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## (54) Method for lowering the formaldehyde content in a glued timber board.

(57) Method for lowering the formaldehyde content in a timber board (10) by into the board absorbing a solution (4) that contains ammonia by compressing by means of a resilient-faced grooved revolving roll (1).

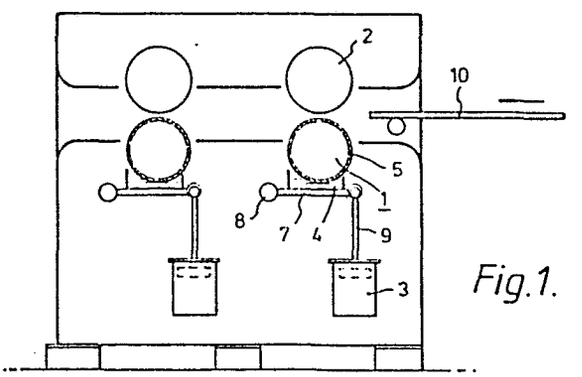


Fig.1.

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# METHOD FOR LOWERING THE FORMALDEHYDE CONTENT IN A GLUED TIMBER BOARD

The present invention relates to a method for lowering the formaldehyde content in a glued timber board by reacting the formaldehyde present in the board with ammonia.

It has been found that formaldehyde may be emitted from a particle board glued by means of urea-formaldehyde glues and urea-melamineformaldehyde glues. This can cause irritation in sensitive people, e.g. in dwellings. This problem is particularly noticeable where poor ventilation exists or where paints soluble in water have been used. As a consequence, limit values have been imposed on the formaldehyde concentration in particle board and in dwelling premises.

In Finland, the average value of the formaldehyde content in particle board, in the case of standard board, is restricted to being less than 30 mg/100 g, and its maximum value is restricted to being less than 40 mg/100 g. For urea-melamine-glued board, the corresponding values are 40 mg and 70 mg, respectively. The measurement is conducted in accordance with EN 120, and the requirements are included in the Finnish standards

SFS 3515 and SFS 4152. These requirements may be met by using conventional glues.

In some countries, for certain purposes of use and for the use of a board in a certain way, stricter requirements have been imposed. For example, in the German Federal Republic and Denmark, in the classes of the highest requirements, the limit value is 10 mg/100 g (corresponding classes E1 and P25B). In order to meet these requirements, particular operations are necessary in the manufacture.

Two methods of lowering the formaldehyde content have been investigated. The first of these is to use glues that emit less formaldehyde. However, such glues have not led to a satisfactory solution. This is because these glues increase the production cost unreasonably or result in the board having inferior properties. Moreover, certain glues cause difficulties of environmental hygiene in the factory.

As an alternative, binding agents have been investigated which chemically bind to the formaldehyde emitted. These binding agents take the form of a suitable substance added to the board. In particular ammonia or derivatives of it have been used with some

success.

The method of choice at the present time is based upon the reaction of the formaldehyde with ammonia, which produces a stable hexamethylenetetra-amine. Several methods of adding ammonia, or a compound that liberates ammonia, to the timber board have been developed. Of these, the addition of ammonia to a previously glued board has provided a technically and economically superior solution than dosage of compounds that contain ammonium, e.g., in connection with the drying and glueing of chips.

Finnish Patent Application FI 780328, describes a method in which ammonia gas is sucked through the board. A drawback of this method is the high requirements imposed by the gas on the equipment as well as the suitability of each set of equipment for a board of only a certain width. Moreover, internal differences in the volumetric weight of the board cause variations in the quality of the finished product.

Finnish Patent Application FI 803093, describes a method in which a water solution which contains ammonium is sprayed onto the board face, after which the boards are kept in an intermediate store for 16 to 24 h.

However, this method has various drawbacks such as the necessity of providing an intermediate storage space, evaporation of ammonia into the working environment, and poor penetration of the solution into the board.

In one aspect, the present invention aims to provide an improved method for the dosage of a solution that contains ammonia into a particle board or any other glued timber board in order to bind the formaldehyde contained therein.

