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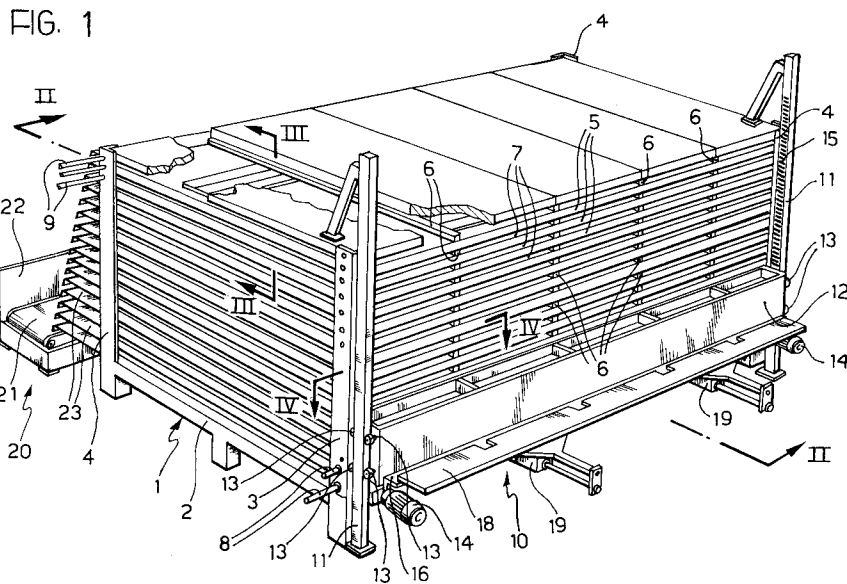
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Machine and method for drying sheets of wood obtained by slicing, rotary cutting and the like.

A dryer for sliced or peeled sheets of wood and the like, characterised in that it includes two or more superimposed or superimposable rigid plates (5), the facing and opposing surfaces of which are substantially flat; spacer means (6) interposed or interposable between the plates so as to define between facing surfaces of the plates at least one interspace (7) of uniform height for receiving the sheets of wood

(A) to be dried, a heat source (8) for supplying the plates with the thermal energy necessary to dry the wood; the height of the spacer means being just sufficient to prevent the plates from squashing the wood while allowing the sheets of wood to shrink freely in their own planes, parallel to the faces of the plates, as a result of the drying.



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The present invention relates to dryers for sheets of wood obtained from slicing and/or peeling machines and also for thin boards obtained by sawing.

The thickness of these sheets is generally between 1 and 5 millimetres and may go up to 10 millimetres.

Conventional dryers for sheets of wood of this type normally use hot air ventilation with the sheets being advanced by rollers or belts; in these dryers the air temperature is always very high (for example up to 230 °C) and the air speed is also very high, reaching up to 15 m/second for longitudinal ventilation (relative to the direction of advancement of the sheets) and up to 5 m/second for transverse ventilation.

These high air speeds and temperatures are used to shorten drying times, mainly in order to limit the length of the dryers.

However, as the sheets are advanced at very high speeds (speeds may vary from 10-12 m/min. for sheet-by-sheet dryers to up to 60 m/min. for machines drying continuous strip) the drying chamber is still very long, so much so that dryers are often constructed on two, three or five U-shaped levels in order to limit the total length of the dryer by 2, 3 or 5 times.

It is easy to imagine the structural complications of this type of dryer, which are due to the enormous size combined with the difficulty of achieving uniform ventilation and of advancing the sheets.

Another problem which has not been entirely resolved is due to shrinkage of the wood, especially in continuous strip dryers where, for example, a strip of wood 60 metres long on input may be reduced to 54 metres on output owing to shrinking; it is therefore necessary to divide the total path of travel of the strip into portions of different speed so as to accommodate the shrinkage and avoid damaging the wood.

Leaving aside conventional dryers for sliced or peeled wood, and passing over a few systems of negligible interest, we would mention the prior art technique which uses a heating press in which the effect of pressure is combined with the effect of contact. The most characteristic aspect of this type of dryer is the transport system which uses chains fitted with heated blades or plates (forming a sort of track) which advance the sheets while at the same time heating and compressing them in an attempt to ensure the dried sheets are flat.

