Method and apparatus for the continuous production of PIR/PUIR/PUR foam cored sandwich panels

Description

Background

The present invention relates to a method for the production of PIR/PUIR/PUR foam cored sandwich panels with metal sheets as facings at top and bottom. The present invention further relates to an apparatus for the production of PIR/PUIR/PUR foam cored sandwich panels with metal sheets as facings at top and bottom.

Such sandwich panels are produced in continuous double belt line. With this production process, the upper metal sheet and the lower metal sheet are continuously fed into a double belt. An adhesive is applied to the lower metal sheet and, subsequently, the foam core material is dispensed between the upper metal and the lower metal sheet. With this process, the adhesion of foam to the lower metal sheet is improved and it provides a very strong foam adhesion to the lower metal sheet. However, the adhesion of the foam to the upper metal sheet is dependent on the formulation of the foam material, the metal sheet temperature, the type of coating on the metal inner surface and application of corona treatment to metal sheets. Generally, the adhesion of foam to the upper metal sheet is weaker compared to the adhesion of the foam to the lower metal sheet, where the foam-metal-bonding strength is much stronger due to the adhesive actually being applied to the lower metal sheet.

Summary

It is therefore an object of the present disclosure to provide a method and an apparatus for the continuous production of a PIR/PUIR/PUR foam cored sandwich panel with an improved foam adhesion to the upper metal sheet. In other words, it is an object of the present disclosure to provide a method and an apparatus adapted to reinforce foam adhesion to an upper metal sheet in the continuous production of a PIR/PUIR/PUR foam cored sandwich panel using a continuous double belt.

This object is solved by the subject-matters of the independent claims. Further preferred embodiments are given in the dependent claims.

In an aspect, there is provided a method for the continuous production of a PIR/PUIR/PUR foam cored sandwich panel with metal sheets as facings at top and bottom, wherein an upper metal sheet and a lower metal sheet are continuously fed into a double belt , wherein a PIR/PUIR/PUR core material is applied between the upper metal sheet and the lower metal sheet, wherein an adhesive is applied to the lower metal sheet , wherein a portion of the adhesive applied to the lower metal sheet is applied to the upper metal sheet by means of a rotating brush.

In another aspect, there is provided an apparatus for the continuous production of a PIR/PUIR/PUR foam cored sandwich panel with metal sheets as facings at top and bottom, comprising
an upper roller for providing an upper metal sheet,
a lower roller for providing a lower metal sheet,
a double belt into which the upper metal sheet and the lower metal sheet are continuously feedable,
an adhesive dispenser for applying an adhesive to the lower metal sheet,
a core material dispenser for applying a PIR/PUIR/PUR core material between the upper metal sheet and the lower metal sheet, characterised in that it comprises
a rotating brush, wherein the rotating brush is adapted to apply a portion of the adhesive applied to the lower metal sheet to the upper metal sheet and wherein the rotating brush preferably comprises a plurality of blades.

In the continuous production of PIR/PUIR/PUR foam cored sandwich panel with metal sheets as facing at top and bottom, the upper metal sheet and the lower metal sheet are continuously fed into a double belt. The PIR/PUIR/PUR core material is applied between the upper metal sheet and the lower metal sheet. An adhesive is applied to the lower metal sheet. According to the present disclosure, a portion of the adhesive applied to the lower metal sheet is applied to the upper metal sheet by means of a rotating brush.

Accordingly, a basic idea of the present disclosure is that the rotating brush takes up and rolls a portion of the adhesive from the lower metal sheet onto the upper metal sheet, e.g. roughly half of the adhesive applied to the lower metal sheet may be brought into contact with the upper metal sheet. Thereby, foam adhesion to an upper metal sheet in the continuous production of a PIR/PUIR/PUR foam cored sandwich panel using a continuous double belt is reinforced

The term "rotating brush" in the sense of the present disclosure covers both a brush, which is rotatable, and a brush, which actually is rotating. In connection with the present disclosure it is preferred that the rotating brush is pneumatically rotated.

The rotating brush may extend in a direction parallel to a width of the upper metal sheet and the lower metal sheet. Thereby, the adhesive may be applied to a substantial portion of the width of the upper metal sheet and the lower metal sheet. A width of the upper metal sheet and/or lower metal sheet in the sense of the present disclosure is a dimension thereof perpendicular to the direction in which the upper metal sheet and/or lower metal sheet are usually conveyed.