According to the present invention, the solution containing ammonium is dosed into the board by means of a resilient-faced grooved revolving roll by pressing.

In the apparatus used, there is, in particular, a grooved roll revolving in a liquid basin and, above the grooved roll, an ordinary roll. The space between the rolls is adjusted such that, when the board is fed into the nip between the rolls, the walls forming partitions between the grooves of the grooved cylinder are compressed together. As a result, the liquid deposited in the grooves from the liquid basin is made to penetrate into the board.

The invention will now be described in more detail

by means of the accompanying drawings and example.

Figure 1 is a schematical view of the apparatus of the present invention.

Figure 2 is a schematic plan view of the grooved roll.

Figure 3 is a schematic sectional view of the grooved roll.

The equipment comprises a roll 1 with a series of grooves in its face, a counter-roll 2 forming a nip with the grooved roll, means 3 for regulating the position of the grooved roll, and a liquid basin 4.

The grooved roll 1 is covered with a layer 5 of rubber or of some other resilient material, and is provided with grooves 6 in the face of the layer.

The shape and location of the grooves 6 on the grooved roll 1 are more particularly illustrated in Figures 2 and 3. The cross-sectional area of the grooves is about 3 x 10 mm, and their depth about 3 mm. The lower part of the grooved roll 1 is placed in a liquid basin 4, which contains the ammonium-containing solution to be

dosed.

A counter roll 2 such as an ordinary steel roll is located above the grooved roll 1.

The grooved roll 1 is further provided with regulating means 3, by means of which the distance between the roll 1 and the counter-roll 2 can be adjusted. The grooved roll 1 is pushed towards the roll 2 with a certain force, whose magnitude can be adjusted likewise by means of the means 3.

In the equipment illustrated in Figure 1, the grooved roll 1 is mounted on a base 7. At one side of the roll 1, the base 7 is linked to a fixed point 8, and at the other side to a lifting rod 9. The lifting rod 9 may be displaced in a verticle direction by means such as hydraulic pressure, or any other suitable means known to those skilled in the art.

In the equipment illustrated in Figure 1, two pairs of rolls are provided mounted one after the other. However, the exact number of pairs of rolls is not essential to the working of the invention.

The space between the rolls 1 and 2 is adjustable

and is made somewhat smaller than the thickness of the board 10 to be treated. Likewise the force pushing the roll 1 upwards is adjustable and is made sufficiently high to compress the partition walls between the grooves 6 when the board is in the nip. Thus as the board 10 passes through the nip, the solution deposited in grooves 6 from the basin 4 is forced from within the grooves into the board. After the first compression step the board 10 is turned upside down and passed through the apparatus again in order to treat the other side of the board.

The quantity of absorption of the compound that contains ammonium can be adjusted by varying the concentration of the solution, the running speed of the rollers and/or board, or the compression force.

After both faces of the board have been treated, the boards may be stacked and transferred to further process stages such as grinding with a relatively short period of time.

Example

By means of an apparatus in accordance with the figures, a series of four trial runs were performed with boards of different types.

| Composition of solution used | Series 1 % | Series 2-4 % |
|---|---|---|
| - Urea | 5 | 11 |
| - Ammoniumbicarbonate | 10 | 20 |
| - Ammonia water (25 %) | 5.5 | 11 |
| - $H_2O$ | 79.5 | 58 |

Quantity of solution used

- Series 1 35 to 45 kg/$m^3$ (dry solids 6 to 8 kg/$m^3$)
- Series 2-4 25 to 45 kg/$m^3$ ( " " 8.5 to 15 kg/$m^3$)

