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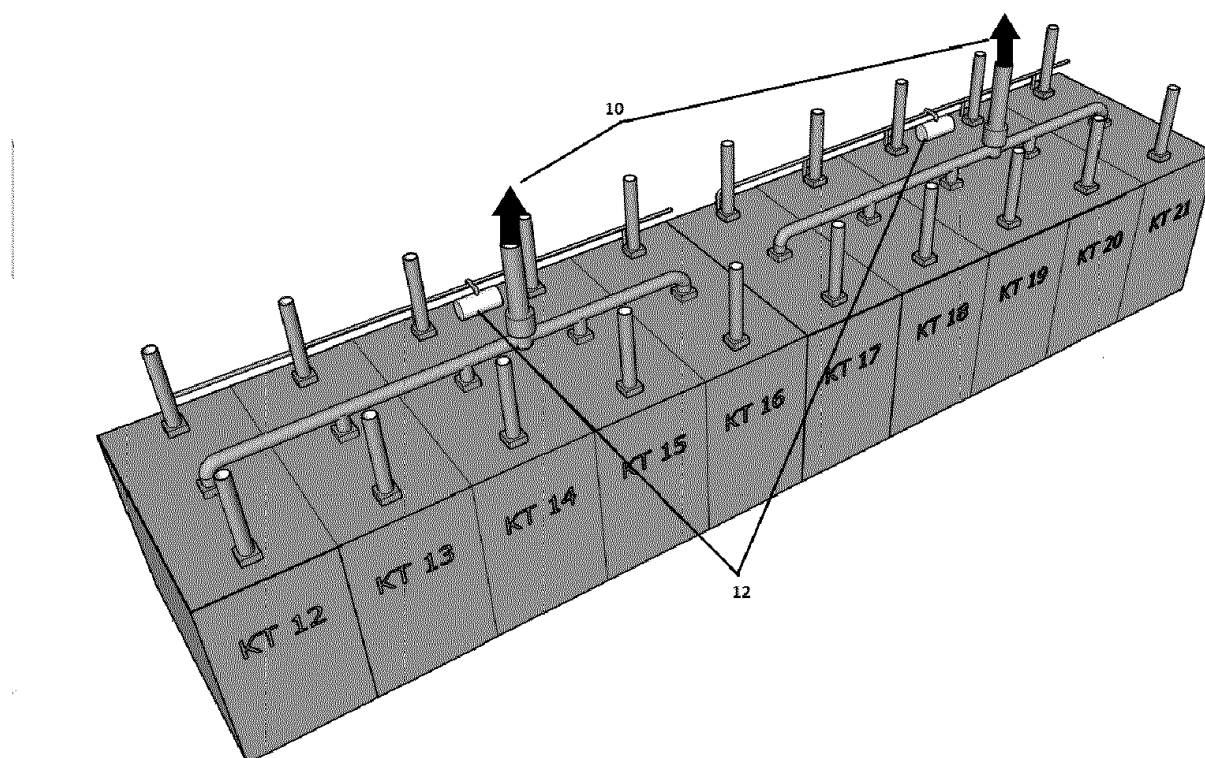
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(54) **TIMBER DRYING PROCESS**

(57) The present invention relates to a process for drying of timber comprising a heating step under conditions of moist heat and a subsequent drying step under conditions of dry heat.

Figure 1:



Description

[0001] The present invention relates to a process for drying of timber comprising a heating step under conditions of moist heat and a subsequent drying step under conditions of dry heat. Further, the present invention relates to a unit adapted for carrying out the process.

[0002] Drying is an important step in the processing of timber in a sawmill. In order to obtain a high-quality product it is important for carrying out the drying process under optimal conditions. Even in modern sawmills the timber drying process, however, is still associated with a substantial loss of energy. Approximately 80% of the added heating energy is lost, e.g. by venting out hot air to the ambient atmosphere without recovery.

[0003] Thus, it is an object of the invention to provide a more efficient use of energy in the timber drying process to save energy costs and to maintain high product quality.

Summary of the invention

[0004] In general, the invention is based on the recirculation of moist hot air generated during a timber drying operation to pre-heat an incoming batch of timber. The invention relates both to the drying of timber in batch chamber driers and in continuous driers such as cross-circulating driers.

[0005] A first aspect of the invention relates to a process for drying of timber comprising the steps:

(a) heating a first batch of timber in a chamber under conditions of moist heat, wherein a moist and heated first batch of timber is obtained,

(b) drying the moist and heated first batch of timber in a chamber under conditions of dry heat, wherein a dry and heated first batch of timber is obtained,

wherein during drying step (b) an exhaust stream of moist hot air is removed from the chamber containing the first batch of timber and wherein at least a portion of said exhaust stream of moist hot air is passed into a chamber containing a second batch of timber for heating said second batch of timber under conditions of moist heat.

[0006] A second aspect of the invention relates to a unit for drying timber adapted for performing the process as described above. The unit comprises means for heating a batch of timber under conditions of moist heat for obtaining a moist and heated batch of timber and means for subsequently drying a moist and heated batch of timber under conditions of dry heat for obtaining a dry and heated batch of timber wherein the means for heating the timber under conditions of moist heat are at least partially provided by an exhaust stream of hot moist air generated during the drying of timber under conditions of dry heat.

