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(54) Production of wall element of sandwich construction and such a wall element

(57) A method for the production of a thermally-insulated wall element of sandwich construction is shown, where the wall elements are glued together, whereby it is possible to achieve an airtight construction, so that a vapour barrier is not necessary to apply. Gluing is made practically applicable because the insulating material is injected into the cavity or cavities of the wall element, which is subsequently sealed. With the method according to the present invention, use can be made of a glue type with short opening time, e.g. 20 minutes, and corresponding short pressing time, e.g. 20 minutes, which results in a quick and rational operation and a very advantageous utilisation of the production equipment.

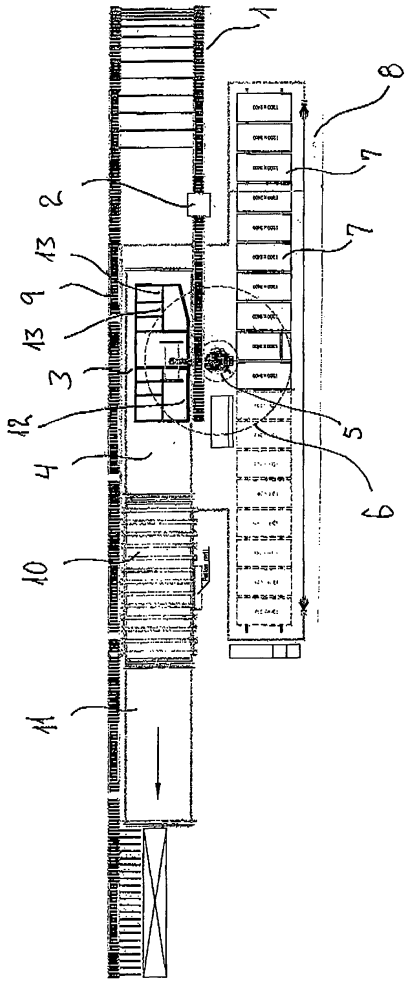

Fig. 1

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Description

[0001] The present invention relates to a special method for the production of a thermally-insulated wall element of sandwich construction, a plant for the production of such a wall element and the wall element itself.

BACKGROUND

[0002] It is known today to assemble finished wall elements at a workshop for later mounting at the building site, where these wall elements are produced in a sandwich construction consisting of two outer plates and a distance-creating framework between said plates, e.g. of wooden laths, and a vapour barrier, e.g. a strong plastic membrane, placed on that side of the construction which will face towards that side of the building where the vapour pressure is highest, i.e. where the element is used as an outer wall the vapour barrier will be placed on the inner side of the inner outer plate to prevent condensation of water vapour in the framework. The outer plates are normally secured to the framework by means of screws which are 1ed through the outer plates and into the framework. Insulating materials, e.g. mineral wool, may also be placed between the outer plates for thermal and possibly acoustic insulation.

BRIEF DESCRIPTION OF THE INVENTION

[0003] With the present invention insulated wall elements are provided which are glued together, whereby it is possible to achieve an airtight construction, so that a vapour barrier is not necessary, unlike the known wall element which is screwed together, whereby openings are formed through which vapour can gain access. Insulating material is injected into the cavity of the wall element, which is subsequently sealed. Moreover, the glued element can more easily be cleaned, for the reason that there are not those depressions which are otherwise formed by the screws unless these are filled out with filler material. Gluing is not normally considered to be applicable for the assembly of insulated wall elements with lath framework, as the time it takes to lay out the mineral wool mats between the laths makes it necessary to use a glue with long opening time, i.e, where a long time can elapse between the application of the glue and the pressing-together of the elements which are to be glued together, which can give rise to a long pressing time in the order of 6-8 hours. With the method according to the present invention, use can be made of a glue type with short opening time, e.g. 20 minutes, and corresponding short pressing time, e.g. 20 minutes, which results in a quick and rational operation and a very advantageous utilisation of the production equipment.

