(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 296 073 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.03.2018 Bulletin 2018/12

(21) Application number: **17185894.7**

(22) Date of filing: **11.08.2017**

(51) Int Cl.:
B27N 3/00 *(2006.01)* *B27N 3/02* *(2006.01)*
B27N 3/04 *(2006.01)* *B27N 3/18* *(2006.01)*
B27N 3/28 *(2006.01)* *B65D 19/00* *(2006.01)*
E04C 2/16 *(2006.01)* *B27M 3/00* *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **12.08.2016 PL 41831416**

(71) Applicant: **"3S Logistyka" Sp. z o.o. Spolka Komandytowa**
15-085 Bialystok (PL)

(72) Inventors:
- **BIERYLO, Dariusz Cezary**
  15-378 Bialystok (PL)
- **CZARNIECKI, Marek**
  15-169 Bialystok (PL)
- **BARTLOMIEJCZUK, Tomasz**
  15-694 Bialystok (PL)
- **WIERZBICKI, Radoslaw**
  15-161 Bialystok (PL)
- **SAJEWICZ, Slawomir**
  15-345 Bialystok (PL)

(74) Representative: **Patpol Kancelaria Patentowa Sp. z o.o.**
Nowoursynowska 162J
02-776 Warszawa (PL)

(54) PELLET BLOCK AND A PROCESS FOR THE MANUFACTURE THEREOF

(57) A pallet block comprising a particulate material glued with a binding material, said binding material being in the form of the urea-formaldehyde resin and melamine-formaldehyde resin mixture (MUF) and **wherein** the particulate material comprises the chipboard waste waste in amounts of from 70 do 90% by weight and the MDF and/or HDF waste in amounts of from 10 do 30% by weight, and a process for the manufacture of a pallet block which comprises the steps of (a) preparing chips from the source material, (b) charging the chips prepared in the step (a) and secondary comminution thereof, (c) drying the chips of the step (b), (d) sieving the chips prepared in the step (c), (e) buffering the chips of the step (d) and metering thereof, (f) gluing chips with the urea-formaldehyde resin and melamine-formaldehyde resin mixture (MUF), (g) compression molding of the glued chips into the form of strips, the strips being cut lengthwise to the shapes of the blocks, (e) conditioning and storage of the blocks prepared in the step (g), **characterized in that** for the manufacture of the chips in the step (a) the material of the chipboard waste and/or HDF and/or MDF board waste is used as a feed material, the chipboard content being from 70 to 90%, and the content of the MDF and/or HDF board waste being from 10 to 30%.

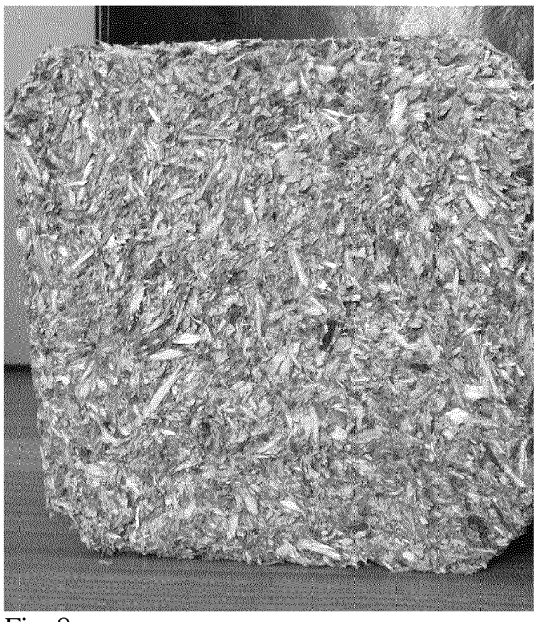

Fig. 9

EP 3 296 073 A1

Description

[0001] The present invention relates to the field of processing the wooden materials. Specifically, the invention relates to a process for the manufacture of a pallet block and a block obtained therefrom.

[0002] Pallet blocks are used as spacing elements in pallets for transportation of goods. Pallet blocks for the EPAL pallet (the so called EURO-pallet) must fulfil requirements of the EU standard No. EN 13698-1, which describes production requirements concerning flat wooden pallets with dimensions of 800 mm x 1200 mm, 1200 mm x 1000 mm, 1000 mm x 1200 mm, 800 mm x 600 mm. The standard states detailed technical parameters to be met by a pallet block to be employed in the EURO-pallet. The EPAL - European Pallet Association is an organization which ascertains compliance of pallets and pallet blocks with the above-indicated standard.

[0003] Prior art conventional pallet chip blocks, as well as chipboards, are manufactured by employing less valuable wood assortments, and the manufacture thereof is aimed at utilizing by-products from the manufacture of planks. In this way, products are made from wood waste materials. Traditionally, logs of smaller diameters originating from thinning operations, various wood sorts, industrial wood and the like are employed for the production.

[0004] Consequently, pallet chip blocks are manufactured mainly from materials originating from processing of wood in sawmills. Some manufacturers of the pallet chip blocks have their plants located in the vicinity of sawmills.

[0005] Apart from the wood from forest sources and products obtained from its processing, the still better and more efficient wood processing technology allows to extend use of recyclable waste wood for the manufacture of wood-based articles.

[0006] The recyclable waste wood comprises a material put to use as a recyclable material. One can distinguish the following:

Class 1 recyclable waste wood: the recyclable waste wood left in a natural state or machined, practically non-contaminated, eg. derived from furniture of a solid wood without a veneer, wooden pallets, non-processed wood structures

Class 2 recyclable waste wood: a glued, coated, varnished recyclable waste wood free from chlorine-derived compounds in the coats and free from wood protection agents, for example derived from plywood, PVC-free furniture, internal doors, floor planks, chipboard, MDF and HDF board waste.

[0007] All other recyclable waste wood sorts, such as furniture with PVC edges or coats, railway ties, overhead line poles, rafters, windows, external doors, fences, wooden garden furniture are solely utilized thermally in suitable incineration plants.

[0008] Use of the waste wood for the manufacture of pallets and blocks is known, among others, from patent descriptions of US4337710, EP1297933, US4559195, US6095061. For example, WO2003013812 discloses a device and process for the manufacture of small blocks from wooden chips by compounding said wooden chips with an agglomerating material.