The most serious problem of these sheet-compression dryers is that a large amount of wood is wasted owing to splitting because the pressure of the plates prevents the natural shrinking of the wood.

Even in these special dryers the operating temperature is very high compared with that of dryers for bulk wood.

In any case, all types of dryer for wood sheets, of both conventional and special design, take up a huge amount of space while their structure is complex and they have a very high purchase price.

In addition, it is difficult to avoid drying defects such as pockets of water and lack of homogeneity of the final moisture content as a result of the difficulty in maintaining uniform ventilation, or surface hardening, coloring and goffering of the sheets as a result of the high temperature.

The principal object of the present invention is to provide a dryer for sheets of wood which is able drastically to reduce defects in the dried sheets by reducing wastage due to cracking, deformation, goffering and coloring of the wood.

Another object of the present invention is to limit the dimensions of dryers for sheets of wood so they may be housed in smaller spaces.

An additional object of the present invention is to reduce the number and the working hours of the personnel required to operate the dryer.

In order to achieve these and other objects which will appear in the description which follows, the subject of the present invention is a dryer for sliced and peeled sheets of wood and the like, characterised in that it includes two or more superimposed or superimposable rigid plates, the facing and opposing surfaces of the plates being substantially flat; spacer means interposed or interposable between the plates so as to define between the facing surfaces of the plates at least one interspace of uniform height for receiving the sheets of wood to be dried; a heat source for supplying the plates with the thermal energy required to dry the wood; the height of the spacer means being just sufficient to prevent the plates from squashing the wood while allowing the sheets of wood to shrink freely in their own planes, parallel to the faces of the plates, as a result of the drying action.

The invention will now be described in detail with reference to the appended drawings, supplied purely by way of a non-limitative example, in which:

Figure 1 is a schematic perspective view in partial cross-section of a machine according to the invention for drying thin wood cuttings,

Figure 2 is a vertical section taken on the line II-II of Figure 1,

Figure 3 is an enlarged vertical section taken on the line III-III of Figure 1,

Figure 4 is a horizontal section taken on the line IV-IV of Figure 1, and

Figure 5 shows the detail indicated with the arrow V in Figure 2 on an enlarged scale.

With reference to the drawings, the machine according to the invention essentially includes a support structure 1 formed by a lower horizontal base 2 and two pairs of vertical uprights, front 3 and rear 4, arranged as the vertices of a quadrilateral. The structure 1 supports a series of horizontal heating plates 5 held equispaced, one above the other, by profiled spacers 6, regularly interposed between pairs of adjacent plates 5 across their width, that is extending parallel to the shorter sides of the support structure 1. The number and positions of the spacers 6 can be varied according to the dimensions of the plates 5 and the dimensions of the wood cuttings which the machine is to dry. These spacers 6 define an interspace 7 between each pair of adjacent heating plates 5 which will hereafter be termed the "drying chamber", open to the front and to the rear, that is along the edges of the plates 5 corresponding to the front uprights 3 and the rear uprights 4 respectively. The height of the spacers 6, and therefore of the drying chambers 7, may also be varied in dependence on the intended use of the machine and, specifically, on the thickness of the wood cuttings to be dried. In general terms, as will be explained in more detail later, the distance at which the plates of each pair of adjacent plates 5 are kept by their spacers 6 is slightly greater than the initial thickness (before drying) of the wood cuttings (board, strip, fillet or sheet). As explained previously, the term "slightly" should be understood to mean that there must be a minimum clearance between the surfaces of each wood cutting and the corresponding surfaces of the two plates 5 between which it is interposed, clearance that will increase as the wood shrinks during the drying process.

The heating plates 5 are of a generally conventional type: in the example illustrated the plates are hollow panels or panels incorporating ducts for the circulation of a heating fluid, normally hot water, supplied by a non-illustrated source of heat through inlet tubes 8 and evacuated through outlet tubes 9. In the case of the example illustrated, each plate 5 is provided with autonomous tubes 8, 9 which extend from the support structure 1 through one of the front uprights 3 and the corresponding rear upright 4 on the same side respectively. Alternatively, the two uprights may have associated manifolds each in communication with inlets or outlets of the plates 5 respectively.