[0007] In a particular embodiment, this aspect relates to a unit for drying timber comprising

(a) a first chamber adapted for subjecting a first batch of timber to heating under conditions of moist heat and subsequent drying under conditions of dry heat,

(b) a second chamber adapted for subjecting a second batch of timber to heating under conditions of moist heat and subsequent drying under conditions of dry heat,

(c) means for passing an exhaust stream of moist hot air during drying the first batch of timber in the first chamber (a) into the second chamber (b) during heating the second batch of timber.

[0008] A further particular embodiment of this aspect relates to a unit for drying of timber comprising

(a) a first chamber adapted for subjecting a batch of timber to heating under conditions of moist heat,

(b) a second chamber adapted for subjecting said batch of timber to drying under conditions of dry heat,

(c) means for passing said batch of timber after heating from the first chamber to the second chamber, and

(d) means for passing an exhaust stream of hot moist air produced during drying the first batch of timber in the second chamber (b) into the first chamber (a) during heating a second batch of timber.

Detailed description

[0009] The present invention relates to the drying of a batch of timber. The size of a timber batch used in the drying process may vary between different timber drying units depending on their size and capacity. In certain embodiments a batch of timber has a total volume of about 1 m³ to about 20 m³, e.g. about 5 m³ to about 16 m³ which may be formed from several packs, e.g. about 4 to about 50 packs of timber.

[0010] According to step (a) of the process, a first batch of timber is heated in a chamber under conditions of moist heat. In certain embodiments, this heating under conditions of moist heat is carried out until a dry temperature of about 40 °C to about 70 °C and a wet temperature from about 40 °C to about 70 °C and the chamber is reached. The term "*conditions of moist heat*" indicates that there is a low difference between the dry temperature and the wet temperature in the chamber, particularly throughout the duration of step (a). In certain embodiments, the difference between dry temperature and wet temperature in the chamber during step (a) is about 25 °C or less, about 20 °C or less or about 15 °C or less. At the end of step (a) a moist and heated batch of timber is obtained. The amount of moisture is typically about 30 weight-% to about 180 weight-% water based on the total weight

of the timber. Typically, the amount of moisture will be derived from the starting moisture content of the timber which may vary between different products and seasons. In particular embodiments, the moisture content of the timber does not substantially change during step (a), e.g. a change of 10 weight-% or less.

[0011] According to step (b) of the process, a moist and heated batch of timber is dried in a chamber under conditions of dry heat. The term "*conditions of dry heat*" indicates that there is a higher difference between the dry temperature and the wet temperature in the chamber, particularly at the end of step (b). In certain embodiments, step (b) comprises drying the timber under conditions of dry heat until a dry temperature from about 70°C to about 90°C and a wet temperature from about 40°C to about 70°C in the chamber is reached. At the end of step (b), the difference between dry temperature and wet temperature may be about 10°C to about 35°C depending on the type of drier which is used. The amount of moisture in the timber after step (b) is about 6-20 weight-% or less based on the total weight of the timber after step (b).

[0012] The present invention is characterized in that during drying step (b) moist hot air is removed from the drying chamber and at least a portion of said moist hot air is recycled to heating step (a), particularly by passing an exhaust stream of moist hot air from a drying chamber containing a first batch of timber into a heating chamber containing a second batch of timber during the step of heating said second batch of timber under conditions of moist heat. Typically, the exhaust stream of moist hot air removed from the chamber in step (b) has a dry temperature from about 57°C to about 90°C, e.g. from about 60°C to about 85°C, and a wet temperature from about 57°C to about 75°C, e.g. from about 60°C to about 70°C. The difference between the dry temperature and the wet temperature in this exhaust stream is typically about 25°C or less or about 20°C or less and particularly about 5°C to about 20°C.

[0013] In a particular embodiment, the exhaust stream of moist hot air is passed into a heating chamber under conditions that a condensation of moisture from the exhaust stream takes place in the chamber, for example on the timber present in the chamber. In a further particular embodiment, the exhaust stream of moist hot air is passed into a heating chamber without substantially reducing the moisture content thereof, e.g. without reducing the moisture content by about 20% or more and more particularly without reducing the moisture content thereof at all.

[0014] In certain embodiments, no external steam is added to the exhaust stream of moist hot air before being passed into the chamber containing the second batch of timber. In other embodiments, external steam is added to the exhaust stream of moist hot air before being passed into the chamber containing the second batch of timber. External steam mainly needs to be added under conditions when the recycled steam is insufficient, for example, if multiple chambers need to be heated at the same time

and/or when only few driers are in operation. Thus, according to the present invention the recycled exhaust stream of moist hot air from drying step (b) may constitute up to about 100% of the total air stream used for heating the second batch of timber.

[0015] In certain embodiments of the invention, additional water may be provided in the heating chamber when heating a batch of timber under conditions of moist heat, wherein the water may be added by spray nozzles or similar means. The additional water is provided into heating step (a) mainly under conditions where the difference between dry and wet temperature needs to be reduced in order to avoid a possible drying effect during heating step (a). Further, in certain embodiments additional heat may be introduced into the heating chamber when heating a batch of timber under conditions of moist heat, e.g. by means of a heater.