[0009] From the prior art, composite blocks are also known. For instance, the document US20070017422 discloses pallets comprising block elements containing at least 20% by weight of particles of a natural material and at least 20% by weight of particles of a plastic material. The natural material comprises comminuted fragments of coniferous trees and juniper, derived from roots, trunks, branches, needles, wood slivers and mixtures thereof. Meanwhile, particles of a plastic material comprise the material selected from polypropylene, polyethylene, polyurethane, PVC, poly(ethylene terephthalate), nylon and mixtures thereof.

[0010] Pallet blocks of glued layers are also known. For instance, US20060005746 discloses pallet blocks of plywood (a laminate containing wooden components).

[0011] Various gluing means or aggregating substances are used for the manufacture of pallet blocks. Exemplary gluing means, also defined as adhesives, tackifiers or binding means, known from the prior art are listed below:

[0012] An urea-formaldehyde resin (UFR). Urea and formaldehyde are dissolved in water and bind within a specific temperature, time period and a specific pH value. The glue sets on heating after a curing agent is added. The glue is used mainly for the manufacture of wood-based boards for indoor applications, furniture, panels. The joint lacks resistance to moisture, and weather conditions.

[0013] A melamine-formaldehyde resin (MF). In this kind of glue melamine is employed instead of urea. Melamine resins are more stable and temperature-resistant than urea resins. Due to their use, joints resistant to high temperatures can be obtained. The melamine-formaldehyde combination is incomparably more durable than the urea-formaldehyde combination.

[0014] A mixture of the urea-formaldehyde resin and the melamine-formaldehyde resin (MUF). This kind of glue is also used for enhancing the weather resistance.

[0015] A phenol-formaldehyde resin, (PF). Phenol is the main component of the glue. Bonding takes place at very high temperatures. Gluing and setting is also performed by heat delivery and adding a curing agent. Phenolic resins are

used for gluing V 100 and V 100 G boards. They enjoy authorization according to a DIN standard. Only slight amounts of formaldehyde are evolved from these boards due to strong chemical bonds.

[0016] Isocyanate glues. These glues are unary adhesives used without addition of water or other solvents, with no formaldehyde added. In the case of diisocyanate-based glues chemical bonds with water contained in wood and cellulose, and lignin, take place. Such glues are largely used for the manufacture of chipboards free of the formaldehyde content.

[0017] For the manufacture of the blocks for pallets, MUF is mostly used. Use of MUF is essential, as the glues used have to satisfy requirements of the DIN EN 13698-1 standard due to requirements of the EPAL. The amount of liberated formaldehyde is defined there at the level of <0,1 ml per m^3 of air in accordance with the test method ENV 717-1, corresponding to the E 1 class.

[0018] For the manufacture of the blocks known from the prior art, materials in a form of wood waste, such as softwood and suitably prepared wood chips and MUF glues are used in the first place.

[0019] From the description of the utility model No. DE202011004658 a structural element, in particular a pallet block which comprises a particulate material bound with the UF, MUF or PUF adhesive or a mixture thereof, and particulate material being wood bark particles, is known. Likewise the above-discussed prior art blocks and pallets, such an element has the drawback of being made from a raw or machined wood, constituting a notable burden for the environment.

[0020] All prior art solutions suffer from the unsolved problem of utilizing a chipboard waste coated, for example, with a finishing coat, which originate from the furniture-making industry and are often mixed with a HDF or MDF board waste.

[0021] MDF (*Medium Density Fibreboard*) is a wood fiber board of the mean density of about 800 kg/m^3. HDF (*High Density Fibreboard*) is a wood fiber board of the high density of about 1000 kg/m^3. To manufacture HDF or MDF-formed articles, wood fibers are glued to one another with a bonding agent, such as the melamine resin. Such bonding is obtained, for example, by the use of the uncured melamine resin, which is set between the wood fibers. Such molded articles would contain, for example, 85% of the wood fibers, 13% of the cured melamine resin and 2% of additives which have an effect on joining or bonding the melamine resin and the wood fibers.

[0022] The MDF or HDF-made molded articles are often machined, for example such as by sanding, grinding, milling, boring or sawing. When machining such molded articles, fine particles are generated which contain the wood fibers with the cured bonding agent, and the wood fibers with the cured melamine resin, so-called HDF or MDF dust, or so-called fine HDF or MDF grains, which constitute the waste to be utilized.

[0023] Another non-utilized product is also a chipboard (PW), which is one of the products widely used in the furniture-making and building industry, and which is made from wooden material in the form of wooden chips, sawmill slivers, or even sawdust, being formed into the highly packed articles by use of a synthetic resin or a suitable adhesive, such as resins discussed hereinabove. As this product is in wide use, there is a number of scrap products from a chipboard or containing a chipboard. Recycling of the PW-derived material is a very complex task and as a rule requires chemical and thermal treatment of a material containing wood particulates/wood fibers bound with a resin (see, for example, US 2003/0056873 and references quoted therein). Such boards are often melamine-coated.

[0024] The waste management of chipboards or HDF/MDF, which cannot be incinerated in standard biomass boilers, is a serious problem. Improper utilization of chipboards waste or MDF/HDF waste (eg. by incineration of the waste in combustion plants not fit for the purpose) often leads to environmental pollution.

[0025] As yet, the waste material from PW and/or MDF/HDF was never disclosed as a material likely to be used for the manufacture of pallet blocks.

[0026] The present inventors found unexpectedly that the manufacture of the pallet blocks can be much cheaper and absorb less energy, when the waste in the form of the chipboard, MDF and HDF waste and the dust originating from the chipboard waste is used for the manufacture of the pallet blocks.

[0027] The object of the present invention is therefore to provide a process of utilization of the material derived from the chipboard and/or MDF/HDF waste for the manufacture the pallet blocks for the pallets, the EURO-pallet in particular, and obtaining the block meeting the requirements of the EPAL manufactured by said process.

[0028] The invention provides the pallet block with a density in the range of 600-750 kg/m^3 comprising the material in the form of particles glued with the binding material in the form of a urea-formaldehyde resin and melamine-formaldehyde resin mixture (MUF) characterized in that the content of the MDF and/or HDF waste in the particulate material is from 10 to 30% by weight, and the content of the chipboard waste is from 70 to 90% by weight.

[0029] Preferably, in the pallet block according to the invention the content of the chipboard waste in the particulate material is 75-80%.

[0030] More preferably the content of the chipboard waste in the particulate material is 78%.

[0031] In the preferred embodiment, the content of the MDF and/or HDF board waste in the particulate material is 20-25%.