[0004] The present invention relates especially to a method for the production of a wall element, said method comprising steps for

providing a wall element comprising a first outer plate and a second outer plate which are substantially of the same extent and placed in parallel to one another, and a plurality of elongated laths which are glued fast between inner surfaces of these two outer plates, said laths having two parallel, opposite surfaces which extend in the longitudinal direction of the laths, where laths are arranged along a first outer edge and an opposite second outer edge of the first outer plate, so that substantially continuous wall plate and sill plate are formed respectively along the first outer edge and the second outer edge, and additionally there are arranged a plurality of the laths so that they extend parallel with one another and substantially right-angled to the wall plate and sill plate, in such a manner that they form substantially continuous parallel extending cross members between the wall and sill plates, and in such a manner that each of the parallel extending cross members abut substantially tight up to both the wall plate and sill plate, whereby between the two outer plates, the wall plate and sill plate and the continuous parallel extending cross members at least one substantially airtight chamber is formed, and

insulating the wall element by introducing into each such chamber a nozzle arranged on an elongated feeding arrangement through an opening formed in the wall plate (respectively in the sill plate), the nozzle is lead close to the sill plate (respectively the wall plate), and an insulating material is injected into the chamber while the nozzle is gradually withdrawn, so that the chamber is substantially completely filled with the insulating material, after which the nozzle is removed from the chamber and the opening in the wall plate (respectively in the sill plate) is sealed. In principle, it is immaterial whether the nozzle is introduced through the wall plate or the sill plate.

[0005] The outer plates can, e.g., be of plywood, e.g. water-resistant plywood, but it is preferred to use plates of wood chips with a content of 15-40 percent by weight, preferably 25-35 percent by weight of cement, such as 30 percent by weight, and with a thickness of 8 to 20 millimetres, preferably of 10 to 16 millimetres, such as 12 millimetres. Each of the outer plates, i.e. the first outer plate and the second outer plate, can each consist of a number of part plates, typically of the standard size 120 by 240 centimetres, or plates cut from these, for the formation of larger wall elements. The edges where the part plates abut against each other can possibly be filled out with a moisture-tightening joint filler.

[0006] The laths are preferably made of wood, where it is preferred to use wood of strength class K18, e.g. in the form of long laths, which are finger joined in the longitudinal direction, but use can be made of other laths, e.g, galvanised steel bars. The overall thickness of the wall elements is typically between 50 and 350 millimetres.

[0007] The insulating material is preferably a granular material, preferably wood wool which has been fire-impregnated, e.g. with ammonium polyphosphate, but use can also be made of e.g. granulated mineral wool, fire-impregnated paper wool or a foamed material. Moreover

impregnated wood wool has advantageous characteristics regarding fire resistance and moisture regulation, as the wood wool can absorb and give off moisture which penetrates through the wall, and hereby prevent condensation in the wooden framework which could lead to rot.

[0008] The elongated feeding arrangement is e.g. a telescopic rod, the base of which can be displaced in the direction parallel with the wall plate, and which due to its telescopic construction can displace the nozzle from the wall plate and to near the sill plate (or vice versa if the nozzle is introduced into the sill plate).

[0009] It is preferred that the laths are joined with the inner surface of the first outer plate and the inner surface of the second outer plate with glue applied to the two parallel opposite surfaces of the laths, which are in contact with said inner surfaces. The glue applied is preferably of a waterproof glue type, such as a two-component adhesive, preferably an emulsion polymerised isocyanate (EPI). A suitable type of glue has proved to be a mixture of the resin Dynea Prefere 6151 and the hardener Dynea Prefere in the ratio of 100:15. Other suitable glue types such as various polyurethane glues may also be used.

[0010] In particular, the step for providing the wall element comprises the steps for

arranging the first outer plate so that its rectangular inner surface extends substantially horizontal and faces upwards,

feeding a plurality of the elongated laths through a glue application arrangement, where glue is applied to both said opposite surfaces of each lath,

placing said laths on the inner surface of the first outer plate by means of a positioning arrangement, so that a glue-applied surface of the laths is in contact with the inner surface of the outer plate for the formation of wall plate and sill plate, respectively, along the first outer edge and the second outer edge and the continuous parallel extending cross members between the wall plate and sill plate,

arranging a second outer plate so that its rectangular inner surface is in contact with the upwardly-facing glue-applied surfaces of the laths placed on the inner surface of the first outer plate, and

pressing the outer surfaces of the two outer plates in a direction towards each other for a predetermined period of time, so that between the two outer plates, the wall and sill plate and the continuous parallel extending cross members there is formed at least one substantially airtight chamber.