[0016] The process of the invention contributes to a significant reduction in the amount of externally added heat introduced into a heating chamber when heating a batch of timber under conditions of moist heat. In this context, the term "*externally added heat*" refers to the amount of heat which is externally generated and added to the process in contrast to the amount of heat which is provided by recycling of moist hot air according to the invention. For example the amount of externally added heat may be reduced by at least about 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80% or 90% by introducing the exhaust stream of moist hot air from the heating of a previous batch of timber compared to the amount of externally added heat required for the heating step without recycling an exhaust stream of moist hot air. In particular embodiments, the process is operated without any external heat thereby reducing the external heat addition by up to about 100%.

[0017] The process of the present invention may be carried out in a batch chamber drier unit or into a continuous drier unit, e.g. a cross-circulating drier unit.

[0018] In a batch chamber drier unit heating step (a) and drying step (b) of a predetermined batch of timber are carried out in the same chamber. A typical sawmill may comprise a plurality of chambers each of which is adapted for performing heating step (a) and subsequently drying step (b). The drying process for predetermined batch of timber starts with insertion of a first timber batch into a first chamber. Then the newly inserted timber batch is heated under conditions of moist heat in the first chamber. During the heating it is important to have a low difference between wet and dry temperature as indicated above. After the batch of timber is sufficiently heated the actual drying process starts by introducing dry hot air into the first chamber until the timber has reached a desired moisture content.

[0019] According to the present invention an exhaust stream from a first chamber may be collected and passed into a different chamber in which heating of a further batch of timber is carried out. In particular embodiments, an exhaust stream from a plurality of chambers each con-

taining a batch of timber is collected during drying step (b) and passed into at least one different chamber, particularly in a plurality of different chambers in which heating (a) of further batches of timber is carried out.

[0020] In this embodiment, the exhaust stream of moist hot air removed from the chamber in step (b) typically has a dry temperature from about 70°C to about 90°C and a wet temperature from about 50°C to about 70°C, e.g. a dry temperature of about 78°C and a wet temperature of about 60°C. The difference between dry temperature and wet temperature is typically about 20°C or less and more particularly about 5°C to about 20°C, e.g. about 18°C.

[0021] In a continuous drier, e.g. a continuous cross-circulating drier heating (a) of a predetermined batch of timber is carried out in a heating chamber and drying (b) of said predetermined batch is carried out in a drying chamber separate from the heating chamber. Thus, the batch of timber is transferred from a heating chamber to a separate drying chamber. A heating chamber may contain a plurality of individual heating zones and the batch of timber is passed through these individual zones during heating (a). Further, the drying chamber may contain a plurality of individual drying zones and the batch of timber is passed through individual zones during drying (b). In case the drying chamber contains a plurality of individual zones, the exhaust streams of moist hot air is preferably collected from zones wherein the first stages of drying (b) are carried out, i.e. wherein the timber still has a reasonably high moisture content.

[0022] In a continuous drier, the exhaust stream of moist hot air may be a stream of evacuation air originating from a single zone or a plurality of different zones in the chamber during step (b). The exhaust stream typically has a dry temperature from about 57°C to about 90°C and a wet temperature from about 45°C to about 70°C. The difference between the dry temperature and the wet temperature may be about 30°C or less, about 20°C or less, about 15°C or less or about 10°C or less and particularly about 5°C to about 10°C or less.

[0023] The second aspect of the invention relates to a unit for drying timber comprising means for heating timber under conditions of moist heat and subsequently drying the timber under conditions of dry heat, wherein the means for heating the timber under conditions of moist heat are at least partially provided by an exhaust stream of moist hot air generated during the drying of timber under conditions of dry heat.

[0024] In Figure 1, a batch chamber drying unit according to the state of the art is shown. The batch drier unit comprises a plurality of drier chambers KT 12-KT 21. Each chamber is operated separately except two shared air exits (10) comprising means, e.g. fans for supporting the removal of air from the drier chambers. The drying process in a first chamber starts with insertion of a timber batch into the chamber. The newly inserted batch of timber is heated in the chamber by introducing low pressure steam into the chamber. The low pressure steam is pro-

duced in a steam generator (12). The batch of timber is heated with steam under conditions of moist heat having a low difference between a wet temperature and dry temperature. When a batch of timber is sufficiently heated, the drying process starts by introducing dry hot air into the chamber until the timber has reached a desired moisture content. During the drying process the moist air from the chamber exits with the evacuation air at fan (10).

