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PATENT

Declaration in Support of an Application for a Patent

*Strike out for non-convention

In support of the *Convention** application made for a patent ~~patent of addition~~ for an invention entitled "PROCESS FOR MANUFACTURING PARTICLE BOARDS AND SIMILAR, AND SUITABLE TWIN-BELT PRESSES"

Insert full name and address of declarant

~~I,~~We, PETER HEINTZ and BERNHARD BRENDEL of Gladbacher Strasse 457, D-4150 Krefeld 1, Federal Republic of Germany

do solemnly and sincerely declare as follows:

1. ~~I am~~ ~~We are~~ ~~the applicant(s) for the patent~~ ~~patent of addition~~ ~~(or in the case of an application by a body corporate)~~

1. ~~I am~~ We are authorised by EDUARD KÜSTERS MASCHINENFABRIK GMBH & CO. KG the applicant for the patent ~~patent of addition~~ to make this declaration on its behalf.

Strike out Para. 2 for non-convention

2. The basic application~~(s)~~ as defined by section 141 of the Act is ~~are~~ —

Filing Date	Country	Applicant(s)
9th October, 1987	Federal Republic of Germany	EDUARD KÜSTERS MASCHINENFABRIK GMBH & CO. KG

Insert details for the/or EACH basic application

Strike out Para. 3 for non-convention

3. The basic application~~(s)~~ referred to in this Declaration was ~~were~~ the first application~~(s)~~ made in a Convention country in respect of the invention the subject of the application.

4. ~~I am~~ ~~We are~~ ~~the actual inventor(s) of the invention.~~ ~~(or, where a person other than the inventor is the applicant:)~~

Insert full name(s) and address(es) of inventor(s)

4. KARL-HEINZ AHRWEILER and BERND HEIMES of Budericher Strasse 87, D-4156 Willich 1, Federal Republic of Germany and Benhutter Strasse 125, D-4050 Monchengladbach, Federal Republic of Germany, respectively

~~is~~ are the actual inventor(s) of the invention and the facts upon which the applicant is entitled to make the application are as follows: The applicant is a person who would, if a patent were granted upon an application made by the said actual inventors, be entitled to have the patent assigned to it.

See over for instructions

DECLARED AT Krefeld

this 12th day of December 1989 Peter Heintz (Peter Heintz)

ppa. Bernhard Brendel (Dr. Bernhard Brendel)

Signature of Declarant

No Legalization No Corporate Seal

To: The Commissioner of Patents.

(12) PATENT ABRIDGMENT (11) Document No. AU-B-24803/88
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 608912

(54) Title
PROCESS FOR MANUFACTURING PARTICLE BOARDS AND SIMILAR, AND SUITABLE TWIN-BELT PRESSES

International Patent Classification(s)
(51)[4] B27N 003/24 B27N 003/08

(21) Application No. : 24803/88 (22) Application Date : 30.09.88

(87) WIPO Number : WO89/03288

(30) Priority Data

(31) Number (32) Date (33) Country
3734180 09.10.87 DE FEDERAL REPUBLIC OF GERMANY

(43) Publication Date : 02.05.89

(44) Publication Date of Accepted Application : 18.04.91

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(57) Claim

1. Double-band press for the continuous manufacture of wood-chip panels and the like, from panel material consisting of wood particles held together by a bonding agent that hardens under the influence of heat and pressure,

having two metal bands, supported on a support structure, that circulate endlessly, above one another at the same speed, around deflection guide drums and through a flat compression stretch, between which a mat consisting of wood particles enters a heated feed-in gap in the support structure which becomes progressively narrower, in the direction perpendicular to the mat, in the direction of forward travel, and between which the mat can be compressed in the substantially flat stretch, under the influence of heat and pressure,

with a feed-in system by means of which the mat is first formed and then fed into the feed-in gap between the forming bands,

characterised in that the supply device comprises a tray (30) located close above the upper run (1') of the lower forming band (1) and reaching up close to the upper guide drum (4), over

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which the mat (10) is introduced into the feed-in gap between the forming bands 1, 2,

and in that at least one of the support plates (6, 7) of the support structure (8, 9) defining the feed-in gap (13), supports the forming band positioned there with transmission of pressure and heat, and it is pre-curved convexly in the vertical longitudinal plane of the double-band press (400) in relation to the mat (10),

and in that the forming band closely adapts to the pre-curvature, in which case the pre-curvature and the heat-transfer are designed in such a way that the distance (36) from the points (34, 35) of first contact of the forming bands (1, 2) with the mat (10) up to the transition point (43) to the adjoining flat portion of the support plates (6, 7) is traversed in a period of time during which the heat transmitted through the forming bands (1, 2) has not yet penetrated into the inner zone (10") of the mat (10),

and in that the pre-curved feed-in zone (50) of the support plates, in the direction of travel of the mat (10), is adjoined by an essentially flat stretch of the support plates to form an integral rigid unit which is located upstream of the compression stretch (5), and which can be pivoted about a transverse axis (42) situated at the far end of the support plate when seen in the direction of travel of the mat (10),

and in that the vertical distance of the transverse axis (42) below the opposite support plate (7) is adjustable.

OPI DATE 02/05/89 APPLN. ID 24803 / 88
AOJP DATE 15/06/89 PCT NUMBER PCT/DE88/00602

(51) Internationale Patentklassifikation 4 : B27N 3/24, 3/08 — A1

(11) Internationale Veröffentlichungsnummer: WO 89/ 03288

(43) Internationales Veröffentlichungsdatum: 20. April 1989 (20.04.89)

(21) Internationales Aktenzeichen: PCT/DE88/00602

(22) Internationales Anmeldedatum: 30. September 1988 (30.09.88)

(31) Prioritätsaktenzeichen: P 37 34 180.4

(32) Prioritätsdatum: 9. Oktober 1987 (09.10.87)

(33) Prioritätsland: DE

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(81) Bestimmungsstaaten: AT (europäisches Patent), AU, BE (europäisches Patent), BR, CH (europäisches Patent), DE (europäisches Patent), DK, FI, FR (europäisches Patent), GB (europäisches Patent), HU, IT (europäisches Patent), JP, LU (europäisches Patent), NL (europäisches Patent), NO, SE (europäisches Patent), SU, US.

Veröffentlicht
Mit internationalem Recherchenbericht.
Mit geänderten Ansprüchen.