[0011] Between the two outer plates there is preferably formed at least four of said substantially continuous extending cross members between the wall plate and the sill plate, and where two of the extending cross members are placed along the two parallel outer edges, where a wall plate or sill plate is not placed, so that at least three of said substantially airtight chambers are formed. However, it is preferred that more chambers are formed, e.g. five, six or eight, and it is further preferred that the continuous extending cross members are arranged with mutually equally-formed distances, e.g. 40-80 centimetres, preferably with a mutual distance of 60 centimetres.

[0012] In connection with the method, with use of the positioning arrangement, substantially parallel with the wall plate and sill plate there may also be arranged a number of transversely-placed laths between neighbouring continuous extending cross members, so that they abut substantially tight up to these extending cross members, and such that a glue-applied surface of the laths is in contact with the inner surface of each of the outer plates, and where an opening is formed in each of the transversely-placed laths, through which openings the nozzle is introduced for the injection of the insulating material. These transversely-placed laths serve typically for the fastening of windows and other elements in the wall elements.

[0013] Moreover it is preferred that the method is executed in a fully automated manner by means of a control element which controls the operation of the arrangements in all steps of the production.

[0014] The invention further comprises a production plant for producing wall elements according to the invention. In particular, the production plant comprises:

- plate handling equipment for handling of a first and a second outer plate,
- a glue application arrangement for applying a layer of glue to two opposite surfaces of laths,
- a positioning arrangement suitable for taking the laths mechanically from the glue application arrangement and placing them on the inner surface of the first outer plate,
- a pressing arrangement for pressing together the first outer surface and the second outer surface for a predetermined period of time,
- a nozzle arranged on an elongated feeding arrangement for the injection of insulating material together with devices for the movement of the feeding arrangement, and
- control arrangement for controlling the operation of the production plant equipment for the execution of the method.

[0015] Finally, the invention also relates to a wall element which can be produced by the method according to the invention.

BRIEF DESCRIPTION OF THE DRAWING

[0016] An example of a production plant for the execution of the method according to the invention is shown in the enclosed figure 1.

DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

[0017] The plant shown in Fig. 1 comprises a feeding

conveyor 1 for laths which are automatically shortened to the correct lengths. Glue is applied to two opposite parallel surfaces of the laths by means of a glue application arrangement 2 which they are fed through by the feeding conveyor 1. The construction of a wall element 3 takes place at the building-up station 4, where a robot 5 with an action radius shown by the broken-line circle 6 partly takes part plates 7 from a plate feeder 8 and places them on the building-up station 4, and partly takes laths from the feeding conveyor 1 and places them on the first outer plate which is lying at the building-up station 4. When all laths have been placed in accordance with a predetermined arrangement, the robot 5 positions the second outer plate, and an element conveyor 9 feeds the wall element 3 to the press 10, where the two outer plates are pressed against each other with a predetermined force for a predetermined period of time, e.g. 20 minutes, so that the gluing between the outer plates and the laths achieves the necessary strength. The element conveyor 9 feeds the wall element 3 further to the insulating station 11, where openings partly are formed in the wall plate 12 and transverse plates 13, partly the nozzle (not shown) is introduced on a telescopic rod for insulation of all cavities in the wall element, and finally the formed openings in the wall plate 12 are plugged. Finally, the wall element 3 is fed out over the end of the element conveyor 9, turned to the vertical position and transported away for storage.

[0018] With the production method according to the present invention, it has become possible to produce the insulated, glued wall elements on one production line, as the pressing action takes relatively short time and the individual steps herewith take about the same time, which is a precondition for being able to use one production line and for the resulting automation of the process.