[0025] In Figure 2 a batch chamber drying unit according to the invention comprising drying chambers KT 12-KT 21 is shown. The unit is provided with pipes in each chamber, e.g. pipes (10a, 10b) for chamber KT 14. Pipes (10a, 10b) have openings and may provide inlet and/or outlet of air, as required. When air enters the pipe, air will exit the other pipe. Pipe (10a) works as an air exit when the chamber KT14 is operated in heating step (a). Both pipes (10a, 10b) may be provided with means, e.g. fans to obtain an active ventilation in the chamber, e.g. to support removal of air. Further a steam generator (12) is present. Instead of heating the timber exclusively with low pressure steam from the generator (12), however, the present invention provides means for heating the timber through recirculation of moist evacuation air from nearby chambers. For this purpose, evacuation air ducts (14) from each chamber are connected to provide a single stream of exhaust air for recycling back the evacuation air into another chamber. Valves (16) are installed in both evacuation air ducts (14) to direct the recirculated air into a specific chamber in which the timber is heated under conditions of moist heat. For this purpose, a ventilation pipe (18) is installed to lead the exhaust air stream from operating chambers into a specific chamber which shall be heated. For example, if chamber KT 14 is to be heated the respective valve (20) on pipe (10b) opens and the evacuation air from one or more surrounding chambers is passed into chamber KT 14 to heat the timber therein.

[0026] Measurement of the mean temperatures of the evacuation air from a drying chamber during the drying process gave a dry temperature of about 78°C and a wet temperature of about 60°C. These temperatures are maintained during the transfer of the evacuation air into a chamber in which timber is heated. When the moist evacuation air enters the chamber and contacts cool timber the moisture in the air condenses thereby providing a perfect heating climate. When using evacuation air from nearby chambers to heat the timber the heating energy is used more efficiently and cooler air with lower energy content will be evacuated out of the heated chamber by means of an exit, e.g. by exit (10) for chamber KT 14 into the atmosphere.

[0027] Figure 3 shows a continuous cross-circulating drying unit according to the state of the art with a single drying chamber (30). The drying chamber comprises a plurality of different drying zones (32a-32j). A batch of timber enters the drying chamber (30) through inlet (34) and is consecutively passed through the different drying zones during the drying operation.

[0028] The unit is operated without a separate heating

chamber. The individual zones act as chamber driers with one heater and two evacuation vents in each zone. These evacuation vents provide inlet and/or outlet of air into the chamber, as required. During the drying step, the timber is moved from one zone to the next zone. The timber enters the unit at the first zone (32a) where the heating starts. The heating is conducted by a heater. Fresh water can be added in the heating zone to obtain a moist and warm climate. Thereafter, the timber is transferred to the next drying zone (32b), where the actual drying process starts. From there, the timber is further transferred to the subsequent drying zones (32c-32j).

[0029] A continuous drying unit according to the present invention is shown in Figure 4. It comprises an additional heating chamber (36) which may include a plurality of individual zones, e.g. three zones. The number of zones in the heating chamber (36) can vary. The heating chamber (36) is adapted for heating incoming timber under conditions of moist heat. It may be heated by evacuation air (38) from the drying chamber (30). For example, the evacuation air stream from drying zones 1-5 in (30) may be joined and transferred to heating chamber (36). Fans may be provided to direct the stream of warm and moist evacuation air (38). For example, fans may work in parallel to supply and remove air from the drying chamber (30) into the heating chamber (36). For example, the joint evacuating air flow (38) may have a dry temperature of 65°C and a wet temperature of 55°C. When the air flow (38) is introduced into heating chamber (36) and comes into contact with the timber the moisture in the air will condense. After condensation the dry temperature of the air may decrease to about 55°C-58°C while the wet temperature remains at 55°C.

[0030] In the heating chamber (36) heated water may be additionally introduced as a supplement to the evacuation air flow (38) in order to prevent drying and facilitating heating if the difference between dry and wet temperature is too high. Cool air with a low energy content leaves the heating chamber (36) via exit (40). Exit (10) may be provided as an active outlet supported by means, e.g. fans in order to facilitate the evacuation of air.

[0031] The invention enables a more efficient use of energy and decreases the drying time since the actual drying can start already in the first zone of drying chamber (32a).

[0032] Further, the present invention is defined by the following embodiments of the specification:

1) A process for drying of timber, comprising the steps:

a) heating a first batch of timber in a chamber under conditions of moist heat, wherein a moist and heated first batch of timber is obtained,

b) drying the moist and heated first batch of timber in a chamber under conditions of dry heat, wherein a dry and heated first batch of timber is

obtained,

wherein during drying step (b) an exhaust stream of moist hot air is removed from the chamber containing the first batch of timber and wherein at least a portion of said exhaust stream of moist hot air is passed into a chamber containing a second batch of timber for heating said second batch of timber under conditions of moist heat.

2) The process of embodiment 1, wherein step (a) comprises heating the timber under conditions of moist heat until a dry temperature from about 40°C to about 70°C and a wet temperature from about 40°C to about 70 °C in the chamber is reached.

3) The process of embodiment 2, wherein the difference between dry temperature and wet temperature in the chamber during step (a) is about 25°C or less, about 20°C or less or about 15°C or less.

4) The process of any one of the preceding embodiments, wherein step (b) comprises drying the timber under conditions of dry heat until a dry temperature from about 70°C to about 90°C and a wet temperature from about 40 °C to about 70 °C in the chamber is reached.

5) The process of embodiment 4, wherein the difference between dry temperature and wet temperature at the end of step (b) is about 10°C to about 35°C.