(54) Title: PROCESS FOR MANUFACTURING PARTICLE BOARDS AND SIMILAR, AND SUITABLE TWIN-BELT PRESSES

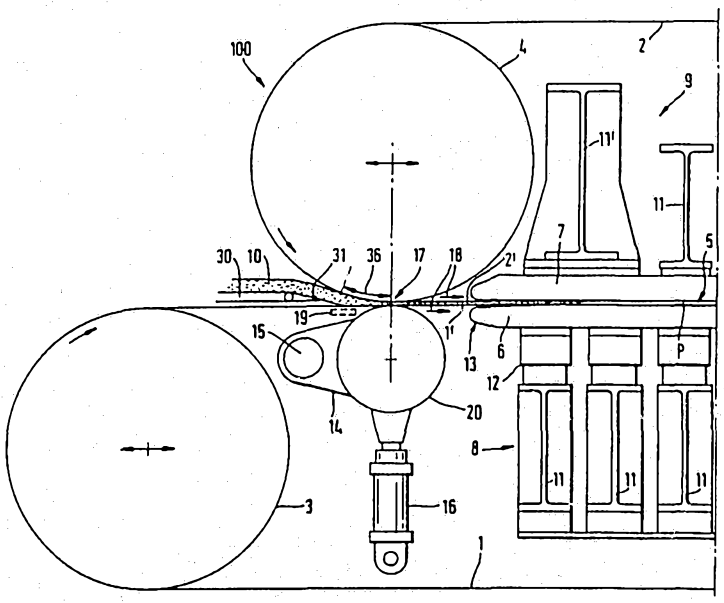
(54) Bezeichnung: VERFAHREN ZUR HERSTELLUNG VON HOLZSPANPLATTEN U.DGL. UND ENTSPRECHENDE DOPPELBANDPRESSEN

(57) Abstract

In a twin-belt press or similar, the pressure on the mat (10) entering the machine is increased rapidly, once the latter comes in contact with the heat-transmitting surfaces (1, 2), so that the high pressure causes the outer regions of the mat to harden before the heat penetrates to the interior of the mat (10). The quality of the surface of the board (P) is thereby enhanced. For this purpose, a nip (17) for example can be provided before the run-in gap (13).

(57) Zusammenfassung

Bei einer Doppelband- oder ähnlichen Presse wird der Druck auf die einlaufende Matte (10), sobald diese mit den wärmeübertragenden Flächen (1, 2) in Berührung gekommen ist, so rasch gesteigert, daß die äußeren Bereiche der Matte (10) unter dem hohen Druck bereits aushärten, während die Wärme noch nicht in das Innere der Matte (10) vorgedrungen ist. Dadurch wird eine Steigerung der Oberflächenqualität der Spanplatte (P) erreicht. Beispielsweise kann zu diesem Zweck vor dem Einlaufspalt (13) ein Walzspalt (17) vorgesehen sein.



The present invention relates to a process of the sort set out in the defining portion of claim 1 and to a corresponding double-band press.

The wood particles are flat chips, as well as other particles produced by the reduction of wood, e.g., by planing, chopping, sawing, grinding, or disintegration [Zerfasern--Tr.] that are combined with a binding agent in the form of a thermal hardening plastic resin and scattered or spread so as to form a mat or a fleece. The mat is compressed between the surfaces to form a panel-like or similar shaped part, whereby the surfaces are heated and heat flows from the surfaces into the mat so as to increase the temperature, harden the bonding agent, and consolidate the mat to form a compact panel or the like. In a multi-stage press the "surfaces" are the pressure panels or plates and in a double-band press they are both the bands. In place of flat surfaces, as in the cases quoted above, presses with a large drum and a steel band that passes around this are used to produce thin panels.

During the production of wood-chip panels and similar materials, the pressure and temperature curves at the initial phase of compression are extremely important for the properties of the finished panel. In conventional continuous presses, this compression takes place in the area of the feed gap of the supporting structure, and it is already known that the feed gap

can be made adjustable and the adjustment can be controlled depending on the type of production (DE-PS 31 33 792, DE-AS 23 43 427) in order that the formation of the panel characteristics can be influenced in an appropriate manner.

The plastification that the wood fibres or chips undergo during the combined effect of pressure, heat, and the moisture which is present in the mat, which is carefully controlled, plays a very important part in the way that the product turns out.

DE-OS 35 38 531, which deals with the so-called calendering press of this kind, with a heated pressure drum that is enclosed about a portion of its periphery by a steel band that passes over guide and pressure rollers, describes how the fleece at the start of the compression gap is compressed to a value that lies in the range above or below the normal thickness of the finished panel and is then heated while contained between heated pressure drums and the steel band during simultaneous forward movement until such time as the particles enter their plastic state and the bonding agent has been brought to the required hardening temperature. These measures are intended to achieve a good panel surface during a single pressing operation and at the same time achieve better thermal transfer in the layer of chips because of the increased density at the start of the compression, as well as a more rapid penetration of the heat into the outer areas of the compressed chip layer. DE-OS 35 38 531 does not provide details about the management of pressure and temperature.

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This also applies to the double-band press disclosed in the DE-PS 21 57 746, which otherwise is based upon the preamble to Patent Claim 1. This double-band press has a flat part of the support construction which delimits the feed gap and which can be adjusted by pivoting about a transverse axis. A particularly rapid and powerful compression of the mat cannot be achieved in this manner. The press does indeed have an adjustable first part of the support plate but, if the steepness of adjustment were selected to achieve a desired rapid compression, the forces developed would be so great that they would endanger the press and the force required for the forward movement could no longer be transmitted by the forming bands, to say nothing of the sharp transition between the steep first part of the pressure plate and the pressure plate in the main compression stretch which would destroy the forming bands.

It is the objective of the present invention to configure the general type of double-band press in such a manner that it is possible to manufacture wood-chip and similar panels of different structures with it while keeping the stresses within acceptable limits.

This objective is achieved by implementation of the invention as described in Patent Claim 1.

Provision can be made by the use of the tray for the mat to come into contact with both forming bands substantially at the same time. First of all, the tray holds the mat up above the forming band disposed beneath it and only deposits it on said lower band at the desired moment. In this way, not only is the desired improvement of the surface promoted, because there is no prolonged preheating of the mat from underneath (as is the case with the example of embodiment in the DE-PS 21 57 746),

but also the production of substantially uniform upper and lower surfaces of the panel is possible.

In the case of the double-band press in accordance with the present invention, no gap between rollers is provided at the feed end, but the feed gap is delimited by the pre-curved support plates, in which case the forming bands fit snugly against the curvature of the support plates and at the feed gap they keep apart from each other at an angle, so that the mat only comes into contact with the forming bands in the feed gap.

