (29-11-1989) See claims; Figs.1-2	5-7
Y	US 5,114,510 A (WRIGHT) 19 May 1992 (19-05-1992) See the whole document	5-7

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 JUNE 2004 (25.06.2004)	28 JUNE 2004 (28.06.2004)

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2004/000405

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	JP 2001-138043 A (SUMITOMO LIGHT METAL IND., LTD.) 22 May 2001 (22-05-2001) See the whole document	1-2
A	JP 7-40480 A (IKEDA BUSSAN CO., LTD.) 10 February 1995 (10-02-1995) See the whole document	1-7
A	US 3,950,585 A (HALE) 13 April 1976 (13-04-1976) See the whole document	1-7

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Information on patent family members

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US 5,114,510 A	19-05-1992	NONE	
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JP 2001-138043 A	22-05-2001	NONE	
JP 7-40480 A	10-02-1995	NONE	
US 3,950,585 A	13-04-1976	NONE	