6) The process of any one of the preceding embodiments, wherein the exhaust stream of moist hot air removed from the chamber in step (b) has a dry temperature from about 57°C to about 90°C and a wet temperature from about 57°C to about 75°C.

7) The process of embodiment 6, wherein the difference between dry temperature and wet temperature is about 25°C or less or about 20°C or less and particularly about 5°C to about 20°C.

8) The process of any one of the preceding embodiments, wherein upon passing the exhaust stream of moist hot air into the chamber containing the second batch of timber, a condensation of moisture from the exhaust stream takes place in the chamber containing the second batch of timber.

9) The process of any one of the preceding embodiments,

wherein the exhaust stream of moist hot air is passed into the chamber containing the second batch of timber without reducing the moisture content thereof.

10) The process of any one of the preceding embodiments, wherein no external steam is added to the exhaust stream of moist hot air before being passed into the chamber containing the second batch of timber.

11) The process of any one of embodiments 1-9, wherein external steam is added to the exhaust stream of moist hot air before being passed into the chamber containing the second batch of timber.

12) The process of any one of the preceding embodiments, wherein the exhaust stream of moist hot air from drying step (b) constitutes up to 100% of the total air stream used for heating the second batch of timber.

13) The process of any one of the preceding embodiments wherein additional water is provided in the chamber when heating a batch of timber under conditions of moist heat.

14) The process of any one of the preceding embodiments wherein additional heat is introduced into the chamber when heating a batch of timber under conditions of moist heat.

15) The process according to any one of the preceding embodiments wherein the amount of externally added heat introduced into the chamber when heating a batch of timber under conditions of moist heat is reduced by at least about 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80% or 90% and preferably up to about 100% by introducing the exhaust stream of moist hot air from the heating of a previous batch of timber.

16) The process of any one of the preceding embodiments, wherein heating (a) and drying (b) of a predetermined batch of timber are carried out in the same chamber.

17) The process of embodiment 16, wherein an exhaust air stream from a plurality of chambers each containing a batch of timber is collected during drying (b) and passed into at least one different chamber in which heating (a) of a further batch of timber is carried out.

18) The process of embodiment 16 or 17, wherein the exhaust stream of moist hot air removed from the chamber in step (b) has a dry temperature from about 70°C to about 90°C and a wet tempera-

ture from about 55°C to about 70°C, e.g. a dry temperature of about 78°C and a wet temperature of about 60°C.

19) The process of embodiment 18, wherein the difference between dry temperature and wet temperature is about 20°C or less and particularly about 5°C to about 20°C, e.g. about 18°C.

20) The process of any one of embodiments 1-16, wherein heating (a) of a predetermined batch of timber is carried out in a heating chamber and drying (b) of said predetermined batch of timber is carried out in a drying chamber separate from the heating chamber.

21) The process of embodiment 20, wherein the heating chamber contains a plurality of different zones and the batch of timber is passed through these different zones during heating, and/or the drying chamber contains a plurality of different zones and the batch of timber is passed through different zones during drying.

22) The process of embodiment 21, wherein the exhaust stream of moist hot air is collected from zones of the drying chamber wherein the first stages of drying (b) are carried out.

23) The process of any one of embodiments 20-22, wherein the exhaust stream of moist hot air removed from the chamber in step (b) has a dry temperature from about 57°C to about 90°C and a wet temperature from about 45°C to about 70°C.

24) The process of embodiment 23, wherein the difference between dry temperature and wet temperature is about 30°C or less, about 20°C or less or about 15°C or less or about 10°C or less and particularly about 5°C to about 10°C.

25) A unit for drying timber comprising means for heating a batch of timber under conditions of moist heat for obtaining a moist and heated batch of timber and means for subsequently drying a moist and heated batch of timber under conditions of dry heat for obtaining a dry and heated batch of timber wherein the means for heating the timber under conditions of moist heat are at least partially provided by an exhaust stream of hot moist air generated during the drying of timber under conditions of dry heat.

26) The unit of embodiment 25 comprising

a) a first chamber adapted for subjecting a first batch of timber to heating under conditions of moist heat and subsequent drying under conditions of dry heat,

b) a second chamber adapted for subjecting a second batch of timber to heating under conditions of moist heat and subsequent drying under conditions of dry heat,

c) means for passing an exhaust stream of moist hot air during drying the first batch of timber in the first chamber (a) into the second chamber (b) during heating the second batch of timber.

27) The unit of embodiment 26, wherein the first and the second chamber each comprise an inlet for introducing an air stream during heating under conditions of moist heat, a heater means for providing dry heat into the chamber during drying and an outlet for removing an exhaust stream of moist hot air during drying.

28) The unit of embodiment 26 or 27, wherein means (c) comprises a ventilation pipe optionally having valves and/or fans for directing the exhaust air stream.

29) The unit of embodiment 25 comprising

a) a first chamber adapted for subjecting a batch of timber to heating under conditions of moist heat,

b) a second chamber adapted for subjecting said batch of timber to drying under conditions of dry heat,

c) means for passing said batch of timber after heating from the first chamber to the second chamber, and

d) means for passing an exhaust stream of hot moist air produced during drying the first batch of timber in the second chamber (b) into the first chamber (a) during heating a second batch of timber.