The part of the support plate which adjoins the pre-curvature of the feed gap can be pivoted around together with the pre-curved portion in order to form an adjustable feed gap. This is extremely important in actual practice, because it makes possible, with the use of one and the same machine, the manufacture of different panel structures. If, for example, the substantially flat part of the support plate is set parallel, or substantially parallel, to the opposite support plate, then the rapid compression takes place in the region of the pre-curved part and subsequently the calibre is retained, as is desired in the important application for the manufacture of thin MDF (Medium-Density Fibreboard) panels having smooth surface layers and especially high tensile strength. This involves fibreboards from 2.5 to 50 millimetres in thickness, having a specific weight from 600 to 900 kg/m^3, which can be used in the furniture industry without further processing of the surface, for example for the rear walls of cabinets and bottoms of drawers, but also for lacquering and as the basis for laminates.

The features of the present invention interact during the manufacture of MDF-panels in such a manner that the mat which is combined with the bonding agent is compressed very rapidly during exposure to the curing temperature which is conducted from the band surfaces onto the outer layers of the mat, and this happens so rapidly that the inner zones of the mat have not reached elevated temperatures by the time full compression has

been achieved. The outer layers have thus already become plastified and yielding and conform to the surface contours of the press bands with densification and formation of a smooth surface, whereas the inner zones have not yet become plastified and thus they offer greater resistance to compression. Thus, during the compression, the outermost layers are subjected to a peak pressure which is higher than if the mat were at a high temperature right through and were then compressed to the same final thickness. The compression must therefore be achieved before the inner zone of the mat reaches the high temperature. The plastification and hardening taking place initially increase not only the smoothness, but also the hardness and tensile strength of the surface layer. During the continued development of the influence of pressure and heat, the heat penetrates into the inner zone and results in plastification of the wood particles. Because the calibre, i.e., the distance between the pressing surfaces, is substantially maintained, there is no progressive densification inside the mat, but there the mass hardens with an essentially constant lower density. Thus, what results is not a continuous maximally-compacted panel, but one in which at least one side, but normally both sides, has an extremely dense, smooth surface layer with high tensile strength, whereas the interior is of a somewhat looser structure, so that there is a type of sandwich effect which leads to very inflexible panels requiring no further finishing work on the surface, which is most desirable in the furniture industry.

However, if the essentially flat part of the pivotable support plate is pivoted upwards, so that it forms a progressively decreasing feed gap with the opposite support plate in the direction of forward movement, then this will not result in an

abrupt densification with subsequent maintenance of calibre, but a gradual densification during the progressive heating of the inner zones of the mat. In this way it is possible to manufacture a panel of which the properties are substantially constant over its entire thickness. These types of panels, having a thickness of the order of 20 millimetres, are used in the furniture industry for cabinet doors or side walls, and are frequently subjected to subsequent machining operations to produce rabbets or decorative surface reliefs. So that the machined surface will possess properties with the greatest possible uniformity, the machine tool must encounter the same material properties at all working depths. This means that the wood-chip board must have homogeneous properties throughout. These requirements can be met with the use of the double-band press under discussion, without the need for undertaking any adjustments in the region of the feed gap. In this connection, it is also possible to adjust the position of the transverse axis in relation to the opposite support surface, in order to be able to adapt the transition to the actual pressing stretch, should this be necessary.

Forms of embodiment of double-band presses with adjustable feed gaps are known from DE-OS 24 48 794 and from both the DE-AS 10 09 797 and DE-AS 23 43 427 where, in the latter case however, the support plate, in contrast to that of the present invention, should actually be elastically deformable.

Because the heat transfer from the press surfaces to the outermost layers of the mat is a transport problem, it requires a certain amount of time. For this reason, the time period between reaching the curing temperature in the outer layers and reaching the highest degree of compression, which essentially corresponds to the final panel thickness, is of decisive importance for the success of the present invention.

It has been found that this time interval should be from 0.1 up to 2 seconds (Claim 2) in order to achieve the desired

panel structure and, for thin MDF-panels, from 0.15 up to 0.5 seconds. According to the present invention, the compression of the mat should be effected in one pass within this short period of time until the final thickness of the panel is reached.

The length of run corresponding to the specified time and within which the highest degree of compression must be reached, depends upon the rate of forward travel of the forming bands, but it can vary greatly in individual cases, for example 30 m/min for panels 3 mm thick and 10 m/min for panels 16 mm thick.

The details of configuration of the pre-curvature is a compromise between the requirements of the method and the technical capabilities of double-band presses. The method for manufacture of MDF-panels requires a rapid compression of the mat, so that the preferred densification of the surface will be achieved. However, as opposed to this, is the fact that the forming bands, which must perform the forwarding of mat under pressure through the compression stretch, are under considerable longitudinal tensile stress, onto which will be superimposed the bending stresses when the bands are subjected to bending. So that the range of yield stress is not reached, particularly at higher temperatures, there is a lower limit to the permissible bend radii. The rule of thumb is that, for each millimetre of band thickness, the smallest radius must not be less than 400 mm. Because the forming bands used in actual practice have a thickness between 1.5 and 2 mm, the smallest radius is in the range from 600 to 800 mm, which results in a diameter for the conventionally-used guide drums of approximately 1500 mm, which is essentially the same as the smallest radius of the pre-curvature (Claim 3).

However, the feed gap need not have a purely circular longitudinal section, but can follow a regular continuous curve

differing somewhat from a circle. However, the deciding factor is that, at any point, it must not have less than the smallest possible permissible radius and yet, at any given operating speed, the desired rapid compression can be achieved.

The heating of the forming bands before they pass in between the support plates is recommended (Claim 4).

However if the forming bands are heated to a sufficiently high temperature by the guide drums, it may be necessary to use a heat shield, for example in the region of the feed gap where the hot forming band is opposite to the unprotected surface of the mat and, if precautions are not taken, the hardening of the binding agent can be initiated prematurely (Claim 5).

If the panels are to be symmetrical in their construction, the procedure according to Claim 6 can be followed.

So that the positions of the contact points of the mat with the upper and/or lower forming band can be adjusted, adjustability of the leading edge of the tray is recommended according to Claim 7 and this can be implemented structurally in the manner set out in Claims 8 and 9.

An example of embodiment of the invention is represented diagrammatically in the drawings.

Fig. 1 is a vertical longitudinal part section through the feed region of a double-band press according to the invention;

Fig. 2 is an enlarged view of the region enclosed in the dashed rectangle at the centre left in Fig. 1;

Figs. 3 and 4 depict portions of the compression zone on an enlarged scale;

Figs. 5 and 6 depict part vertical sections through the mat or panel web enclosed between the forming bands;

Fig. 7 is a side elevation of the double-band press;

Figs. 7a and 7b are the calibre-setting zones for different adjustments of the double-band press.