A rotational axis of the rotating brush may extend substantially parallel to the upper metal sheet and the lower metal sheet. Thereby, it is ensured that the rotating brush comes into contact with the upper metal sheet and the lower metal sheet over its complete length which improves the distribution of the adhesive. The term "substantially parallel" in the sense of the present disclosure covers arrangements being exactly parallel as well arrangements with a deviation from the exact parallel orientation not more than 10 ° and preferably not more than 5 °.

For example, the rotational axis may extend in a direction parallel to a width of the upper metal sheet and the lower metal sheet. Thereby, the rotating brush may be arranged

The rotating brush may be arranged downstream from an adhesive dispenser applying the adhesive. For example, the rotating brush may be arranged at a distance of 300 cm to 500 cm, preferably 350 cm to 450 cm and most preferably 370 cm to 430 cm from the adhesive dispenser. Thereby, it is ensured that sufficient amounts of the adhesive are applied to the upper metal sheet and the lower metal sheet.

The rotating brush may be arranged upstream from a core material dispenser for applying the PIR/PUIR/PUR core material. The rotating brush may be arranged at a distance of 40 cm to 80 cm, preferably 45 cm to 75 cm and most preferably 50 cm to 70 cm from the core material dispenser. Thereby, it is ensured that sufficient amount of the adhesive applied to the lower metal sheet may be applied to the upper metal sheet by means of the rotating brush before the foam core material is dispensed.

The adhesive may applied to the lower metal sheet at a temperature of 30 °C to 40 °C, preferably 32 °C to 38 °C and most preferably 33 °C to 37 °C. The adhesive has to remain liquid and low viscosity, i.e. the viscosity is lower than 500 cps or 0,5 Pa*s, for at least 90 seconds at 35 C, i.e. the gelling time of the adhesive is more than 100 seconds at 35 °C, than with usual production processes in order to allow for the rotating brush to take up the adhesive from the lower metal sheet and to apply to the upper metal sheet. This can only be done effectively and the adhesive distributed to the upper metal sheet evenly if the adhesive remains in a liquid state for longer duration before gelling, which is ensured by these temperature ranges and the low viscosity and slow reactivity formulation of the adhesive.

An apparatus for the continuous production of PIR/PUIR/PUR foam cored sandwich panel with metal sheets as facings at top and bottom according to the present disclosure comprises an upper roller for providing an upper metal sheet, a lower roller for providing a lower metal sheet, an adhesive dispenser for applying an adhesive to the lower metal sheet, a core material dispenser for applying a PIR/PUIR/PUR core material between the upper metal sheet and the lower metal sheet, and a rotating brush, wherein the rotating brush is adapted to apply to the upper metal sheet a portion of the adhesive applied to the lower metal sheet .

The rotating brush may extend in a direction parallel to a width of the upper metal sheet and the lower metal sheet. A rotational axis of the rotating brush may extend substantially parallel to the upper metal sheet and the lower metal sheet. The rotational axis may extend in a direction parallel to a width of the upper metal sheet and the lower metal sheet. The adhesive dispenser may be adapted to apply the adhesive to an inner surface of the lower metal sheet

and the rotating brush is adapted to apply a portion of the adhesive applied to the lower metal sheet to an inner surface of the upper metal sheet. The adhesive dispenser may be adapted to apply the adhesive over a complete width of the lower metal sheet. The apparatus may further comprise a pneumatic motor for driving the rotating brush. The rotating brush may comprise a plurality of blades. The blades may be at least partially made of polytetrafluoroethylene. Each of the plurality of blades may comprise a length of 30 mm to 150 mm. Each of the plurality of blades may comprise a plurality of bristles. The plurality of blades may be arranged in rows spaced apart in a circumferential direction around the rotating brush. The rows may extend parallel to a rotational axis of the rotating brush. The blades may comprise extension portions. The extension portions of two adjacent rows may be arranged shifted relative to one another in a direction parallel to a rotational axis of the rotating brush. The rotating brush may be arranged downstream from the adhesive dispenser. The rotating brush may be arranged at a distance of 300 cm to 500 cm, preferably 350 cm to 450 cm and most preferably 370 cm to 430 cm from the adhesive dispenser. The rotating brush may be arranged upstream from the core material dispenser. The rotating brush may be arranged at a distance of 40 cm to 80 cm, preferably 45 cm to 75 cm and most preferably 50 cm to 70 cm from the core material dispenser. The adhesive may be a one- or two-component adhesive. The adhesive may be an isocyanate-based or isocyanate-polyol reaction adhesive. The adhesive may comprises at least a polyol component and an isocyanate component.