30) The unit of embodiment 29, wherein the first chamber comprises an inlet for introducing an air stream during heating under conditions of moist heat, and the second chamber comprises a heater means for providing dry heat into the chamber during drying and an outlet for removing an exhaust stream of moist hot air during drying.

31) The unit of embodiment 29 or 30, wherein means (d) comprises a ventilation pipe optionally having valves and/or fans for directing the exhaust air stream.

32) Use of a unit of any one of embodiments 25-31 for the drying of timber, particularly in a process of

any one of embodiments 1-24.

Claims

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1. A process for drying of timber, comprising the steps:

- a) heating a first batch of timber in a chamber under conditions of moist heat, wherein a moist and heated first batch of timber is obtained,
- b) drying the moist and heated first batch of timber in a chamber under conditions of dry heat, wherein a dry and heated first batch of timber is obtained,

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wherein during drying step (b) an exhaust stream of moist hot air is removed from the chamber containing the first batch of timber and wherein at least a portion of said exhaust stream of moist hot air is passed into a chamber containing a second batch of timber for heating said second batch of timber under conditions of moist heat.

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2. The process of claim 1,

wherein step (a) comprises heating the timber under conditions of moist heat until a dry temperature from about 40°C to about 70°C and a wet temperature from about 40°C to about 70 °C in the chamber is reached, and wherein the difference between dry temperature and wet temperature in the chamber during step (a) is about 25°C or less, about 20°C or less or about 15°C or less.

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3. The process of any one of the preceding claims, wherein step (b) comprises drying the timber under conditions of dry heat until a dry temperature from about 70°C to about 90°C and a wet temperature from about 40 °C to about 70 °C in the chamber is reached, and wherein the difference between dry temperature and wet temperature at the end of step (b) is about 15°C to about 35°C.

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4. The process of any one of the preceding claims, wherein the exhaust stream of moist hot air removed from the chamber in step (b) has a dry temperature from about 57°C to about 90°C and a wet temperature from about 57°C to about 75°C and wherein the difference between dry temperature and wet temperature is about 25°C or less or about 20°C or less and particularly about 5°C to about 20°C.

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5. The process of any one of the preceding claims, wherein upon passing the exhaust stream of moist hot air into the chamber containing the second batch of timber, a condensation of moisture from the exhaust stream takes place in the chamber containing the second batch of timber.

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6. The process of any one of the preceding claims, wherein the exhaust stream of moist hot air is passed into the chamber containing the second batch of timber without substantially reducing the moisture content thereof. 5
7. The process of any one of the preceding claims, wherein no external steam is added to the exhaust stream of moist hot air before being passed into the chamber containing the second batch of timber, or wherein external steam in an amount of up to about 8 MW of energy is added to the exhaust stream of moist hot air before being passed into the chamber containing the second batch of timber. 10
8. The process according to any one of the preceding claims wherein the amount of externally added heat introduced into the chamber when heating a batch of timber under conditions of moist heat is reduced by at least about 10%, 20%, 30%, 40% or 50% and up to about 60%, 70%, 80% or 90% and preferably by up to about 100% by introducing the exhaust stream of moist hot air from the heating of a previous batch of timber. 15 20 25
9. The process of any one of the preceding claims, wherein heating (a) and drying (b) of a predetermined batch of timber are carried out in the same chamber. 30
10. The process of claim 9, wherein the exhaust stream of moist hot air removed from the chamber in step (b) has a dry temperature from about 70°C to about 90°C and a wet temperature from about 55°C to about 70°C, e.g. a dry temperature of about 78°C and a wet temperature of about 60°C and wherein the difference between dry temperature and wet temperature is about 20°C or less and particularly about 5°C to about 20°C, e.g. about 18°C. 35 40
11. The process of any one of claims 1-8, wherein heating (a) of a predetermined batch of timber is carried out in a heating chamber and drying (b) of said predetermined batch of timber is carried out in a drying chamber separate from the heating chamber. 45
12. The process of any one of claim 11, wherein the exhaust stream of moist hot air removed from the chamber in step (b) has a dry temperature from about 57°C to about 90°C and a wet temperature from about 45°C to about 70°C and wherein the difference between dry temperature and wet temperature is about 30°C or less, about 20°C or less or about 15°C or less or about 10°C or less and particularly about 5°C to about 10°C. 50 55
13. A unit for drying timber comprising means for heating timber under conditions of moist heat for obtaining moist and heated batch of timber and means for subsequently drying a moist and heated batch of timber under conditions of dry heat for obtaining a dry and heated batch of timber wherein the means for heating the timber under conditions of moist heat are at least partially provided by an exhaust stream of hot moist air generated during the drying of timber under conditions of dry heat.
14. The unit of claim 13 comprising
- (a) a first chamber adapted for subjecting a first batch of timber to heating under conditions of moist heat and subsequent drying under conditions of dry heat,
- (b) a second chamber adapted for subjecting a second batch of timber to heating under conditions of moist heat and subsequent drying under conditions of dry heat,
- (c) means for passing an exhaust stream of moist hot air during drying the first batch of timber in the first chamber (a) into the second chamber (b) during heating the second batch of timber.
15. The unit of claim 13 comprising
- (a) a first chamber adapted for subjecting a batch of timber to heating under conditions of moist heat,
- (b) a second chamber adapted for subjecting said batch of timber to drying under conditions of dry heat,
- (c) means for passing said batch of timber after heating from the first chamber to the second chamber, and
- (d) means for passing an exhaust stream of hot moist air produced during drying the first batch of timber in the second chamber (b) into the first chamber (a) during heating a second batch of timber.
16. Use of a unit of any one of claims 13-15 for the drying of timber, particularly in a process of any one of claims 1-12.