The double-band press indicated overall by the number 400 in Fig. 1 includes a lower forming band 1 and an upper forming band 2 made from sheet steel approximately 1.5 mm thick, which circulate endlessly, vertically above one another. The forming bands 1, 2 travel around deflecting guide drums 3, 4 which are associated with corresponding guide drums at the right-hand end of the press (not depicted), the position of which is adjustable in order to apply tension to the forming bands (see Fig. 7). The upper run of the lower forming band 1 and the lower run of the upper forming band 2 are disposed at a small distance apart above one another and provide pressing surfaces between which the mat 10 is compressed in accordance with a specific time program. The forming bands 1, 2 travel horizontally at the same speed over essentially flat compression stretches 38, 5 in the same direction indicated by the arrow 18. Within the compression stretch 38, 5, a mat 10 of wood chips mixed with bonding agent, located between the runs 1' and 2' is subjected to the influence of pressure and heat and hardened to form a cohesive panel web P (Fig. 6). The forming bands 1, 2 are driven by rotation of the deflection guide drums. The guide drums 3, 4 depicted are heated and possess a heat-conducting surface, so that heat is transmitted to the forming bands 1, 2. The heating is regulated in such a manner so that the forming bands 1, 2, as they pass around the guide drums 3, 4, reach a temperature that is sufficient to harden the layers, in contact with the forming bands 1, 2, of the mat 10 enclosed between the forming bands 1, 2.

In the compression stretch 38, 5 there is a lower support plate 6 below the upper run of the forming band 1 and there is an upper support plate 7 located above the lower run of the upper forming band 2. Endless roller chains (not depicted) travel in longitudinal channels of the support plates 6, 7 to

provide rolling support for the runs of the forming bands 1, 2 in the compression stretch 5. The support plates 6, 7 are themselves supported on multiple support structures numbered respectively 8 and 9 which consist of I-beams 11 that extend across the width of the forming bands 1, 2 and are disposed in pairs, one vertically above the other, in the compression stretch 38, 5, to be joined together on either side of the forming bands 1, 2. Pressure is applied by means of hydraulic pressure elements 12 arranged between the support structures 8 and the lower support plate 6. It is with the aid of said elements 12 that the calibre, i.e., the distance between the two facing runs of the forming bands 1, 2 in the compression stretch 38, 5 can be regulated. The compression stretch 5 can be 10 to 20 metres long. As shown in Fig. 1, a large number of successive I-beam pairs 11, 11 extend towards the right. At the left-hand end, as shown in Fig. 1, the support plates 6, 7 form a feed gap 13 which becomes progressively narrower in the direction of travel of the forming bands 1, 2. The guide drums 3, 4 are located as close as possible to the feed gap 13.

The mat 10 is not, as is usually the case, laid down by the spreader system onto the upper run of the lower forming band 1, which would need to be much further to the left. The formation of the mat is effected at another location and the mat is supplied on a tray 30 that extends in the direction of movement 18 right up to the feed gap 13. The mat 10 slides off from the leading edge 31 onto the lower forming band 1 which carries it into the press.

The actual compression stretch 5 in which the forming bands 1, 2 run essentially parallel is preceded by a feed-in stretch 37 which is considerably shorter than the compression stretch 5 and, in the example of embodiment depicted, it is a stretch 38 having flat support plates 6, 7 which extend over the length

occupied by six pairs of I-beams 11, 11, and there is also a preliminary feed-in stretch 50 in which the support plates 6, 7 are curved outwards away from one another so that the pre-curved outermost ends 6, 7, at the left-hand end in Fig. 1, are convexly curved in relation to the mat 10 entering the feed-in gap 13 to enclose an angle of approximately 40 degrees with the plane of the mat 10. In the illustrated example of embodiment, the curved portions 6', 7' are uniformly pre-curved in relation to the mat 10. i.e., they form part surfaces of a cylinder with a radius which corresponds, approximately, to the radius of the guide drums 3, 4. The support plates 6, 6' and 7, 7' are single units or in any case they are joined together to form a rigid unit. The forming bands 1, 2 do not run anywhere near parallel, but on a slope down from above and up from below into the feed-in gap 13 and they are in close contact with the pre-curved ends 6', 7' of the support plates 6, 7, so that, right from the outset, they are in heat-conducting contact with the heated support plates 6, 6' and 7, 7' and they are already at the required temperature when they come into contact with the mat 10 at the positions indicated by 34 and 35 (Fig. 2).

For additional heating of the forming bands 1, 2 before they come into contact with the mat 10, extra heating elements 39 are provided as shown by the dashed lines in Fig. 1. It is also possible to heat the guide drums 3, 4. If the guide drum 4 is responsible for the heating of the forming band 2 and this band is heated strongly, a heat shield 41 can be mounted in front of the band above the feed-in region for the mat 10 so that the upper surface of mat 10 will not be prematurely heated to a temperature at which the hardening will be initiated. At the point 43, the curved V-shaped tapering feed-in zone 50 passes over into the narrow stretch 38 in which the support plates 6, 7 are essentially flat and parallel.

The delivery and pulling-in zone is illustrated on an even larger scale in Fig. 3. The leading edge 31 of the tray 30 is in the form of a blade-like pivoted flap member 33 which is attached to a transverse axis 32 at its rear end away from the sharp edge. In the fully extended position of the leading edge 31 of flap 33 shown with the solid line in Fig. 3, the underside of the mat 10 comes into contact with the heated lower forming band 1 at the point 34, whereas the upper side of the mat 10 comes into contact, approximately at point 35, with the upper forming band 2 which is in contact with the upper support plate 7. The points 34 and 35 are thus the sites at which the outermost layers of the mat 10 are exposed to the curing temperature.

In the example of embodiment illustrated, the points 34, 35 are not directly above one another. By pivoting the flap 33 downwards into the position shown by the dashed line, the mat 10 will drop down sooner so that the contact point 34 shifts to the left and the contact point 35 shifts to the right, thus making it possible to alter the relative position of these contact points. When the panel to be manufactured from the mat 10 is to have the same structure on both sides, provision is made for both points 34, 35 to be in approximately the same vertical plane with respect to the direction of travel of the mat 10.

In Fig. 4, a tray 30' is depicted, the leading edge 31 of which can be moved in either direction indicated by the double-headed arrow. In this example of embodiment, the points 34, 35 of contact of the mat 10 with the heated forming bands 1, 2 are practically vertically in line with one another.

In the manufacture of MDF-panels, it is essential that the maximum compression from points 34, 35 onward to the peak 43 must be achieved in the short period of time between 0.1 and 2 seconds.

In an actual embodiment, the diameter of the drum 4 is approximately 150 centimetres and the distance 36 shown in Fig. 4 from the contact points 34, 35 up to the peak 43 of the roller gap is approximately 25 centimetres. At an operating speed of the double-band press 400 of 15 m/min, the time taken for the mat to travel the distance 36 is 1.0 second.