Claims

1. Method for the production of a wall element, said method comprising the steps of
providing a wall element comprising a first outer plate and a second outer plate which are substantially of the same extent and placed parallel to one another, and a plurality of elongated laths which are glued fast between inner surfaces of these two outer plates, said laths having two parallel, opposite surfaces which extend in the longitudinal direction of the laths, where laths are arranged along a first outer edge and an opposite second outer edge of the first outer plate, so that substantially continuous wall plates and sill plate are formed respectively along the first outer edge and the second outer edge, and additionally there are arranged a plurality of the laths so that they extend parallel with one another and substantially right-angled to the wall plate and sill plate, in such a manner that they form substantially continuous parallel extending cross members between the wall plate and sill plate, and in such a manner that each of the parallel extending cross members abut substantially tight up to both the wall plate and sill plate, whereby between the two outer plates, the wall plate and sill plate and the continuous parallel extending laths at least one substantially airtight chamber is formed, and
insulating the wall element by introducing into each such chamber a nozzle arranged on an elongated feeding arrangement through an opening formed in the wall plate, the nozzle is lead close to the sill plate, and an insulating material is injected into the chamber while the nozzle is gradually withdrawn, so that the chamber is substantially completely filled with the insulating material, after which the nozzle is removed from the chamber and the opening in the wall plate is sealed.

2. Method according to claim 1, where the insulating material is a granular material, preferably fire-impregnated wood wool.

3. Method according to claim 1 or 2, where the laths are joined with the inner surface of the first outer plate and the inner surface of the second outer plate with glue applied to the two parallel opposite surfaces of the laths.

4. Method according to any of the claims 1 to 3, where the step for providing the wall element comprises steps for
arranging the first outer plate so that its rectangular inner surface extends substantially horizontal and faces upwards,
feeding a plurality of the elongated laths through a glue application arrangement, where glue is applied to both said opposite surfaces of each lath,
placing said laths on the inner surface of the first outer plate by means of a positioning arrangement, so that a glue-applied surface of the laths is in contact with the inner surface of the outer plate for the formation of wall plate and sill plate, respectively, along the first outer edge and the second outer edge and the continuous parallel extending cross members between the wall plate and sill plate,
arranging a second outer plate so that its rectangular inner surface is in contact with the upwardly-facing glue-applied surfaces of the laths placed on the inner surface of the first outer plate, and
pressing the outer surfaces of the two outer plates in a direction towards each other for a predetermined period of time, so that between the two outer plates, the wall plate and sill plate and the continuous parallel extending cross members there is formed at least one substantially airtight chamber.

5. Method according to any of the claims 1 to 4, where there are formed at least four of said substantially continuously extending cross members between the

wall plate and sill plate, and where two of the extending cross members are placed along the two parallel outer edges, where a wall plate or sill plate is not placed, so that at least three of said substantially airtight chambers are formed.

6. Method according to any of the claims 1 to 5, where by use of the positioning arrangement, substantially parallel with the wall plate and sill plate there are arranged a number of transversely-placed laths between neighbouring continuous extending cross members, so that they abut substantially tight up to these extending cross members, and such that a glue-applied surface of the laths is in contact with the inner surface of the outer plate, and where an opening is formed in each of the transversely-placed laths, through which openings the nozzle is introduced for the injection of the insulating material.

7. Method according to any of the claims 3 to 6, where the glue applied is of a waterproof type, such as a two-component adhesive, preferably an emulsion polymerised isocyanate (epi).

8. Method according to any of the foregoing claims, where the operation of arrangements for all steps of the production is controlled by a control arrangement.

9. Production plant for producing wall elements according to the method of any of the claims 1-8, said production plant comprising
plate handling equipment for the handling of a first and a second outer plate,
glue application arrangement for applying a layer of glue on two opposite surfaces of laths,
a positioning arrangement suitable for taking the laths mechanically from the glue application arrangement and placing them on the inner surface of the first outer plate,
a pressing arrangement for pressing together the first outer surface and the second outer surface for a predetermined period of time,
a nozzle arranged on an elongated feeding arrangement for the injection of insulating material together with devices for the movement of the feeding arrangement, and
control arrangement for controlling the operation of the production plant equipment for execution of the method.