Figure 1:

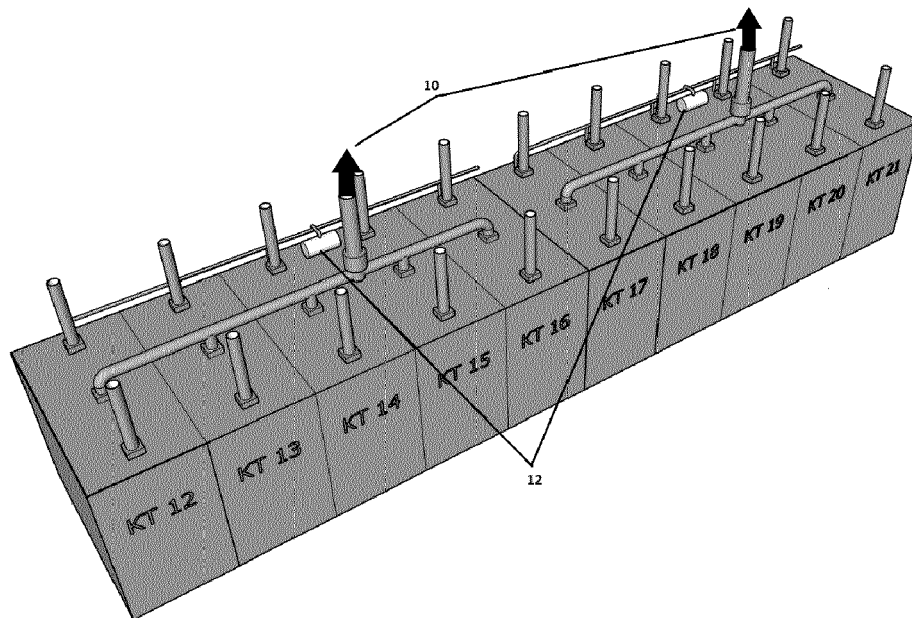


Figure 2:

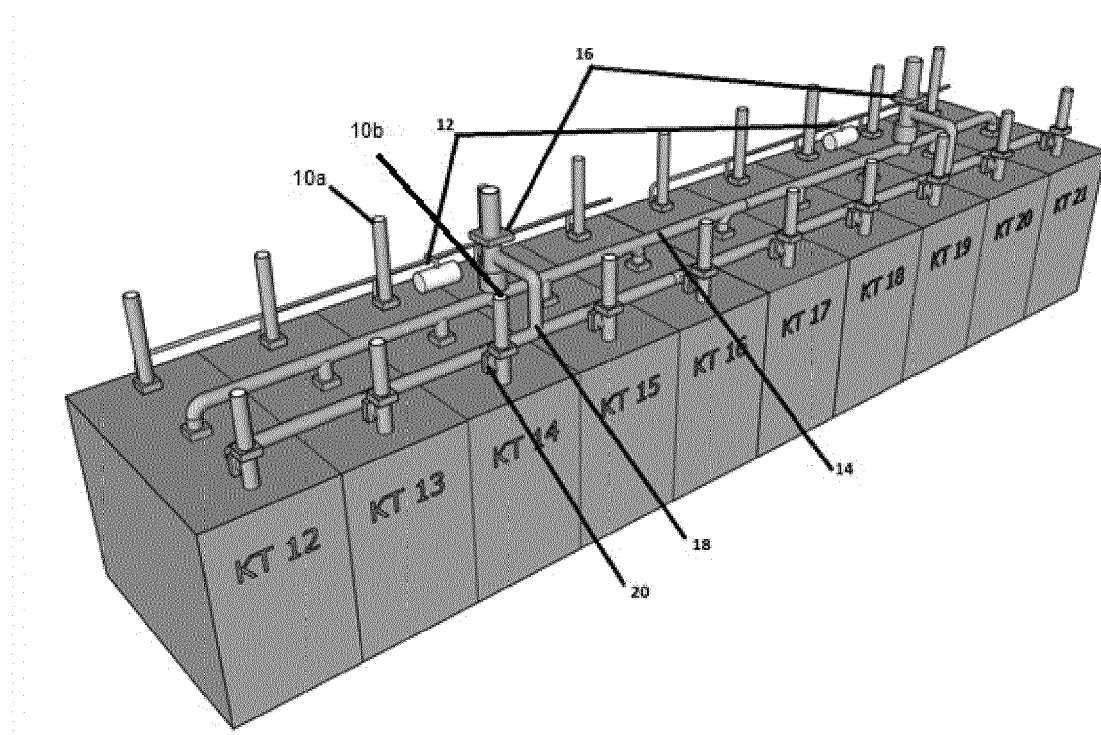


Figure 3:

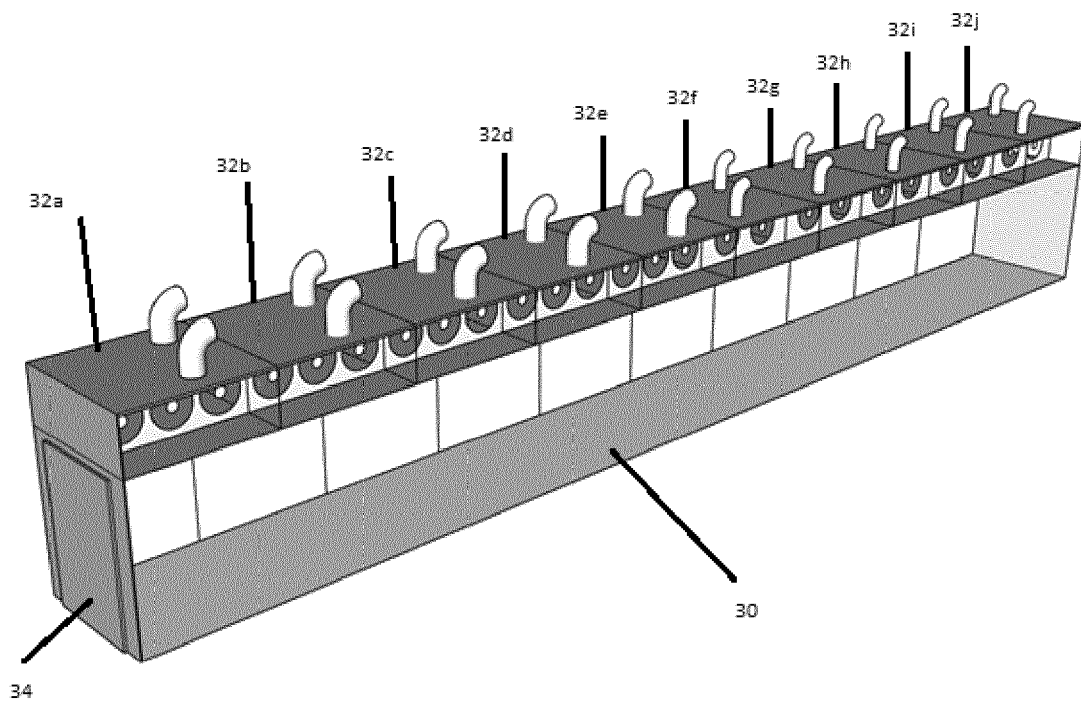
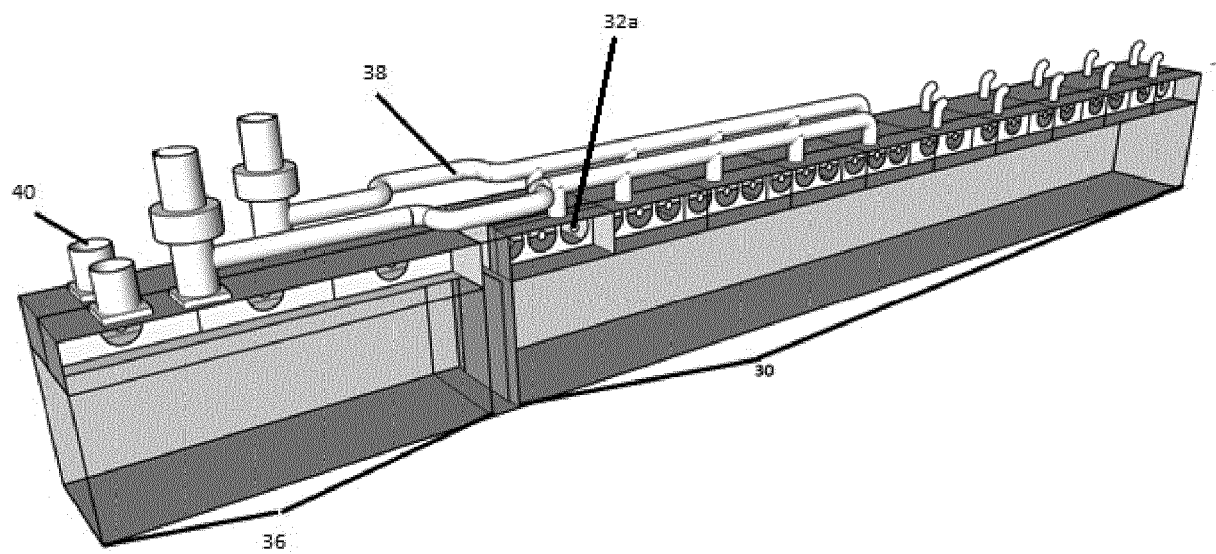


Figure 4:





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