It is apparent that if the points 34, 35 are not at the same distance away from the peak 43 of the feed-in gap 13, the point which is furthest away (35 in Fig. 3) must satisfy the condition that the run time is from 0.1 to 2 seconds. If the contact time with the heated forming bands 1, 2 is too prolonged, heating will take place right through the thickness of the mat and the effect indicated in Fig. 5 will not be realised.

Fig. 5 characterises the situation in the feed-in gap 13. The mat 10 has first been in contact for the short time of 0.1 up to 2 seconds with the runs 1', 2' of the forming bands 1, 2 and undergoes a severe compression in the feed-in gap 13, during which time the heat transmitted from the runs 1', 2' has only penetrated the outermost layers 10' and the interior zone 10" of the mat 10 is still cold. This zone presents a considerably greater resistance to compression than do the wood chips in the outer layers 10' which are already plastified and have been strongly compacted, which is indicated by the closeness of the horizontal lines representing the chips in the layers 10'. Simultaneously, however, the bonding agent is cured by the elevated temperature in the zones 10' and this is indicated by the denser cross-hatching in Fig. 5.

In this condition, i.e., with compressed and bonded outer layers 10' and an unbonded inner zone 10", the mat 10 travels between the runs 1', 2' into the feed-in gap 13 and into the compression stretch 5 where it is exposed for a longer period of time to the influence of pressure and heat, which leads to

the situation where the heat penetrates into the inner zone 10" and also causes hardening of the bonding agent there, as indicated by the wider-spaced cross-hatching in Fig. 6.

Although preferred, it is not necessary that the improvement of the surface quality on both sides of the panel P should be striven for. If, for example, in the first instance, the upper side of the mat 10 is to be compressed as indicated in Fig. 1, the lower guide drum 3 need not be heated.

As indicated by the dot-dash line in Fig. 1, the lower support plate 6, 6' may be pivoted downwards away from the upper support plate 7, 7' through an angle of a few degrees about a transverse axis 42 located at the right-hand end of the compression stretch 38, i.e., adjacent to the start of the compression stretch 5. This is brought about by the appropriate actuation of the pressure element 12. It is not unconditionally necessary for the transverse axis to be formed by a transverse journal on the support plate 6, 6'. It can be an imaginary axis. The inclined position of the support plate 6, 6' results from adjustment of the pressure element 12. By this means it is also possible to displace the transverse axis 42 somewhat further down from the upper support plate 7, 7' according to Fig. 1, so that the feed-in gap 37 can be adjusted nor only for angle of slope, but also for the inside free dimension. It will be apparent that, instead of the lower support plate 6, 6', the upper support plate 7, 7' could also be pivoted and thus both the support plates 6, 6' and 7, 7' would be able to be pivoted.

The significance of this construction will be explained once more with reference to Figs. 7, 7a and 7b. The overall view in Fig. 7 allows for recognition of the convexly-curved feed-in zone 50, the adjoining flat zone 38 and actual compression zone 5 which is likewise essentially flat.

Figs. 7a and 7b show the course of the support surfaces through the whole length of the double-band press 400.

If MDF-panels, from 2.5 up to 5 mm thick, having a specific weight of 600 up to 900 kg/m^3, of the type used for rear walls of cabinets and for the bottom of drawers, are to be manufactured on the double-band press 400, and if these panels are to have a particularly strengthened and smooth surface layer, then the support plate 6, 6', as shown in Fig. 7a, is adjusted in such a manner so that it is parallel to the support plate 7, 7' in the stretch 38. The rapid compression is completed at point 43, approximately where the end of the feed-in zone passes over into the stretch 38. From there on, the calibre is essentially maintained, i.e., the supporting surfaces S_1, S_2 are parallel to one another and their distance apart corresponds to the final thickness of the panel. In the example of embodiment shown in Fig. 7a, the panel to be manufactured is 2.5 mm thick. The calibre "2.5" is maintained from point 43 onwards up to the end of the compression stretch 5, as indicated by the dimensions in Fig. 7a.

However, if, as shown in Fig. 7b, a panel 20 mm thick is to be manufactured, within which the most homogeneous structure possible is present through the whole thickness, then the lower support plate 6 is tilted down somewhat and moved away from the upper support plate 7, 7' to form a passage in which the distance between the support plates 6, 7 at the beginning is 90 mm and at the end of the support plate 7 the distance apart of the support plates 6, 7 is 25 mm. Appropriate actuation of the pressure elements in the first half of the compression stretch 5 will result in a wedge-shaped passage up to the point 44, with the initial distance apart corresponding to that of the

passage at the end of the support plate 7. From the point 44 onwards, up to the right-hand end of the compression stretch 5, the distance apart of the support surfaces S_1, S_2 remains constant at 20 millimetres.

With the machine adjusted in this manner, the compression is not completed right at the start, as is the case at point 43 with the adjustment as shown in Fig. 7a, but progresses more slowly right up to the point 44 within the compression stretch 5. The effect of this is that the wood particles are heated right into the interior of the mat and this results in more uniform compression and hardening through the entire thickness of the panel, without any peaks in density and tensile strength at the surface.

Patent Claims

1. Double-band press for the continuous manufacture of wood-chip panels and the like, from panel material consisting of wood particles held together by a bonding agent that hardens under the influence of heat and pressure,

having two metal bands, supported on a support structure, that circulate endlessly, above one another at the same speed, around deflection guide drums and through a flat compression stretch, between which a mat consisting of wood particles enters a heated feed-in gap in the support structure which becomes progressively narrower, in the direction perpendicular to the mat, in the direction of forward travel, and between which the mat can be compressed in the substantially flat stretch, under the influence of heat and pressure,

with a feed-in system by means of which the mat is first formed and then fed into the feed-in gap between the forming bands,

characterised in that the supply device comprises a tray (30) located close above the upper run (1') of the lower forming band (1) and reaching up close to the upper guide drum (4), over which the mat (10) is introduced into the feed-in gap between the forming bands 1, 2,

and in that at least one of the support plates (6, 7) of the support structure (8, 9) defining the feed-in gap (13), supports the forming band positioned there with transmission of pressure and heat, and it is pre-curved convexly in the vertical longitudinal plane of the double-band press (400) in relation to the mat (10),

and in that the forming band closely adapts to the pre-curvature, in which case the pre-curvature and the heat-transfer are designed in such a way that the distance (36) from the points (34, 35) of first contact of the forming bands (1, 2) with the mat (10) up to the transition point (43) to the adjoining flat portion of the support plates (6, 7) is traversed in a period of time during which the heat transmitted through the forming bands (1, 2) has not yet penetrated into the inner zone (10") of the mat (10),

and in that the pre-curved feed-in zone (50) of the support plates, in the direction of travel of the mat (10), is adjoined by an essentially flat stretch of the support plates to form an integral rigid unit which is located upstream of the compression stretch (5), and which can be pivoted about a transverse axis (42) situated at the far end of the support plate when seen in the direction of travel of the mat (10),

and in that the vertical distance of the transverse axis (42) below the opposite support plate (7) is adjustable.