A loader assembly, generally indicated 10, is provided for automatically inserting the wood cuttings into the drying chambers 7 and for unloading them. This loader assembly 10 essentially includes two pillars 11 fixed to the base 2 adjacent the front uprights 3 and a container 12 extending between the pillars 10 for holding stacks C of wood cuttings for drying which, in the example illustrated, are

strips A of substantially homogeneous dimensions for packaging.

The container 12 is movable vertically along the pillars 11 and is therefore conveniently provided at each end with guide and bearing rollers 13, seen more clearly in Figure 4, in rolling contact with the pillars 11.

In the case of the example illustrated, the container 12 is moved vertically relative to the pillars 11, and therefore to the plates 5, by a pair of electric motors 14 fitted under the ends of the container 12 and driving a pair of sprockets, not illustrated, each of which is meshed with a respective vertical rack 15 carried by the associated pillar 11. Alternatively, the container 12 could be moved by a chain transmission, or by pressurised-fluid actuators or in fact by any equivalent system a specialist of the field might choose.

As may be seen more clearly in Figure 5, the entire length of the container 12 is open at the bottom at 16, there being an underlying platform 17 at a distance slightly greater than the thickness of the strips A. Between the opening 16 and the platform 17 a horizontal pusher plate 18 is reciprocable between a withdrawn position, schematically illustrated in Figure 1, in which the plate 18 is in front of the opening 16, and an advanced position, shown in Figures 2, 4 and 5, in which the plate 18 extends across the opening 16. The pusher plate 18 is driven, in the example illustrated, by a pair of hydraulic jacks 19, fitted under the platform 17. It is clear that, as an alternative, equivalent motorised systems of a different type could be used.

The vertical movement of the container 12 and the horizontal movement of the pusher plate 18 are synchronized so that the former is moved stepwise to position the pusher plate 18 at successive levels in correspondence with successive drying chambers 7 and, at each stop at one of these levels, the pusher plate 18 is reciprocated several times, the precise number of movements depending on the width of the group of plates 5 and the width of the strips A. In order to carry out this cycle, which will be described in greater detail below, the motors 14 and the actuators 19 are connected to a programmable control circuit, not illustrated in the drawings but perfectly clear to a specialist in this field.

On the opposite side of the group of plates 5 from the loader assembly 10, that is adjacent the rear uprights 4, is a collecting and unloading assembly generally indicated 20. In the case of the example illustrated, this assembly 20 consists simply of a motorised conveyor belt 21 which extends parallel to the rear of the plates 5 and is provided to convey the strips A on exit therefrom to a packing station, not illustrated. Still in the case of the example illustrated, the conveyor 21 is asso-

ciated on one side with a rear containment panel 22 and on the other with a series of horizontal slats 23 which increase in length progressively from the top to the bottom, forming a slip linkway between the bottoms of the successive drying chambers 7 and the conveyor 21. The slats 23 are not strictly necessary and could therefore be absent.

The machine according to the invention is able to execute a fully automatic and continuous cycle of loading, drying and unloading the strips A according to the following procedure.

At the start, the strips A are put into the container 12 in piles or stacks C end-to-end after which the machine is turned on. The motors 14 position the container 12 at a first level, corresponding for example to the top or the bottom drying chamber, and stop it in this position. The jacks 19 reciprocate the pusher plate 18. When the plate 18 is withdrawn, the strips A at the bottom of the stacks C drop onto the platform 17 through the opening 16 of the container 12. In the subsequent advancing phase of the pusher plate 18, these strips are pushed into the drying chamber 7, as shown in Figure 5. The strips A are then introduced one after the other and pushed forwards until the drying chamber 7 is completely full.

At the end of this stage, activation of the jacks 19 is interrupted and the motors 14 are actuated to lift the container 12 to the level of the drying chamber 7 immediately above (or below). The cycle is repeated in the same way until all the drying chambers 7 are filled.

At the same time, the plates 5 are supplied with the heating fluid so that the strips A loaded between them, and kept still in turns during the whole loading operation, are dried. The periods for which the strips A are kept stationary are variable but are generally about the same length of time as that required for the container 7 to return to the level of each drying chamber 7 after all the other chambers have been filled. This period may be, for example, around 15 minutes.