10. Wall element comprising a first outer plate and a second outer plate which are substantially of the same extent and placed in parallel with one another, and between inner surfaces of these two outer plates a plurality of elongated laths, said laths having two parallel, opposite surfaces which extend in the longitudinal direction of the laths, where laths are arranged along a first outer edge and an opposite second outer edge of the first outer plate, so that substantially continuous wall plate and sill plate are formed along the first outer edge and the second outer edge, and additionally there are arranged a plurality of the laths so that they extend parallel with one another and substantially right-angled to the wall and sill plates, in such a manner that they form substantially continuous parallel extending cross members between the wall plate and sill plate, and in such a manner that each of the parallel extending cross members abut substantially tight up to both the wall and sill plate, where between the two outer plates, the wall plate and sill plate and the continuous parallel extending cross members at least one substantially airtight chamber is formed, where all airtight chambers are substantially filled with a granular insulating material, preferably fire-impregnated wood wool, and where the laths are joined with the inner surface of the first outer plate and the inner surface of the second outer plate with glue applied to the two opposite parallel surfaces of the laths.

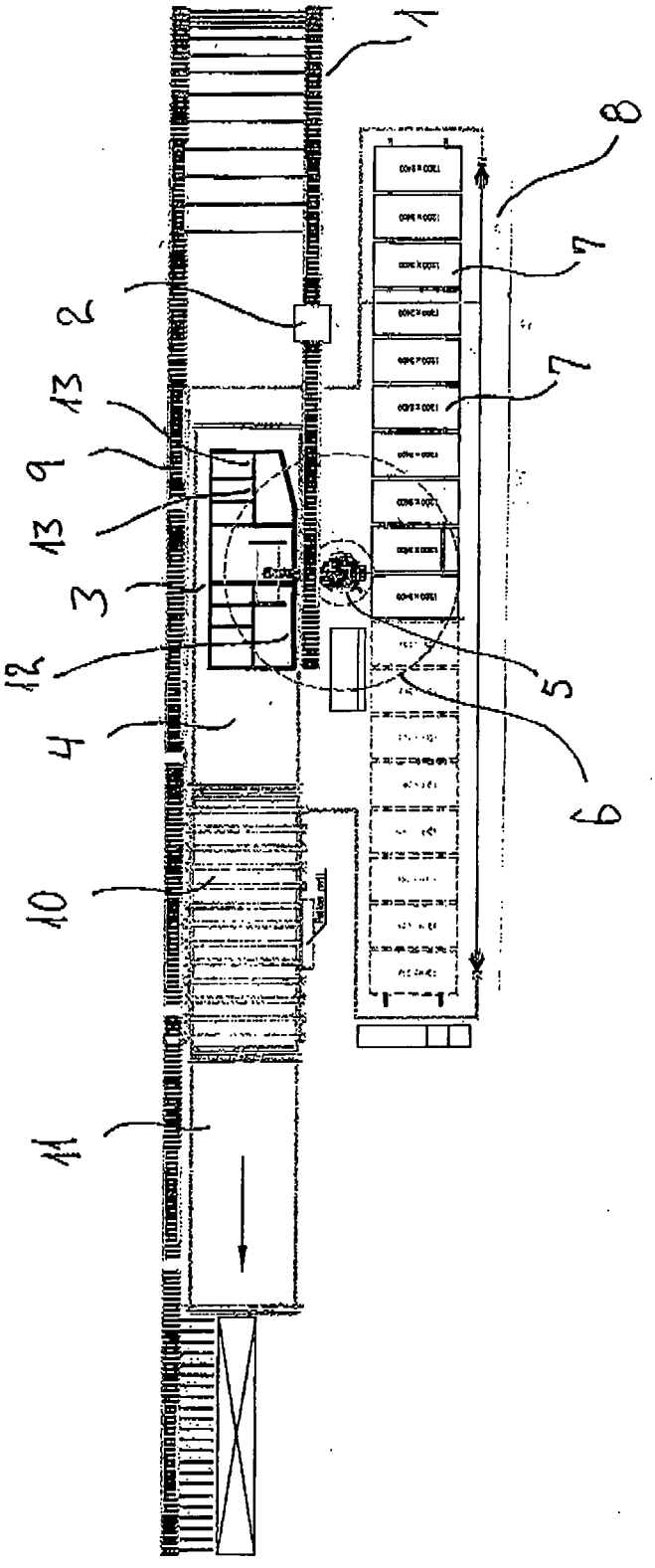

Fig. 1