The results of the trial runs are given in the following table:

| Particle board product | | Perforat. mg HCHO | | Moisture % | | Transverse tensile strength N/$mm^2$ | | Bending strength N/$mm^2$ | | Swelling 2 h % | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Bef. | After | Bef. | After | Before | After | Before | After | Before | After |
| 1 | | | | | | | | | | | |
| Standard | 12 mm | 23 | 4 | 9.5 | 9.7 | | | | | | |
| " | 15 mm | 20 | 9 | 6.6 | 8.1 | | | | | | |
| 2 | | | | | | | | | | | |
| Standard | 12 mm | 17 | 7 | 7.5 | 8.4 | 0.60 | 0.61 | 18.8 | 17.9 | 11.4 | 17.8 |
| " | 12 mm | 14 | 2 | 7.5 | 8.7 | 0.63 | 0.66 | 19.0 | 18.6 | 11.7 | 17.2 |
| " | 12 mm | 16 | 7 | 7.5 | 8.3 | 0.59 | 0.60 | 18.7 | 18.8 | 12 | 18 |
| 3 | | | | | | | | | | | |
| Standard | 22 mm | 15 | 7 | 8.0 | 8.6 | | | | | | |
| " | 22 mm | 15 | 11 | 8.2 | 8.3 | | | | | | |
| 4 | | | | | | | | | | | |
| V313 | 12 mm | 53 | 11 | 8 | 8.8 | 1.00 | 0.96 | 24.7 | 21.5 | 2.2 | 3.2 |
| " | 12 mm | 56 | 12 | 7.9 | 8.7 | 0.95 | 0.93 | 23.1 | 20.9 | 2.4 | 2.5 |

The studies that were carried out indicated that an excess quantity of material does not improve the perforator values, but the hygroscopicity is increased.

The studies that were carried out indicated that an excess quantity of material does not improve the perforator values, but the hygroscopicity is increased.

The equipment used in the invention may, of course, also be made such that the distance of the counter-roll from the grooved roll is adjusted. The arrangement of the rolls may also be different, and, in principle, it is possible to apply the solution from both sides of the board simultaneously.

The method can also be applied to the manufacture of other glued timber boards besides particle boards. Such boards are, e.g., the so-called MDF (medium density fibre board) products.

CLAIMS:

1. A method for lowering the formaldehyde content of a glued timber board by absorbing a solution comprising ammonia into the board characterized by the step of:

forcing the solution under pressure into the board.

2. A method according to claim 1 further characterised by:

depositing the solution (4) into grooves (6) formed on the resilient face (5) of a rotating roll (1),

pressing the board against the face of the roll treated with the solution with a force sufficient to compress the walls forming partitions between the grooves thus forcing the solution into the board, and

displacing the board relative to the roll.

3. A method according to claim 2 wherein the board is forced against the rotating roll by passing it through a nip between the rotating roll (1) and a second roll (2).

4. A glued timber board when produced by a method according to any preceding claim.

5. An apparatus for applying ammonia solution to a glued timber board characterized in that it comprises a rotating roll (1) having a resilient face (5) with grooves (6) formed therein, means for depositing the ammonia solution into the grooves, means for pressing the board against the face of the roll, and means for displacing the board relative to the roll.

6. An apparatus according to claim 5 further comprising a second roll (2) positioned to form a nip with the rotating roll through which the board is passed to press it against the rotating roll.

7. An apparatus according to claim 6 wherein means are provided for adjusting the distance between the two rolls.

8. An apparatus according to any of claims 5-7 further comprising a succession of grooved rolls for applying the ammonia solution to the board.

9. Method for lowering the formaldehyde content in a glued timber board by into the board absorbing a

solution that contains ammonia, characterized in that the solution (4) that contains ammonia is dosed constantly into the grooves (6) provided on the face of a grooved roll (1) provided with a resilient face, whereupon the roll is pressed against the face of the board (10) with such a high force that the partition walls between the grooves are compressed, and the board is displaced at the same time relative the roll.

10. Equipment for lowering the formaldehyde content in a glued timber board by into the board absorbing a solution that contains ammonia, in which said equipment there are a resilient-faced roll (1) provided with a grooved face, equipment (4) for dosage of the solution that contains ammonia into the grooves (6) of the roll, as well as means (2, 3) for pressing the board (10) to be treated against the face of the revolving roll.