Figure 3 shows the arrangement of the strips A at the end of the drying period: as can be clearly seen in this drawing, the thickness of the strips at the end of the drying period, normally less than their thickness before drying owing to natural shrinkage, is such that there is still a clearance between the opposite surfaces of the strips A and the corresponding surfaces of the heating plates 5 in each chamber 7. In other words, as stated previously, the thickness of the spacers 6, and therefore the distance between the plates 5, must always be sufficient to prevent any force fit of the strips A in the drying chambers 7.

Once the top (or bottom) chamber 7 is full, the container 12 (which in the meantime will have been topped up with more stacks C) is returned to the

initial bottom level (or top level) so that new strips A can be fed into the bottom (or top) drying chamber 7. As these are fed in, the dried strips A are pushed to the rear ends of the plates 5 and unloaded one at a time over the slats 23, if provided, and onto the conveyor 21.

The cycle is then repeated continuously for the drying chamber 7 at each level in turn.

The operating cycle of the machine is identical to that described above in the case of thin sheets but must be long enough for the sheets to be pushed across the plates 5, the spacing of the heater plates 5 as well as the conformation of the container 12 for receiving the sheets being adapted accordingly.

It must finally be pointed out that, though the machine described with reference to the example operates at ambient pressure, the protective scope of the present invention also covers a version in which drying takes place in a vacuum. In this case the heater plates 5, or in fact the entire machine, need to be placed inside a sealable cell and connected to a suction source of conventional type.

The advantages obtained by the invention in drying boards, strips and fillets for packing and flooring, as well as sheets of modest dimensions, may be summarized as follows:

- constantly homogeneous drying which avoids the development of strong stress, undulation or cracking and leaves no noticeable change in the original colour at the end of the treatment;
- high output and low cost, including both low operating costs and low machinery costs;
- full automation of the entire process, including loading and unloading.

Naturally constructional details and embodiments may vary broadly from the description and illustrations given, without departing from the scope of the present invention.

Claims

1. A dryer for sliced or peeled sheets of wood and the like, characterised in that it includes two or more superimposed or superimposable rigid plates (5), the facing and opposing surfaces of which are substantially flat; spacer means (6) interposed or interposable between the plates so as to define between the facing surfaces of the plates at least one interspace (7) of uniform height for receiving the sheets (A) of wood to be dried; a heat source (8) for supplying the plates with the thermal energy required to dry the wood; the height of the spacer means being just sufficient to prevent the sheets of wood from being squashed by the plates while allowing the sheets of wood to

shrink freely in their own planes, parallel to the faces of the plates, as a result of the drying.

2. A dryer according to Claim 1, characterised in that the height of the spacers (6) is equal to the initial thickness of the sheets of wood (A), measured before drying, plus an increment equal to the maximum distortion in the planarity of the dried sheets permissible in the use for which they are intended.
3. A dryer according to Claim 2, characterised in that the height increment of the spacers (6) is normally between 0 and 20% of the initial thickness of the sheets before drying.
4. A dryer for sliced or peeled sheets of wood and the like, characterised in that it includes, in combination with a hermetically sealable container able to withstand the external atmospheric pressure when a vacuum has been formed inside, a plurality of superimposed or superimposable rigid plates (5), the facing and opposing surfaces of which are substantially flat; spacer means (6) interposed or interposable between the plates so as to define between the facing surfaces of the plates at least one interspace (7) of uniform height for receiving the sheets of wood (A) to be dried; a heat source (8) for supplying the plates with the thermal energy required to dry the wood; the height of the spacer means being just sufficient to prevent the plates from squashing the sheets of wood while allowing the sheets of wood to shrink freely in their own planes, parallel to the surfaces of the plates, as a result of the drying, the plurality of rigid plates being housed or housable inside the closed container so that the sheets of wood can be dried at below atmospheric pressure and consequently at a temperature considerably lower than those normally used in conventional dryers for sheets of wood.
5. A process for drying sliced or peeled sheets of wood or the like having a low, even thickness, characterised in that it consists of introducing the sheets of wood (A) singly between fixed parallel heating plates (5) spaced from each other by a predetermined distance slightly greater than the thickness of the sheets of wood (A) in their undried state before being placed between the heating plates (5), and of maintaining the sheets there for a predetermined period of time.
6. A process according to Claim 5, characterised in that it includes a stage in which the sheets

of wood (A) are kept stationary between the heating plates (5).