2. The double-band press according to Claim 1, characterised in that the time period is between 0.1 and 2 seconds.

3. The double-band press according to Claim 1 or 2, characterised in that the smallest radius of curvature of the pre-curved zone is essentially equal to the radius of the associated deflection guide drum (3, 4).

4. The double-band press according to any one of Claims 1 to 3, characterised in that at least one forming band (1, 2) has an associated heating element (39) by means of which the forming band (1, 2) can be heated immediately before it enters the feed-in zone (50).

5. The double-band press according to any one of Claims 1 to 4, characterised in that a heat shield (41) is associated with one forming band (2) immediately opposite to the mat (10), this heat shield preventing the heat radiated from the forming band (2) from reaching the mat (10) before it comes into contact with said forming band (2).

6. The double-band press according to any one of Claims 1 to 5, characterised in that the mat (10) is transported by the tray (3) that it comes into contact simultaneously with both forming bands (1, 2).

7. The double-band press according to any one of Claims 1 to 6, characterised in that the position of the leading edge (31) of the tray (30, 30') close to the upper deflection guide drum (4) is adjustable.

8. The double-band press according to Claim 7, characterised in that the leading edge (31) may be pivoted up or down about a transverse axis (32).

9. The double-band press according to Claim 7, characterised in that the leading edge (31) may be moved backwards or forwards parallel to the direction of travel of the forming bands (1, 2).

FIG. 1

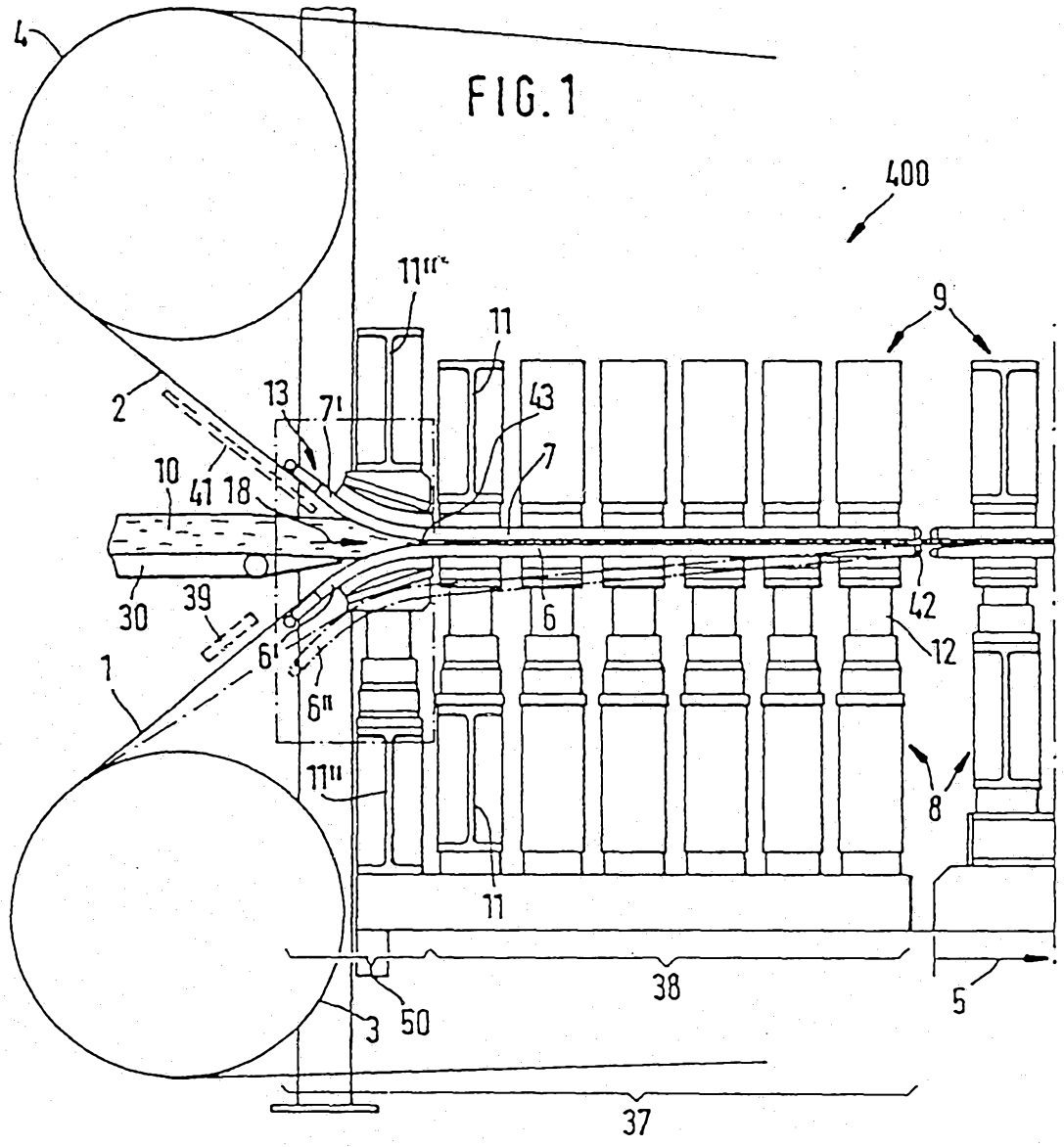
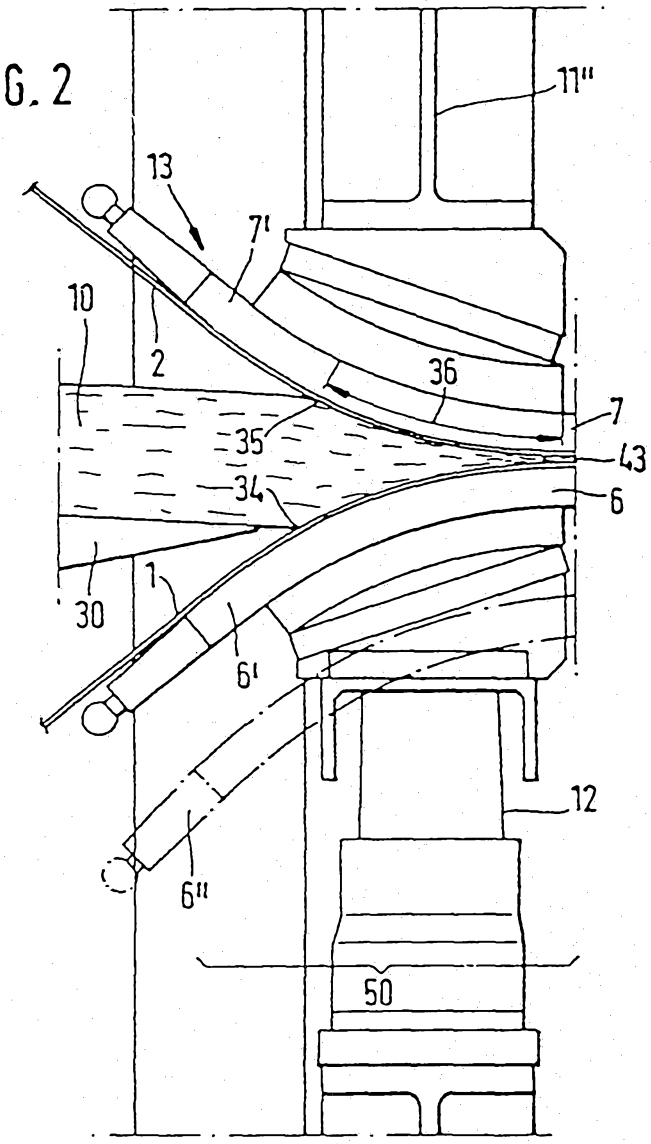