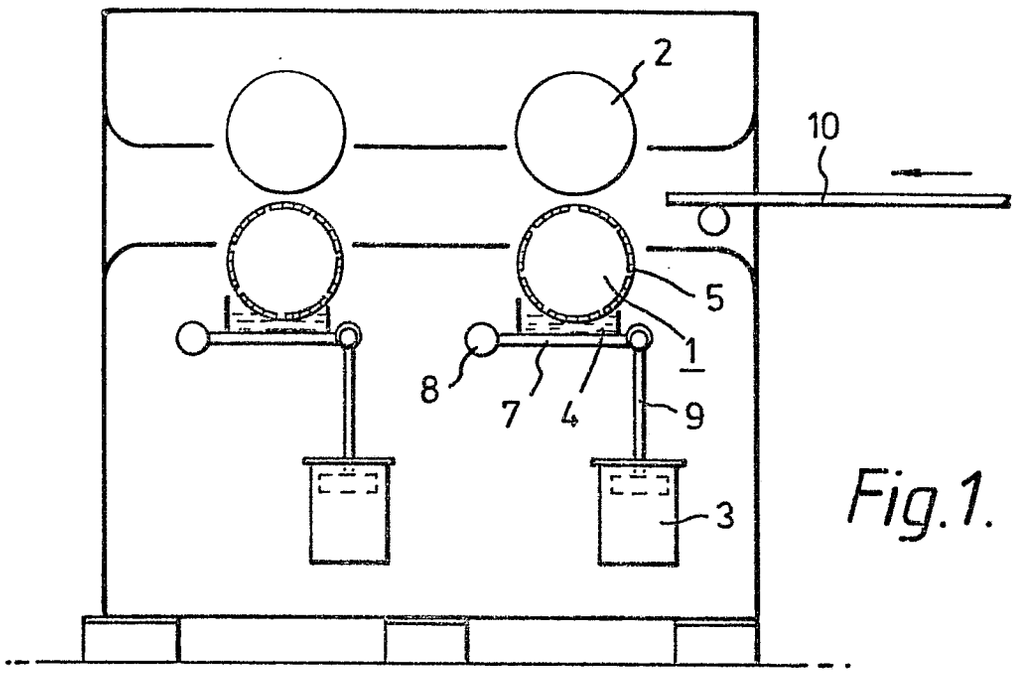


Fig.1.

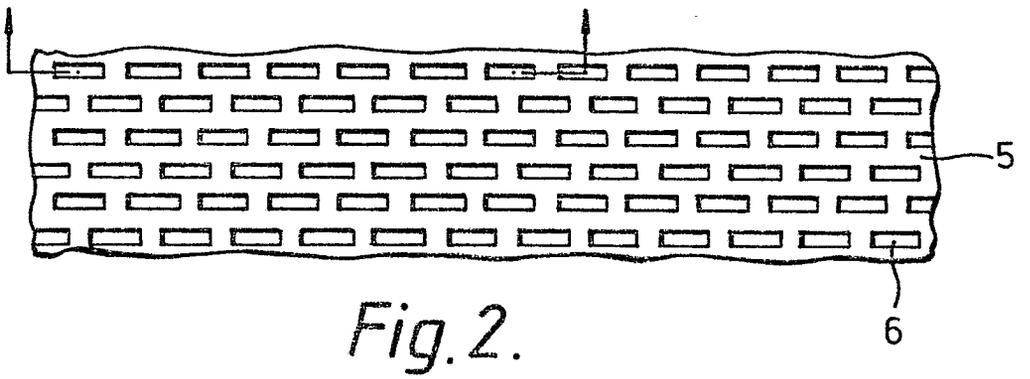


Fig.2.

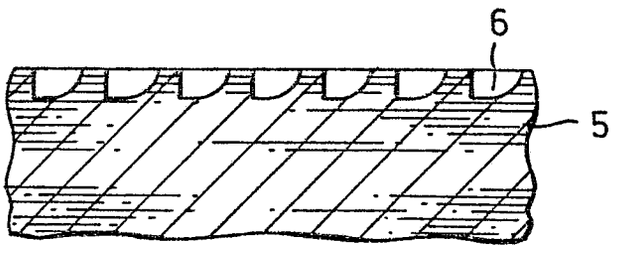


Fig.3.