7. A process according to Claim 6, characterised in that it includes an initial and a final stage which precede and follow the stationary stage and in which the sheets of wood (A) are made to advance across the heating plates (5).
8. A process according to Claim 7, characterised in that the sheets of wood (A) are inserted one after the other between the heating plates (5) and are made to advance in the said initial and final stages by pushing.
9. A process according to Claim 6, characterised in that the stationary stage is carried out at atmospheric pressure.
10. A process according to Claim 6, characterised in that the stationary stage is carried out in a vacuum.
11. A machine for drying wood cuttings of a low even thickness such as strips, sheets or the like, characterised in that it includes at least one pair of fixed, parallel heating plates (5) superimposed one above the other, spacer means (6) interposed between the heating plates (5) to space them by a distance slightly greater than the thickness of the wood cuttings (A) in their state prior to drying, means (8) for supplying heat to the heating plates (5), means (10) for inserting the wood cuttings (A) between the said plates (5) at one end and means (20) for unloading the wood cuttings (A) from the opposite end of the said heating plates (5).
12. A machine according to Claim 11, characterised in that it includes a plurality of heating plates (5) horizontally superimposed one above another.
13. A machine according to Claim 12, characterised in that the loading and unloading means include a loader (10) positioned at one end of the heating plates (5) and including a container (12) with an open bottom (16) for receiving the wood cuttings (A) in a stack, a motorised pusher (18) movable across the open bottom (16) of the container (12) between a withdrawn position and an advanced position, motorised means (14, 15) for moving and positioning the loader (10) vertically at various consecutive levels corresponding to the zones (7) separating the heating plates (5), and means (19) for controlling the motorized pusher (18) to effect

consecutive cycles of expelling the wood cuttings (A) from the bottom (16) of the container (12) then inserting them and pushing them forwards between each pair of adjacent heating plates (5) until each level is filled, then pushing the cuttings (A) out at the opposite end of the heating plates (5) after the other levels have been filled. 5

14. A machine according to Claim 13, characterised in that it also includes means (20) for collecting and removing the wood cuttings (A) expelled from the said opposite end of the heating plates (5). 10