4
400
11'''
11
9
2
13
7'
43
10
41
18
7
30
39
6
42
12
1
6'
6''
11'''
8
11
38
5
3
50
37

FIG. 2


11''
13
7'
10
2
36
7
35
43
34
6
30
1
6'
12
6''
50

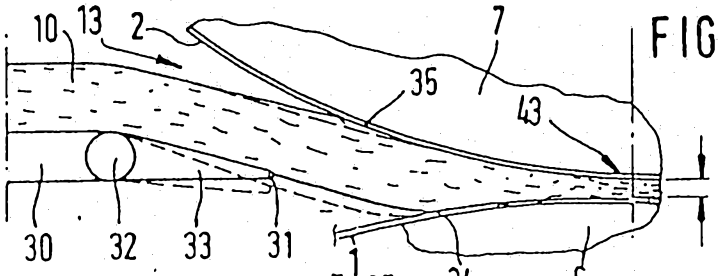


FIG. 3

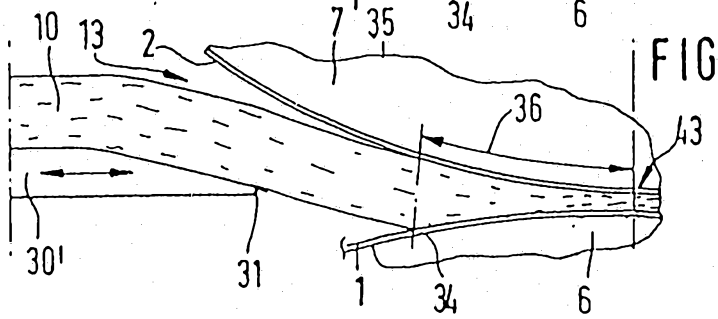


FIG. 4

FIG. 5

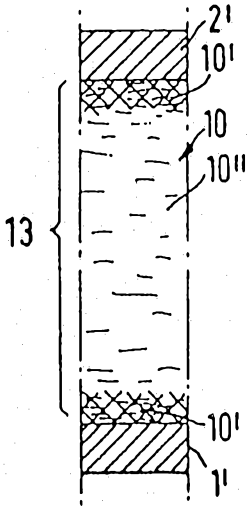
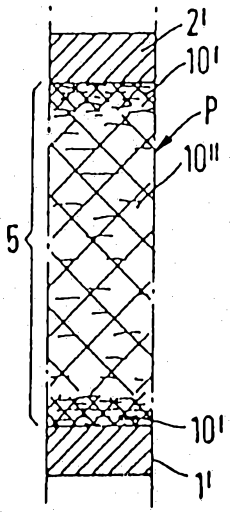