[0032] More preferably, the content of the MDF and/or HDF board waste in the particulate material is 22%.

[0033] The invention provides also a process for the manufacture of the pallet block as defined above which comprises the steps of: manufacturing of the chips, charging the chips, secondary comminuting, drying, sieving, buffering, metering, gluing, compression molding, lengthwise cutting, conditioning and storage. The process is characterized in that at the

stage of manufacturing the chips the particulate material is a material from the chipboard waste and/or HDF and/or MDF board waste, wherein the content of the MDF and/or HDF board waste is from 10 to 30%, and the content of the chipboard is from 70 to 90%.

[0034] Preferably, in the process according to the invention at the stage of manufacturing the chips, chipboard content in the particulate material is 75-80%, and more preferably from 78%.

[0035] Preferably, in the process according to the invention at the stage of manufacturing the chips, content of the MDF and/or HDF board waste in the particulate material is 20-30%, and more preferably 12%.

[0036] Preferably, the drying step is performed in a belt drier.

[0037] In conclusion, the invention provides a pallet block used for the manufacture of transport pallets, including the EPAL system pallets, manufactured from the chipboard and MDF/HDF waste material.

[0038] The invention provides also a technology and manufacture recipe for a pallet block, including the EPAL system pallets, by employing the recycled raw material and the MDF/HDF waste at 30%.

Product

[0039] The blocks according to the invention have, among other things, a sufficiently smooth surface, practically stable strength, practically stable hardness, sufficient elasticity, sufficient durability, limited water permeability, limited and relatively slow water absorption and sufficient fastness to water. The blocks are suitable, among other things, for use in the EURO-pallets, as they meet requirements of the EN-13698-1 standard within the scope of: the boiling, density, swelling, nail withdrawal tests, the formaldehyde test, reproducibility.

[0040] The advantageous feature of the blocks according to the invention is also employing the waste material which was till now deemed incompatible with the manufacture of molded articles. The term waste material means, in particular, the material obtained from recovered (recycled) chipboards, e.g. from old furniture. Moreover, the manufacture of the blocks is cheaper than for the standard blocks.

[0041] The manufacture of the blocks is based on an innovative technology. Individual components correspond to the up-to-date chipboard production technology. The manufacturing process diagram is shown on Fig. 1 and described below.

[0042] A processing line for the manufacture of blocks according to the invention employs standard equipment for the manufacture of chipboards:

- ring crushers are used for the raw material comminution
- beater mills or impact mills with cross-shaped beater are used for the secondary comminution;
- a separator and sifter are used for foreign material removal;
- belt or drum driers are used for drying
- sifting machines equipped with flat or vibratory sieves and classification in the ascending air stream are used for sieving;
- a high-speed ring layer mixer is used for gluing;
- extruders, continuous duty presses are used for extruding.

[0043] However, these are not all the pieces of equipment: For example, while veener slicers are used for the manufacture of the high-quality chips from logs and a drum chopper for the manufacture of slivers, such equipment finds no use herein.

Description of the production process

[0044] First, the waste material is collected. The incoming residual materials, composed of coarser MDF/HDF elements and chipboard cuttings, are stored in the shop separately divided into types of materials, wherein the finer material is transferred from the truck directly onto the stacking yard close by a material feeder. However, the coarser waste fractions are delivered to crushers and comminuted therein into small flakes. Possible metallic residues are removed with a magnet arranged above a belt.

[0045] The obtained chips are stored separately according to the type of the material. A wheeled loader delivers them to the material feeder, where they are mixed.

[0046] In this way, the required recipe is completed, i.e. the required ratios of the mixture of the chipboard waste - and

MDF/HDF waste are prepared. This is the so-called "manufacturing of the chips" step.

[0047] The flakes from the material feeder are fed onto a sieve. Possible coarser fractions are separated at this site. The useful material is sent to a metering container. From there it is metered to a beater mill, where the material particles are comminuted to the required final size. Before that, in a cleaning unit, the flakes are purified from other foreign materials.

[0048] Then the comminuted material is transported with the aid of a conveyor to a subsequent metering container. The container serves the function of uniform loading to a belt drier. With the defined parameters of the temperature and drier passage time the material is dried to reach the desired wood humidity. The outlet humidity is measured in a constant manner. If necessary, automatic correction of the equipment parameters is made based on the measurement data.

[0049] In the further course of the process, the material which is too fine or too coarse is separated by means of a vibratory sieve. The fine fractions are passed to the energy-producing unit, and the coarse fractions are passed to the material storage at the beginning of the processing line. The suitable fractions of the material are passed to a silo.

[0050] From the silo, conveyers transfer it to a metering silo. Its function is the delivery of precisely metered amounts to a gluing machine. In accordance to the amount of the material, additives are added such as a glue, curing agent and emulsion (paraffin) according to the scheduled recipe, and intensive mixing takes place. Preparation and metering of the individual components is carried out in a mixing-metering device.

[0051] The chip mixture prepared in this way is transferred by a chain conveyor to 3 extruders. Metering containers arranged upstream will smooth small deviations. In the extruders, the material is set with the aid of the pressure and temperature. Steam is delivered to accelerate the process. Parameters of the compression molding are set according to the given recipe.

[0052] Molds are mounted in the extruder for every scheduled size. Strips are produced of the sizes of 145 x145mm and 100 x 145mm. Other sizes are possible.

[0053] After leaving the press, the strips are cut with automatic saws to the required height of 78 mm and passed to the quality control. The weight and dimensions are controlled. Blocks that do not meet the requirement are automatically removed and reprocessed.

[0054] A processing line can be equipped with aspirating devices for collecting chips and dust across the entire process and delivering them to a dust storage silo. The silo can deliver the dust to be a fuel for providing supply to the processing line, i.e. a part of the energy will be recovered.

[0055] Furthermore, additional fuel can be delivered to the dust storage silo by a material feeder.

[0056] It should be emphasized that in the foregoing description the process of preparing and mixing of the chips, the so-called "manufacturing of the chips" step is a novel feature.

[0057] The solution is based on the fact that for the manufacture of the pallet blocks, a mixture of the chipboard waste, i.e. the recycled chipboard, with the initial structure of pieces (chips), is combined with the waste (fibers) from the manufacture of the MDF / HDF boards. Fig. 4 and 5 show the structure of the chipboard waste and MDF/HDF board waste prior to the processing.