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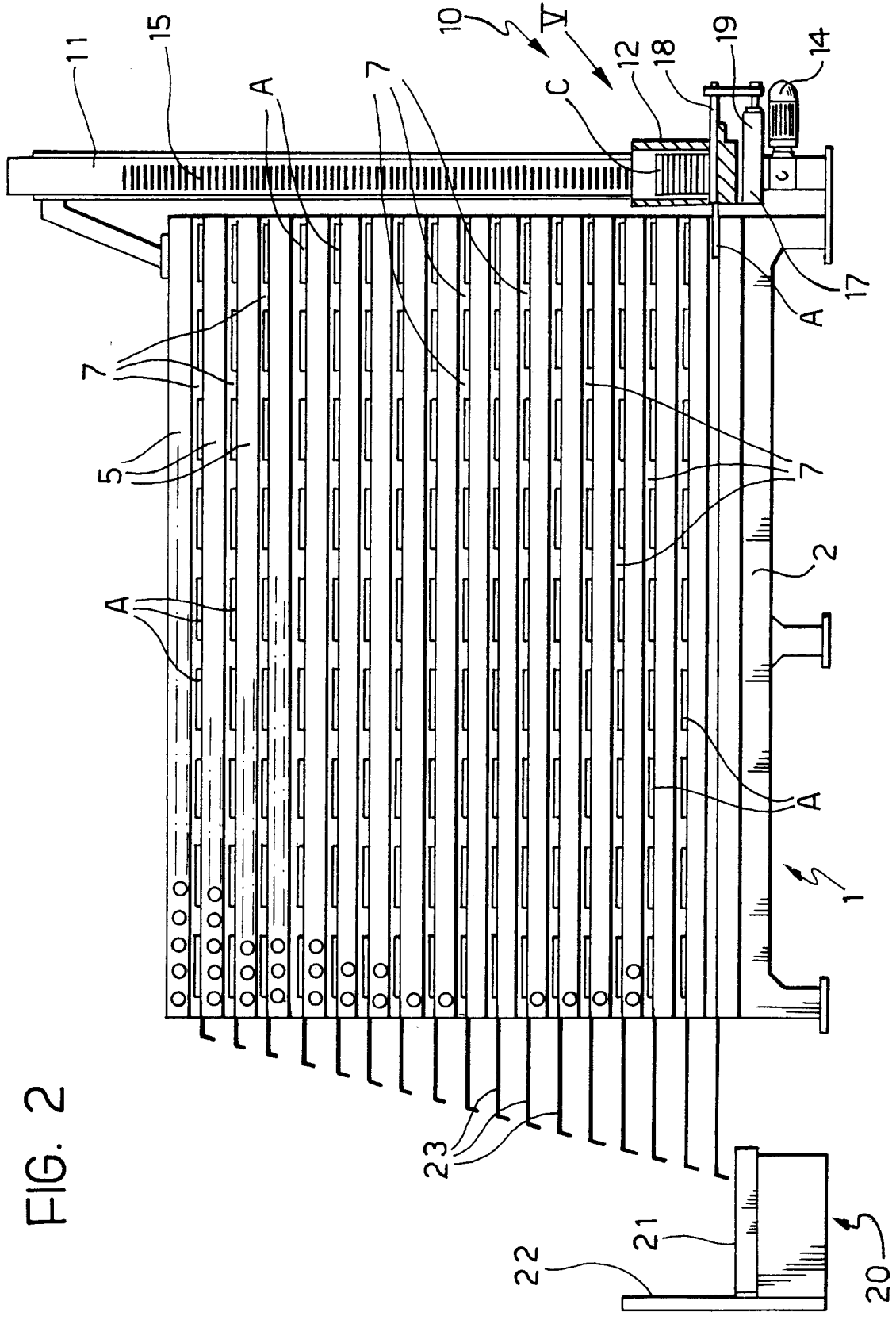