Summarizing the above, particular embodiments of the present disclosure are:

1. A method for the continuous production of a PIR/PUIR/PUR foam cored sandwich panel with metal sheets as facings at top and bottom, wherein an upper metal sheet and a lower metal sheet are continuously fed into a double belt, wherein a PIR/PUIR/PUR core material is applied between the upper metal sheet and the lower metal sheet, wherein an adhesive is applied to the lower metal sheet, wherein a portion of the adhesive applied to the lower metal sheet is applied to the upper metal sheet by means of a rotating brush.

2. The method according to the preceding embodiment, wherein the rotating brush extends in a direction parallel to a width of the upper metal sheet and the lower metal sheet.

3. The method according to any preceding embodiment, wherein a rotational axis of the rotating brush extends substantially parallel to the upper metal sheet and the lower metal sheet.

Claims

1. A method for the continuous production of a PIR/PUIR/PUR foam cored sandwich panel with metal sheets as facings at top and bottom, wherein an upper metal sheet and a lower metal sheet are continuously fed into a double belt , wherein a PIR/PUIR/PUR core material is applied between the upper metal sheet and the lower metal sheet, wherein an adhesive is applied to the lower metal sheet , wherein a portion of the adhesive applied to the lower metal sheet is applied to the upper metal sheet by means of a rotating brush.

2. The method according to the preceding claim, wherein the rotating brush extends in a direction parallel to a width of the upper metal sheet and the lower metal sheet.

3. The method according to any preceding claim, wherein the adhesive is applied to an inner surface of the lower metal sheet and a portion of the adhesive applied to the lower metal sheet is applied to an inner surface of the upper metal sheet by means of the rotating brush.

4. The method according to any preceding claim, wherein the adhesive is applied over a complete width of the lower metal sheet.

5. The method according to any preceding claim, wherein 40 % to 60 % of the adhesive applied to the lower metal sheet is applied to the upper metal sheet by means of the rotating brush.

6. The method according to any preceding claim, wherein an amount of the adhesive applied to the inner surface of lower metal sheet is 200 g/m² to 300 g/m², preferably 220 g/m² to 280 g/m² and most preferably 230 g/m² to 270 g/m².

7. The method according to any preceding claim, wherein a rotation speed of the rotating brush is 60 rpm to 90 rpm, preferably 65 rpm to 85 rpm and most preferably 70 rpm to 80 rpm.

8. The method according to any preceding claim, wherein the rotating brush comprises a plurality of blades, wherein each of the plurality of blades comprises a plurality of bristles.

9. The method according to the preceding claim, wherein the plurality of blades are arranged in rows spaced apart in a circumferential direction around the rotating brush, wherein the rows extend parallel to a rotational axis of the rotating brush.

10. The method according to any preceding claim, wherein the adhesive is applied to the lower metal sheet at a temperature of 30 °C to 40 °C, preferably 32 °C to 38 °C and most preferably 33 °C to 37 °C.

11. An apparatus for the continuous production of a PIR/PUIR/PUR foam cored sandwich panel with metal sheets as facings at top and bottom, comprising
an upper roller for providing an upper metal sheet,
a lower roller for providing a lower metal sheet,
a double belt into which the upper metal sheet and the lower metal sheet are continuously feedable,
an adhesive dispenser for applying an adhesive to the lower metal sheet,
a core material dispenser for applying a PIR/PUIR/PUR core material between the upper metal sheet and the lower metal sheet, characterised in that it comprises
a rotating brush, wherein the rotating brush is adapted to apply a portion of the adhesive applied to the lower metal sheet to the upper metal sheet and wherein the rotating brush preferably comprises a plurality of blades.

12. The apparatus according to the preceding claim, wherein the rotating brush extends in a direction parallel to a width of the upper metal sheet and the lower metal sheet.

13. The apparatus according to any of the two preceding claims, further comprising a pneumatic motor for driving the rotating brush.

14. The apparatus according to any of three preceding claims, wherein each of the plurality of blades comprises a plurality of bristles, wherein the plurality of blades are preferably arranged in rows spaced apart in a circumferential direction around the rotating brush, wherein the rows preferably extend parallel to a rotational axis of the rotating brush.

15. The apparatus according to the preceding claim, wherein the blades comprise extension portions, wherein the extension portions of two adjacent rows are arranged shifted relative to one another in a direction parallel to a rotational axis of the rotating brush.