[0058] Both of the stocks have different properties, with MDF fibers having greater propensity for swelling. It is an important feature, as swelling of the chip pallet blocks is one of the essential quality requirements. It is determined by both the structure of the particles used and the gluing and proportion of a hydrophobizing agent.

[0059] Therefore, the choice and proportions of the mixture are novel features of the present process, being of great importance for the manufacture of the chip pallet blocks which will meet the mandatory requirements.

[0060] Energy savings are additional effects attained during the manufacture of the blocks by the process according to the invention. As a rule, timber conventionally employed for the manufacture of the blocks exhibits higher humidity than required for further use and compression molding. The fresh wood chips have the humidity which can exceed 50% of the dry timber mass, while the recyclable waste wood sawdust has the humidity of about 12-30%.

[0061] Test were conducted within the present invention to determine the optimal composition of the chipboard and MDF/HDF waste mixture, wherein MDF/HDF was added to the chipboard chip fraction at various quantitative proportions. The results are disclosed in the working example section.

[0062] Use of the chipboard waste mixture with the HDF/MDF waste for the manufacture of the pallet blocks is non-obvious, since it was considered to date that due to presence of an already hardened bonding agent, such as the set melamine resin, such particles are unsuitable for re-gluing to a molded article, as indicated hereinabove.

[0063] Within the present invention it is also possible to feed with a raw material input. The existing material streams will be used for economical manufacture of the pallet blocks. The raw materials provided for combustion are reused in the process in the form of the material. Such a cascading mode of use allows to obtain ecological and economical benefits, combined with reduction of the environmental burden, reduction in greenhouse gas emissions, decreased costs and a higher value added.

[0064] The present invention is explained in detail by the working examples disclosed on the drawings, wherein:

Fig. 1 shows a block diagram of the process for the manufacture of chip pallet blocks according to the first working example.

Fig. 2 is a photograph of the raw chipboard waste component before the treatment according to the first working example.
Fig. 3 is a photograph of the raw MDF board waste component according to the first working example.
Fig. 4 shows the structure of the raw component according to the first working example after the treatment - after comminuting the chipboard waste.
Fig. 5 shows the structure of the raw component according to the first working example after the treatment - after comminuting the MDF board waste.
Fig. 6 is a photograph of the binary raw material according to the first working example after the treatment - of the chipboard waste and MDF board waste - after the steps of: production, charging and comminuting.
Fig. 7 is a photograph of the element according to the first working example.
Fig. 8 is a photograph of the element according to the first working example.
Fig. 9 is a photograph of the product according to the first working example.

[0065] The Example below illustrates the manufacture of a pallet block from the chipboard scraps processed into chips with the admixture of the comminuted MDF/HDF production waste within the defined weight ratio.

EXAMPLE

Manufacturing of the pallet blocks from the chipboard waste processed into chips and admixed with the comminuted MDF/HDF production waste within the defined weight ratio.

[0066] In the following example, prospects for the manufacture of blocks was examined and a quality of the pallet blocks made from the materials containing the recycled comminuted chipboards was measured. The tests were performed in a German laboratory, which comply with the standards:

- EN 325, regarding the dimensions
- EN 323 regarding the density
- EN 319 regarding the tensile strength
- EN311 regarding the surface soundness
- EN320 regarding the resistance to withdrawal of screws
- EN310 regarding the bending strength and modulus of elasticity in bending.

Raw material

[0067] As a raw material, reclaimed chipboard waste with a finishing coat (Fig. 1) and MDF/HDF board waste were used (Fig. 2) .

[0068] The chipboards had the following parameters:

Thickness:	6 mm do 36 mm
Density of the material:	650 to 680 Kg/m^3
Packing:	400 Kg/m^3
Moisture content:	11,2%

[0069] The MDF/HDF boards, consisting in about 22% of raw boards, 45% of laminated boards, and 33% of lacquered boards, had the following parameters:

Thickness in the range:	1,5 mm to 36 mm
Density of the material:	from 750 to 850 Kg/m^3
Packing:	500 Kg/m^3
Moisture content:	15%

Raw material preparation

[0070] Preparation, i.e.: mixing (the so-called "manufacturing of the chips" step), comminuting and drying of the above-indicated raw material was performed at the test stand as above. The tested materials, according to the scheduled process, were mixed before the preparation step, to result in the following mixtures:

Sample 1	10 % MDF/HDF	90 % PW
Sample 2	20 % MDF/HDF	80 % PW
Sample 3	30 % MDF/HDF	70 % PW

[0071] As a result of the raw material preparation, three comminuted and mixed units of the raw material were obtained in the first step, which were submitted to further tests. The comminuted and mixed raw material units are shown in Fig. 4.

Drying

[0072] The chip-shaped material was dried until the mean humidity at the level of 7% of the material (timber plus other materials) was obtained. Further processing of the chips was performed on the test stand in the German laboratory.

Press molding to the pallet block shape

[0073] The chips were blended, fed into extruders and the product was cut to the suitable lengths. The test equipment including a gluing device and a saw for cutting the final product to the predetermined length was used to this end.

Binding means

[0074] A commercial MUF glue (the liquid Kauramin 610 glue from BASF) was used for gluing. As a curing agent, ammonium nitrate at the concentration of 40% and an emulsion in the form of paraffin was used.

	Sample 1	Sample 2	Sample 3
Glue consumption:	about 60 kg/m^3	about 70 kg/m^3	about 80 kg/m^3
Curing agent:	about 1,7 kg/m^3	2,0 kg/m^3	2, 3 kg/m^3
Emulsion:	about 15 kg /m^3	about 20 kg/m^3	about 25 kg/m^3

Test results:

[0075] Elements were manufactured in the form of strips. Elements obtained in the form of the strips are shown at Fig. 7 and 8. Elements with dimensions of 100 x 145 mm x 78 mm and 145 x 145 mm x 78 mm were cut from the strips.
[0076] Elements were subjected to further tests. The following observations were made during the tests:
[0077] Blocks meet the requirements of the standard No. EN 13698 1, i.e.: the part A3 thereof entitled: Wood based element and A.3.1 entitled: Wood based composition and dimensions

a) Rectangular blocks with dimensions of 100 x 145 mm x 78 mm and 145 x 145 mm x 78 mm were obtained.
a) Product density was measured in accordance with the standard No. EN 323. The results were within the range of about 600 kg/m^3 up to maximum 750 kg/m^3
b) Product humidity was within the range of 7% and 13% according to the standard No. EN 1087 -1
c) Material-given formaldehyde emission per m^3 of air was < 0,1 ml, when measured in accordance with the standard No. ENV 717-1.
d) Efficiency of the binding process was determined based on the following tests:

1) size variation was tested in accordance with the standard No. EN 317, after 24h immersion in water at 20°C, for the test samples:

- the length and width did not increase by more than 2%;
- the height did not vary by more than 4,5%, except one of ten blocks, the height change of which varies between 4,5% and 5,5%

2) retention of material strength material regarding absence of splits, loss of cohesion after test cycle was tested and bond quality was determined, in accordance with EN 1087-1 by:

- a 2 h immersion of the blocks in water at 100 C under ambient pressure
- a 2 h holding of the blocks in the oven at (65 ±3)°C
  No splits or loss of cohesion was found.