FIG. 2

FIG. 3

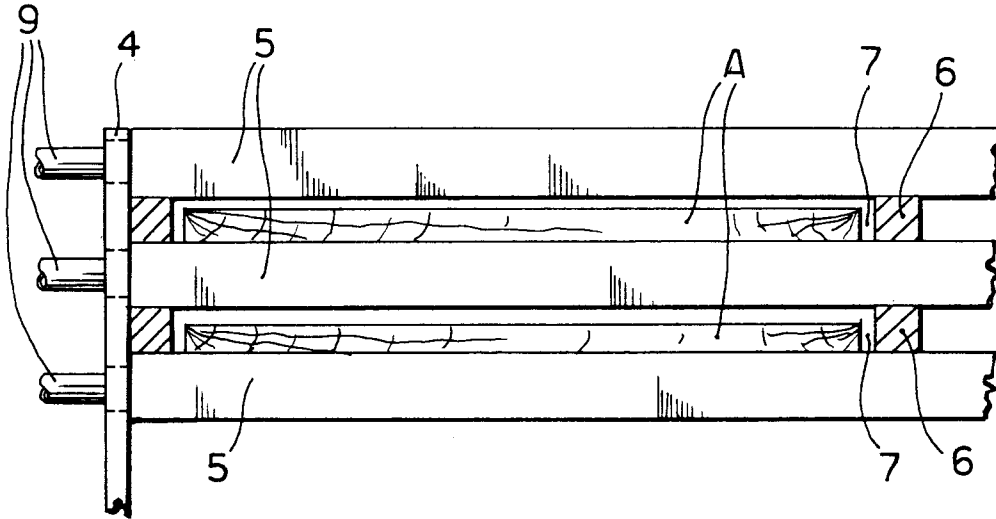
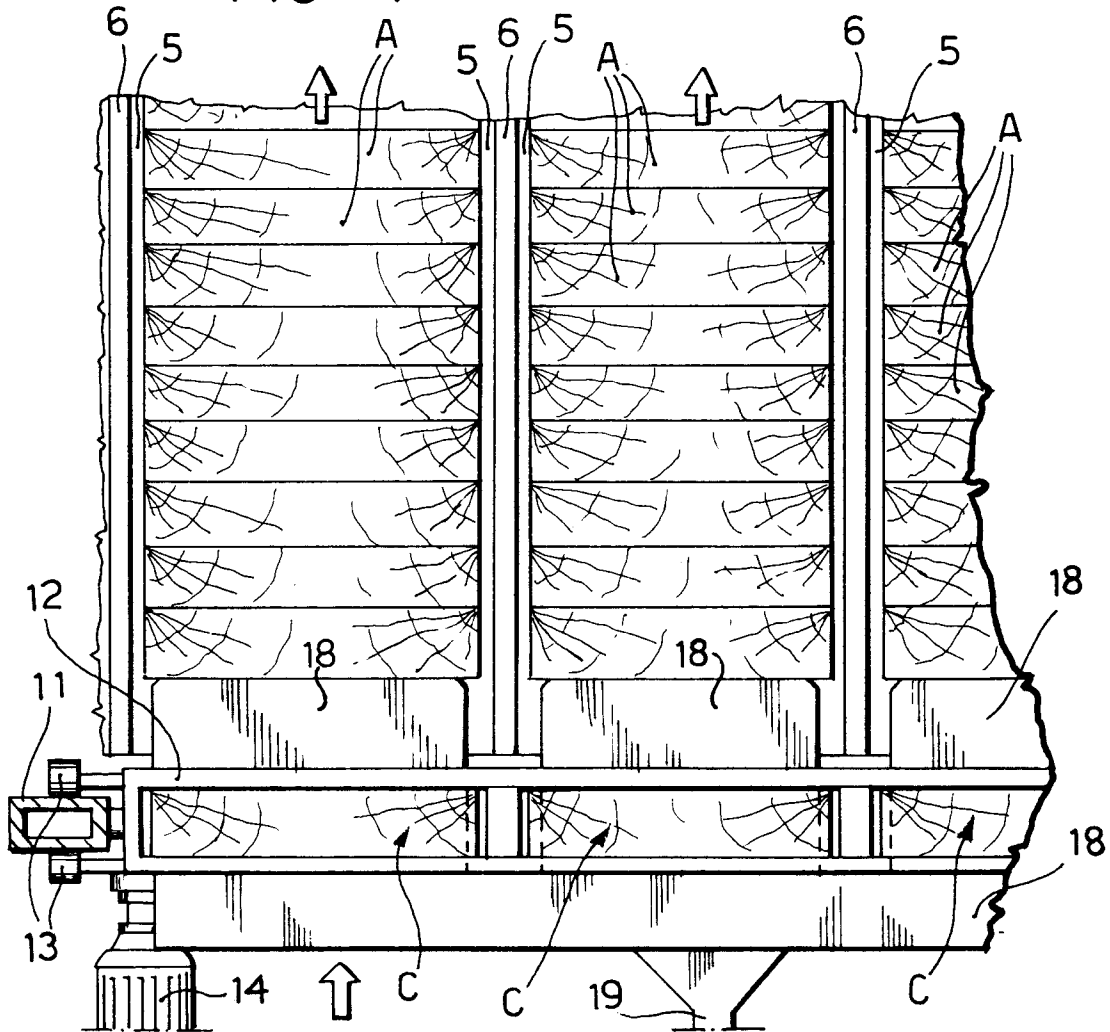
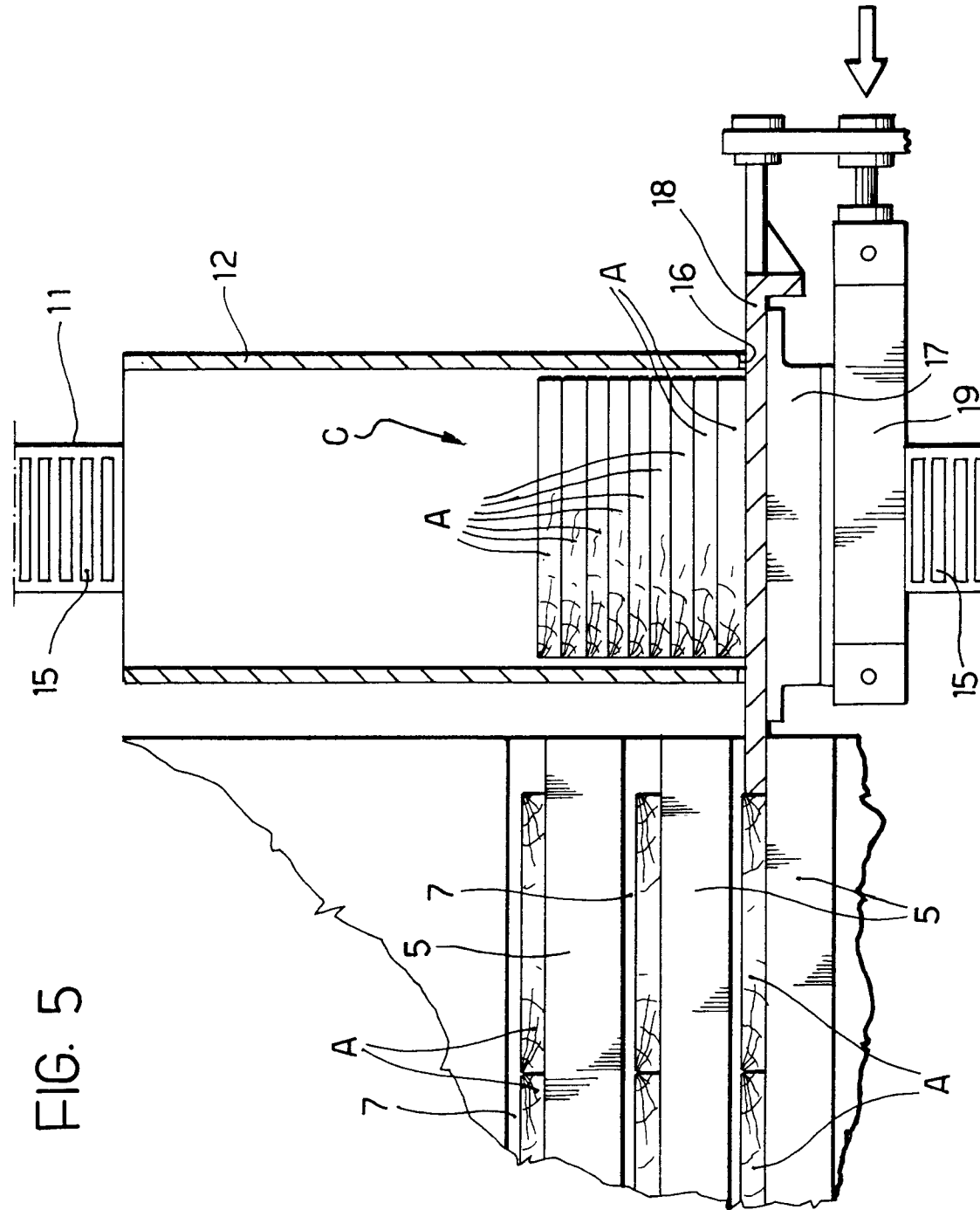


FIG. 4







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EUROPEAN SEARCH REPORT

Application Number

EP 92 83 0573

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	FR-E-62 054 (GROSKOPF)	1, 4, 5, 6, 10	F26B3/20 F26B7/00
A	* the whole document * ---	11, 12	F26B25/00
X	US-A-4 811 496 (HONDA ET AL)	1	
A	* column 12, line 56 - column 13, line 15; figures 1,16,17 * ---	5, 6, 7, 9, 11, 12	
A	DE-U-9 101 990 (FIBRON GMBH) * the whole document * ---	1, 5, 6, 7, 9, 11, 12	
A	DE-B-1 191 405 (BENNO SCHILDE MASCHINENBAU-AKTIENGESELLSCHAFT) * the whole document * ---	8, 13	
A	DE-A-2 904 243 (COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION) ---		
A	DE-C-495 236 (NIEDERRHEINISCHE MASCHINENFABRIK BECKER & VAN HÜLLEN A.-G.) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F26B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21 MAY 1993	Examiner SILVIS H.
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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