FIG. 6



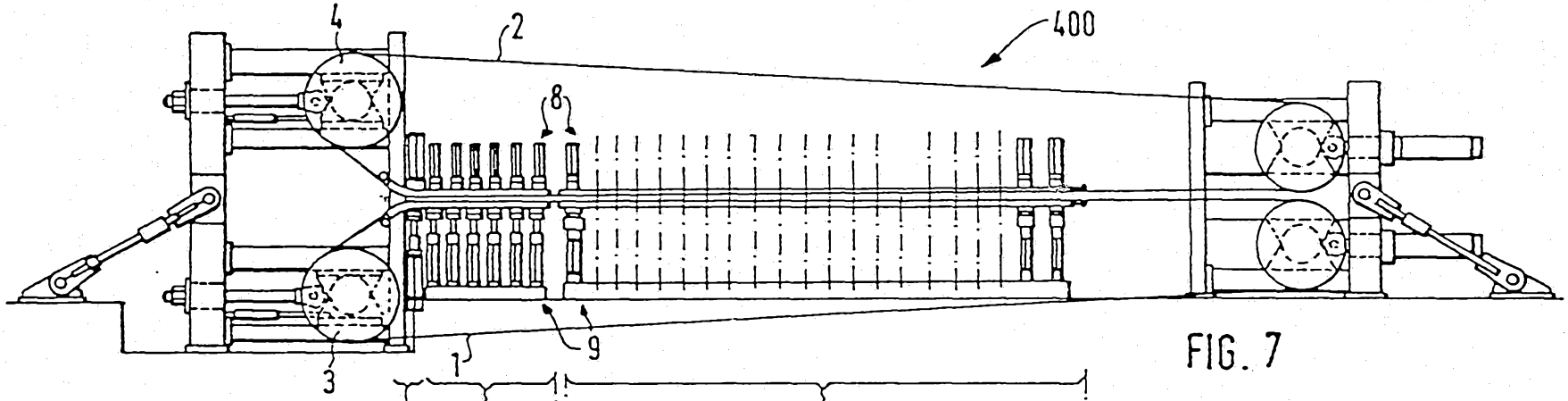


FIG. 7

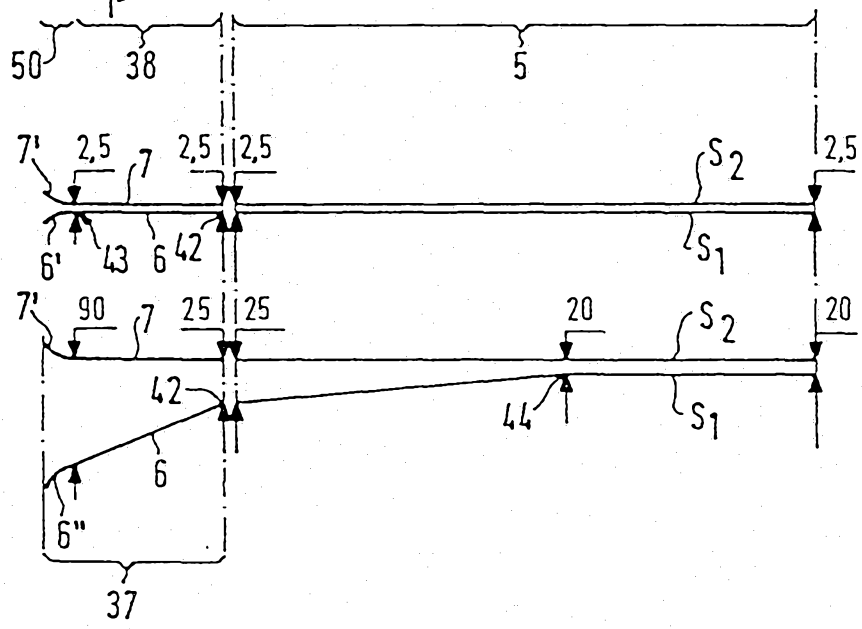


FIG. 7a

FIG. 7b

INTERNATIONAL SEARCH REPORT

International Application No PCT/DE 88/00602

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[4]: B 27 N 3/24; B 27 N 3/08

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
Int. Cl.[4]:	B 27 N; B 30 B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	FR, A, 2139811 (MENDE) 12 January 1973 see page 2, lines 15-40	1,6,19
A	FR, A, 2217151 (MOTALA) 6 September 1974 see page 2, lines 9-20	6,9,11,13 19,21
A	FR, A, 2142546 (DE METS) 26 January 1973 see page 6, line 29 - page 7, line 2	12, 24
A	DE, B, 1084014 (HERCULOK CORP.) 23 June 1960 see figures cited in the application	6,19

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
16 November 1988 (16.11.88)	6 December 1988 (06.12.88)
International Searching Authority	**Signature of Authorized Officer**
European Patent Office	

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. DE 8800602 SA 24376

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 29/11/88
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR-A- 2139811	12-01-73	NL-A- 7207019	01-12-72
		DE-A,C 2126935	30-11-72
		CH-A- 535649	15-04-73
		US-A- 3832115	27-08-74
		GB-A- 1390454	16-04-75
		CA-A- 985999	23-03-76
		BE-A- 783848	18-09-72
		SE-B- 392066	14-03-77
FR-A- 2217151	06-09-74	DE-A- 2404052	15-08-74
		JP-A- 49111284	23-10-74
		SE-B- 379681	20-10-75
FR-A- 2142546	26-01-73	DE-A,B 2135230	01-02-73
		US-A- 3795470	05-03-74
		CH-A- 552462	15-08-74
		AT-B- 321556	10-04-75
		GB-A- 1393164	07-05-75
		CA-A- 972275	05-08-75
		BE-A- 777308	17-04-72
		SE-B- 376569	02-06-75
DE-B- 1084014			

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen PCT/DE 88/00602

I. KLASSIFIKATION DES ANMELDUNGSGEGENSTANDS (bei mehreren Klassifikationssymbolen sind alle anzugeben)[6]

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

Int. Cl.4 B 27 N 3/24; B 27 N 3/08

II. RECHERCHIERTE SACHGEBIETE

Recherchierter Mindestprüfstoff[7]

Klassifikationssystem	Klassifikationssymbole
Int. Cl.4	B 27 N; B 30 B

Recherchierte nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Sachgebiete fallen[8]

III. EINSCHLÄGIGE VERÖFFENTLICHUNGEN[9]

Art*	Kennzeichnung der Veröffentlichung[11], soweit erforderlich unter Angabe der maßgeblichen Teile[12]	Betr. Anspruch Nr.[13]
A	FR, A, 2139811 (MENDE) 12. Januar 1973 siehe Seite 2, Zeilen 15-40 --	1,6,19
A	FR, A, 2217151 (MOTALA) 6. September 1974 siehe Seite 2, Zeilen 9-20 --	6,9,11,13 19,21
A	FR, A, 2142546 (DE METS) 26. Januar 1973 siehe Seite 6, Zeile 29 - Seite 7, Zeile 2 --	12,24
A	DE, B, 1084014 (HERCULOK CORP.) 23. Juni 1960 siehe Figuren in der Anmeldung erwähnt --------	6,19

* Besondere Kategorien von angegebenen Veröffentlichungen[10]:

"A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist

"E" älteres Dokument, das jedoch erst am oder nach dem internationalen Anmeldedatum veröffentlicht worden ist

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"O" Veröffentlichung, die sich auf eine mündliche Offenbarung, eine Benutzung, eine Ausstellung oder andere Maßnahmen bezieht

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"X" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als neu oder auf erfinderischer Tätigkeit beruhend betrachtet werden

"Y" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als auf erfinderischer Tätigkeit beruhend betrachtet werden, wenn die Veröffentlichung mit einer oder mehreren anderen Veröffentlichungen dieser Kategorie in Verbindung gebracht wird und diese Verbindung für einen Fachmann naheliegend ist

"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist

IV. BESCHEINIGUNG

Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
16. November 1988	16 DEC 1988
Internationale Recherchenbehörde	Unterschrift des bevollmächtigten Bediensteten
Europäisches Patentamt	B.C.G. VAN DER PUTTEN

ANHANG ZUM INTERNATIONALEN RECHERCHENBERICHT ÜBER DIE INTERNATIONALE PATENTANMELDUNG NR.

DE 8800602
SA 24376

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben.
Die Angaben über die Familienmitglieder entsprechen dem Stand der Datei des Europäischen Patentamts am 29/11/88
Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie		Datum der Veröffentlichung
FR-A- 2139811	12-01-73	NL-A-	7207019	01-12-72
		DE-A,C	2126935	30-11-72
		CH-A-	535649	15-04-73
		US-A-	3832115	27-08-74
		GB-A-	1390454	16-04-75
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		SE-B-	379681	20-10-75
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		CH-A-	552462	15-08-74
		AT-B-	321556	10-04-75
		GB-A-	1393164	07-05-75
		CA-A-	972275	05-08-75
		BE-A-	777308	17-04-72
		SE-B-	376569	02-06-75
DE-B- 1084014		Keine		

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