CONCLUSIONS:

[0078] The following conclusions were drawn on the grounds of the results obtained:
[0079] Material form the chipboard and MFD waste is suitable for the manufacture of pallet blocks for the pallets and EURO-pallets, since, as the tests revealed:
[0080] It is physically possible to add the MDF material to the raw chipboard.
[0081] However, the conventional arrangement must be modified and some devices should be adapted to the new task. It is required, in particular:

1) to meter the MDF and PW material upstream the mill and the drier in order to obtain the material of uniform humidity and homogeneous mixture content as regards fibers and chips. The sooner the material is mixed in the process, the better is the final result.

2) to keep gluing at the level higher than normal, and to avoid blocking caused by MDF acting as "woollen balls", the mixer should be set to the level higher than normal.

3) to differentiate the feeding rate and use steam in the press to avoid sticking of the material

Claims

1. A pallet block with the density within the range of 600-750 kg/m^3 comprising a particulate material glued with a binding material, said binding material being in the form of an urea-formaldehyde resin and melamine-formaldehyde resin mixture (MUF), **characterized in that** the particulate material contains a chipboard waste in amounts of 70 to 90% by weight and a MDF and/or HDF waste in amounts of 10 to 30% by weight.

2. The pallet block of claim 1, **characterized in that** the particulate material contains the chipboard waste in amounts of 75-80%.

3. The pallet block of claim 1, **characterized in that** the particulate material contains the chipboard waste in an amount of 78%.

4. The pallet block of claim 1 or 2 or 3, **characterized in that** the particulate material contains the MDF and/or HDF waste in amounts of 20-25%.

5. The pallet block of claim 1 or 2 or 3, **characterized in that** the particulate material contains the MDF and/or HDF waste in an amount of 22%.

6. A process for the manufacture of the pallet block as defined in claim 1, which comprises the steps of:

(a) preparing chips from the source material,
(b) charging the chips prepared in the step (a) and secondary comminution thereof,
(c) drying the chips of the step (b),
(d) sieving the chips prepared in the step (c),
(e) buffering the chips of the step (d) and metering thereof,
(f) gluing chips with the urea-formaldehyde resin and melamine-formaldehyde resin mixture (MUF),
(g) compression molding of the glued chips into the form of strips, the strips being cut lengthwise to the shapes of the blocks,
(e) conditioning and storage of the blocks prepared in the step (g), **characterized in that** for the manufacture of the chips in the step (a) the material of the chipboard waste and/or HDF and/or MDF board waste is used as a feed material, the chipboard content being from 70 to 90%, and the content of the MDF and/or HDF board

waste being from 10 to 30%.

7. The process for the manufacture of claim 6, **characterized in that** the chipboard content in the feed material is from 75 to 80%.

8. The process for the manufacture of claim 6 or 7, **characterized in that** the chipboard content in the feed material is from 78% to 80%.

9. The process for the manufacture of claim 6 or 7 or 8, **characterized in that** the content of the MDF and/or HDF board waste in the feed material is from 20 to 30%.

10. The process for the manufacture of claim 6 or 7 or 8, **characterized in that** the content of the MDF and/or HDF board waste in the feed material is 12%.

11. The process for the manufacture of any one of claims 6-10, **characterized in that** the drying step is performed in a belt drier.

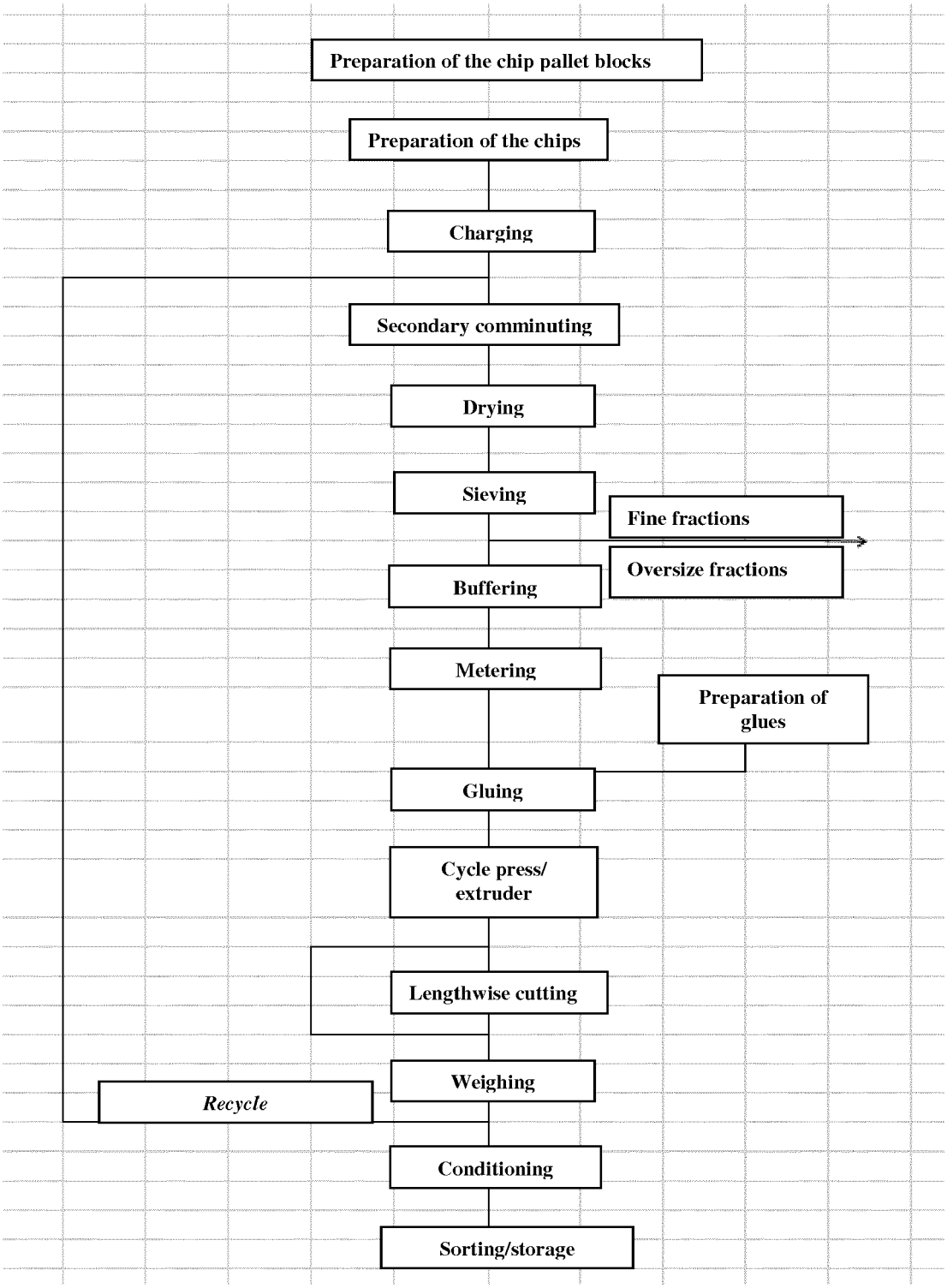
Preparation of the chip pallet blocks
Preparation of the chips
Charging
Secondary comminuting
Drying
Sieving
Fine fractions
Oversize fractions
Buffering
Metering
Preparation of glues
Gluing
Cycle press/ extruder
Lengthwise cutting
Weighing
Recycle
Conditioning
Sorting/storage

Fig. 1

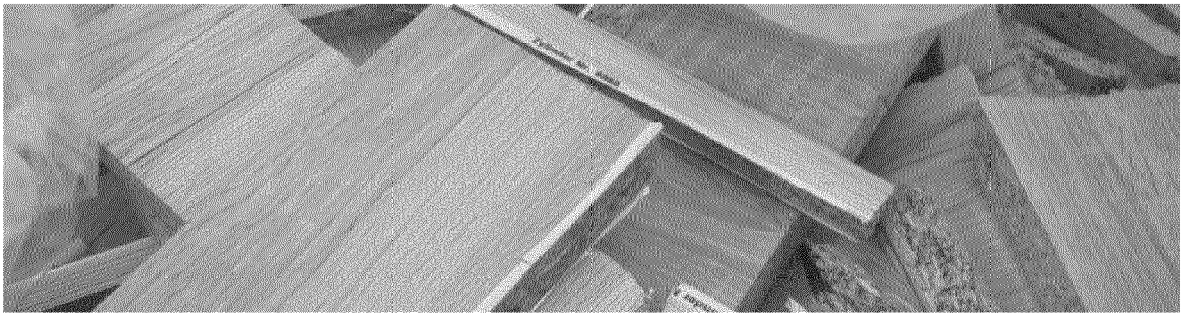

Fig. 2

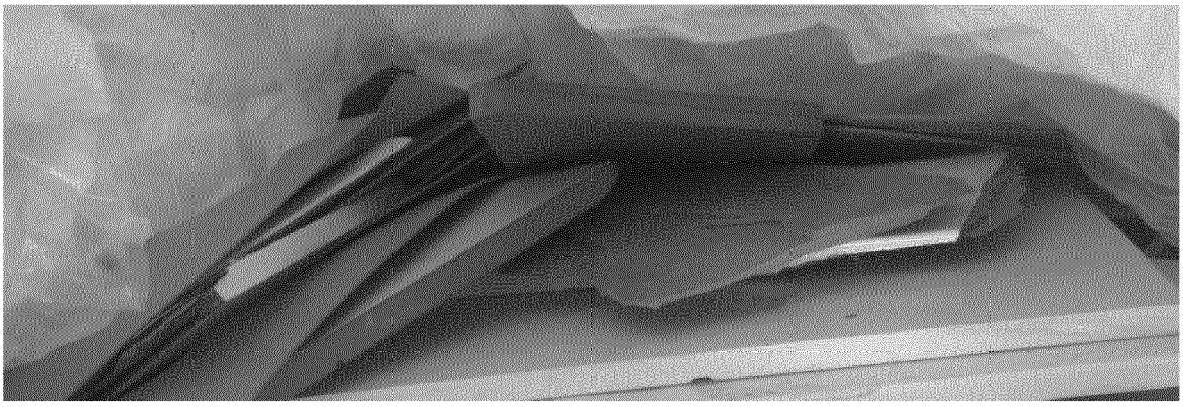

Fig. 3

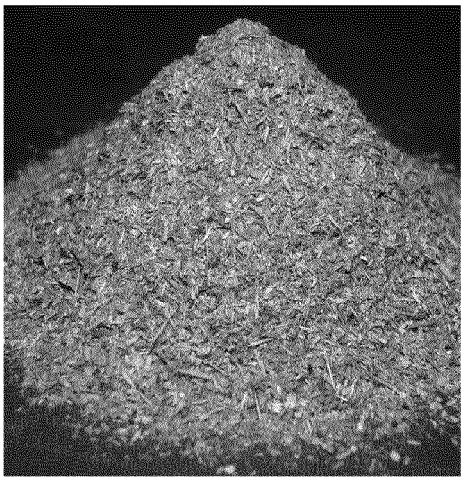

Fig. 4

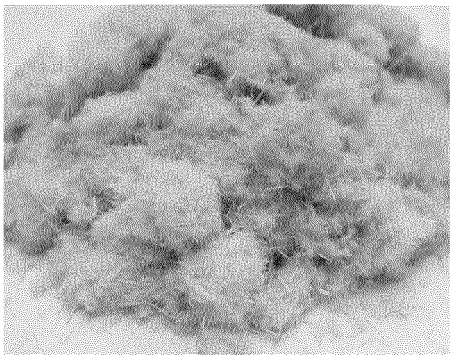

Fig. 5

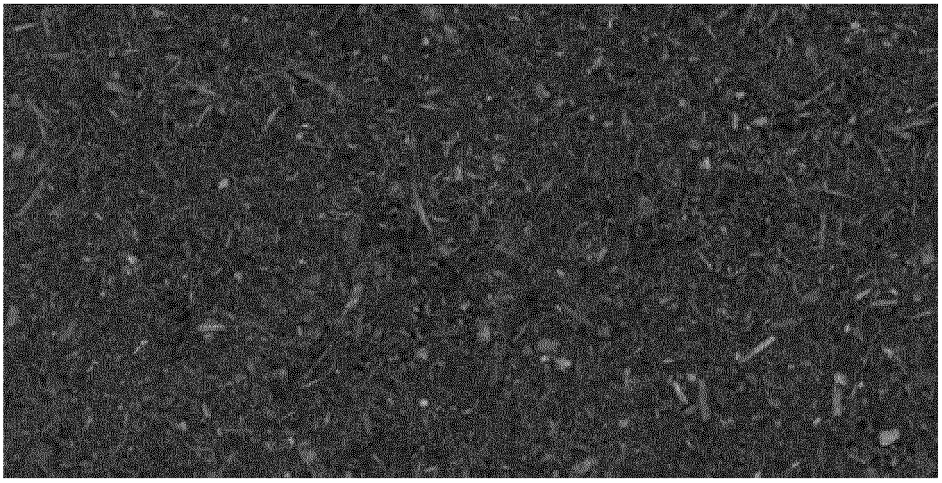

Fig. 6

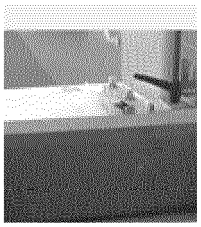

Fig. 7

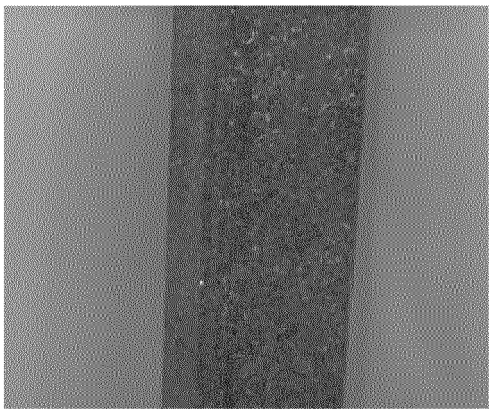

Fig. 8

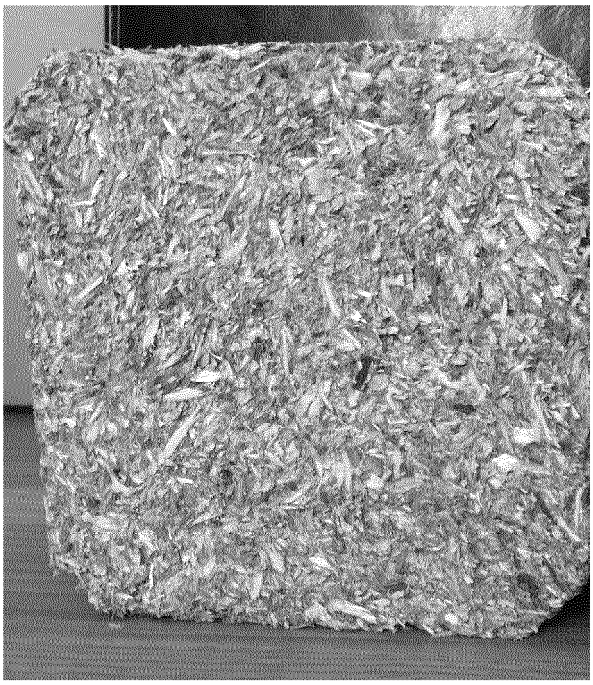

Fig. 9

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 18 5894

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2003/056873 A1 (NAKOS PANAGIOTIS [GR] ET AL) 27 March 2003 (2003-03-27)	1-11	INV. B27N3/00
Y	* paragraphs [0001], [0006], [0009], [0012], [0013], [0015], [0024] - [0033], [0035], [0039], [0041], [0044]; claims 1,5,6,8,10; examples 1,2 * * claims 1,5,6,8,10 *	1,6	ADD. B27N3/02 B27N3/04 B27N3/18 B27N3/28
Y	DE 10 2012 204238 A1 (UNIV DRESDEN TECH [DE]) 19 September 2013 (2013-09-19) * paragraphs [0040], [0043], [0045], [0052], [0069]; claims 7,9,13 *	1,6	B65D19/00 E04C2/16 B27M3/00
Y	DE 101 24 638 A1 (ROFFAEL EDMONE [DE]) 21 November 2002 (2002-11-21) * paragraph [0001]; claims 1,4; example 1 *	1,6	
Y	US 2002/153107 A1 (ROFFAEL EDMONE [DE]) 24 October 2002 (2002-10-24) * paragraphs [0001], [0003], [0035], [0036], [0039], [0040], [0048], [0049], [0051], [0054] - [0057]; claims 1-3,6; example 2 *	1,6	TECHNICAL FIELDS SEARCHED (IPC) B27N B65D E04C B27M
Y	DE 10 2004 008822 A1 (IHD INST FUER HOLZTECHNOLOGIE [DE]) 22 September 2005 (2005-09-22) * paragraphs [0001], [0002]; claims 1,5 *	1,6	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 February 2018	Baran, Norbert

CATEGORY OF CITED DOCUMENTS

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

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

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 18 5894

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	Reiner Franke: "Ikonographische Untersuchungen zum Gottinger Barfusser-altar von 1424. Der geschlossene Zustand : dissertation : zur Erlangung des philosophischen Doktorgrades am Fachbereich Historisch-Philologische Wissenschaften der Georg-August-Universitat zu Gottingen", , 1 February 2001 (2001-02-01), pages 1-128, XP055448539, Germany Retrieved from the Internet: URL:https://d-nb.info/1045069418/34 [retrieved on 2018-02-06]	6	
A	* page 4, paragraph 4 * * page 5, paragraph 2 * * page 6, paragraph 1 * * page 7, paragraphs 1,2 * * page 8, paragraph 1 * * page 9, paragraph 1 * * page 10, paragraph 2 * * page 11, paragraph 1 * * page 12, paragraph 1 * * page 13, paragraphs 1,2 * * page 14, paragraph 1-4 * * page 15, paragraph 2 * * page 16, paragraph 2 * * page 17, paragraphs 1,3 * * page 19, paragraph 1 * * page 22, paragraphs 4,5 * * page 23, paragraph 5 * * page 24, paragraphs 2,3 * * page 25, paragraph 2-4 * * page 34, paragraph 2 * * page 37, paragraphs 1,2 * * page 45, line 1 * * page 64, lines 1,2 * * page 68, paragraph 1 * -/--	1-5	TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 February 2018	Baran, Norbert

CATEGORY OF CITED DOCUMENTS

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

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

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 18 5894

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
	* page 69, paragraph 4 * * page 74, paragraphs 1,2 * * page 76, paragraph 1 * * page 87, paragraph 3 * * page 91, paragraph 5 * * page 95, paragraph 1 * * figure 4 * * tables 2,3 * * vgl. ebenfalls "Übersicht" 7-10 * -----		
Y	Alireza Kharazipour ET AL: "Recycling of Wood Composites and Solid Wood Products", , 18 May 2014 (2014-05-18), XP055448902, Retrieved from the Internet: URL:https://www.researchgate.net/profile/Ursula_Kuees-GAUG/publication/262179636_Recycling_of_Wood_Composites_and_Solid_Wood_Products/links/0c9605378d7666743f000000/Recycling-of-Wood-Composites-and-Solid-Wood-Products.pdf [retrieved on 2018-02-07] * page 511, paragraph 2 * * page 514, paragraphs 1,3 * * page 516, paragraph 3 * * page 518, paragraphs 1,2 * * page 520, paragraph 2 * * page 521, paragraph 1-3 * * page 522, paragraph 1 * * page 525, paragraph 2 * * figures 2-6 * ----- -/--	1,6	TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 February 2018	Baran, Norbert

CATEGORY OF CITED DOCUMENTS

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

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

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 18 5894

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	Michanickl ET AL: "Recycling von MDF und daraus hergestellten Produkten", MDF-Magazin, Supplement zu Holz-Zentralblatt (Zusammenfassung), 31 December 1997 (1997-12-31), XP055449085, Retrieved from the Internet: URL:http://publica.fraunhofer.de/dokumente/PX-31408.html [retrieved on 2018-02-07] * abstract *	1,6	
Y	WO 2011/077155 A1 (NEW ARTHUR JAMES [GB]) 30 June 2011 (2011-06-30) * claims 1,9 * * page 1, lines 3-5,14-24 * * page 2, lines 13-21 * * page 4, lines 7-14 * * page 5, lines 4-18 * * page 7, lines 15-17 * * page 8, lines 4-11 *	1,6	TECHNICAL FIELDS SEARCHED (IPC)
Y	Anonymous: "Recycling MDF: are we there yet? - Wood Based Panels", , 9 March 2012 (2012-03-09), pages 1-4, XP055448889, Retrieved from the Internet: URL:http://www.wbpionline.com/features/recycling-mdf-are-we-there-yet/ [retrieved on 2018-02-07] * page 1, lines 36-51 * * page 2, lines 14-52 *	1,6	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 February 2018	Baran, Norbert

CATEGORY OF CITED DOCUMENTS

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

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

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 18 5894

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
T	Anonymous: "Holzfaserdämmplatte - Wikipedia", , 9 January 2016 (2016-01-09), pages 1-3, XP055450294, internet Retrieved from the Internet: URL:https://de.wikipedia.org/w/index.php?title=Holzfaserdämmplatte&oldid=149979161 [retrieved on 2018-02-12] * figure 1 * * page 1, paragraph 1 * * page 2, paragraphs 1,2 * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 February 2018	Baran, Norbert

CATEGORY OF CITED DOCUMENTS

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

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 18 5894

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

14-02-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2003056873 A1	27-03-2003	AT 261801 T	15-04-2004
		AU 771047 B2	11-03-2004
		BR 0016062 A	30-07-2002
		CN 1402662 A	12-03-2003
		DE 60009165 D1	22-04-2004
		DE 60009165 T2	25-11-2004
		EP 1255630 A1	13-11-2002
		ES 2221862 T3	16-01-2005
		PL 355315 A1	19-04-2004
		PT 1255630 E	30-07-2004
		US 2003056873 A1	27-03-2003
		WO 0139946 A1	07-06-2001
DE 102012204238 A1	19-09-2013	DE 102012204238 A1	19-09-2013
		EP 2825615 A1	21-01-2015
		WO 2013135890 A1	19-09-2013
DE 10124638 A1	21-11-2002	NONE	
US 2002153107 A1	24-10-2002	AT 215006 T	15-04-2002
		AU 734282 B2	07-06-2001
		BR 9714375 A	21-03-2000
		CA 2272714 A1	11-06-1998
		DE 69711424 D1	02-05-2002
		DE 69711424 T2	07-11-2002
		EP 0942815 A1	22-09-1999
		ES 2175381 T3	16-11-2002
		JP 2001505829 A	08-05-2001
		KR 20000057335 A	15-09-2000
		NO 992682 A	02-06-1999
		NZ 335773 A	29-06-2001
		PT 942815 E	30-09-2002
		RU 2165352 C2	20-04-2001
		TR 9901154 T2	23-08-1999
		US 2002153107 A1	24-10-2002
		WO 9824605 A1	11-06-1998
DE 102004008822 A1	22-09-2005	NONE	
WO 2011077155 A1	30-06-2011	DK 2516730 T3	23-01-2017
		EA 201290561 A1	30-01-2013
		EP 2516730 A1	31-10-2012
		ES 2610204 T3	26-04-2017
		GB 2476465 A	29-06-2011
		HR P20170004 T1	10-03-2017
		HU E030142 T2	28-04-2017

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 18 5894

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

14-02-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		KR 20120106837 A	26-09-2012
		LT 2516730 T	25-01-2017
		MY 154712 A	15-07-2015
		PL 2516730 T3	31-08-2017
		PT 2516730 T	10-01-2017
		WO 2011077155 A1	30-06-2011

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 4337710 A **[0008]**
- EP 1297933 A **[0008]**
- US 4559195 A **[0008]**
- US 6095061 A **[0008]**
- WO 2003013812 A **[0008]**
- US 20070017422 A **[0009]**
- US 20060005746 A **[0010]**
- DE 202011004658 **[0019]**
- US 20030056873 A **[0023]**