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**(54) PROCESS FOR THE MANUFACTURE OF A PALLET BLOCK**

VERFAHREN ZUR HERSTELLUNG EINES PALLETTENBLOCKS

PROCÉDÉ DE FABRICATION D'UN BLOC D'UNE PALLETTE

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**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

**[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:

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.

**[0012]** 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.

**[0013]** 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.

**[0014]** 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.

**[0015]** 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.

**[0016]** 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<sup>3</sup> of air in accordance with the test method ENV 717-1, corresponding to the E 1 class.

**[0017]** 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.

**[0018]** 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.

**[0019]** 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.

**[0020]** MDF (*Medium Density Fibreboard*) is a wood fiber board of the mean density of about 800 kg/m<sup>3</sup>. HDF (*High Density Fibreboard*) is a wood fiber board of the high density of about 1000 kg/m<sup>3</sup>. 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.

**[0021]** 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.

**[0022]** 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.

**[0023]** 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.

**[0024]** 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.

**[0025]** Document US2003056873A1, which represents the closest prior art, discloses a process for the manufacture of the fiberboard, 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 fibers of the step (b), (d) buffering the fibers of the step (b) and metering thereof, (e) gluing fibers with the urea-formaldehyde resin and melamine-formaldehyde resin mixture (MUF), (f) compression molding of the glued fibers into the form of boards, **wherein** for the manufacture of the chips in the step (a) the material of the chipboard waste or HDF or MDF board (particleboard, fibreboard) waste is used as a source material.

**[0026]** Document DE10124638A1 discloses a process for the preparation of tannin-bound lignocellulose plates from used chipboard and fibreboard, wherein crushed products from used plates with tannin solutions in concentration between 1% and 30% are dried in the temperature range between 70° C and 200° C, spread into mats and hot pressed.

**[0027]** Article "Recycling MDF: are we there yet - Wood Based Panels" 9 March 2012, pages 1-4 discloses recycling of MDF fiberboard by soaking of the pre-shredded MDF chips with liquid medium and then heating to around 90° C, which allows for resin hydrolysis and freeing wood fibers for effective recovery. Once the MDF chips become damp, electric current can flow through them, causing them to heat much more rapidly than would occur through normal heat conduction. In addition, the temperature within the particulates can rise above 100° C, causing the MDF to split and expand, allowing more rapid ingress of water and the rate of hydrolysis to increase. This leads to a high processing rate with minimal water usage and at high efficiency.

**[0028]** 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.

**[0029]** 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.

**[0030]** The disclosure provides the pallet block with a density in the range of 600-750 kg/m<sup>3</sup> 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.

**[0031]** Preferably, in the pallet block the content of the chipboard waste in the particulate material is 75-80%.

**[0032]** More preferably the content of the chipboard waste in the particulate material is 78%.

**[0033]** In the preferred embodiment, the content of the MDF and/or HDF board waste in the particulate material is 20-25%.

**[0034]** More preferably, the content of the MDF and/or HDF board waste in the particulate material is 22%.

**[0035]** The invention provides a process for the manufacture of the pallet block as defined in claim 1.

**[0036]** 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%.

**[0037]** 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%.

**[0038]** Preferably, the drying step is performed in a belt drier.

**[0039]** In conclusion, the disclosure 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.

**[0040]** The disclosure 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

**[0041]** The blocks according to the disclosure 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.

**[0042]** The advantageous feature of the blocks according to the disclosure 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.

**[0043]** 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.

**[0044]** A processing line for the manufacture of blocks according to the disclosure 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.

**[0045]** However, these are not all the pieces of equipment: For example, while veneer 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**

**[0046]** 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.

**[0047]** 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.

**[0048]** 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.

**[0049]** 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.

**[0050]** 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.

**[0051]** 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.

**[0052]** 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.

**[0053]** 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.

**[0054]** Molds are mounted in the extruder for every scheduled size. Strips are produced of the sizes of 145 x 145mm and 100 x 145mm. Other sizes are possible.

**[0055]** 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.

**[0056]** 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.

**[0057]** Furthermore, additional fuel can be delivered to the dust storage silo by a material feeder.

**[0058]** 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.

**[0059]** 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.

**[0060]** 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.

**[0061]** 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.

**[0062]** 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%.

**[0063]** Tests were conducted within the present disclosure 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.

**[0064]** 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.

**[0065]** 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.

**[0066]** 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.

**[0067]** 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

**[0068] 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.**

**[0069]** 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

**[0070]** As a raw material, reclaimed chipboard waste with a finishing coat (Fig. 1) and MDF/HDF board waste were used (Fig. 2) .

**[0071]** The chipboards had the following parameters:

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

## EP 3 296 073 B1

**[0072]** 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 <sup>3</sup>
Packing:	500 Kg/m <sup>3</sup>
Moisture content:	15%

### Raw material preparation

**[0073]** 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

**[0074]** 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

**[0075]** 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

**[0076]** 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

**[0077]** 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 <sup>3</sup>	about 70 kg/m <sup>3</sup>	about 80 kg/m <sup>3</sup>
Curing agent:	about 1,7 kg/m <sup>3</sup>	2,0 kg/m <sup>3</sup>	2, 3 kg/m <sup>3</sup>
Emulsion:	about 15 kg /m <sup>3</sup>	about 20 kg /m <sup>3</sup>	about 25 kg /m <sup>3</sup>

### Test results:

**[0078]** 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.

**[0079]** Elements were subjected to further tests. The following observations were made during the tests:  
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

- Rectangular blocks with dimensions of 100 x 145 mm x 78 mm and 145 x 145 mm x 78 mm were obtained.
- Product density was measured in accordance with the standard No. EN 323. The results were within the range of about 600 kg/m<sup>3</sup> up to maximum 750 kg/m<sup>3</sup>
- Product humidity was within the range of 7% and 13% according to the standard No. EN 1087 -1
- Material-given formaldehyde emission per m<sup>3</sup> 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  $(65 \pm 3)^{\circ}\text{C}$
- No splits or loss of cohesion was found.

## CONCLUSIONS:

**[0080]** The following conclusions were drawn on the grounds of the results obtained:

Material from the chipboard and MFD waste is suitable for the manufacture of pallet blocks for the pallets and EURO-pallets, since, as the tests revealed:

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 process for the manufacture of the pallet block with the density within the range of 600-750 kg/m<sup>3</sup> 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), wherein the particulate material contains a chipboard waste in amounts of 70 to 90% by weight and a MDF or HDF waste in amounts of 10 to 30% by weight, 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,
- (h) conditioning and storage of the blocks prepared in the step (g), **wherein** for the manufacture of the chips in the step (a) the material of the chipboard waste and HDF or MDF board waste is used as a source material, the chipboard content being from 70 to 90%, and the content of the MDF or HDF board waste being from 10 to 30% by weight, wherein chipboard and HDF/MDF waste comprise already hardened bonding agent, such as the set melamine resin.

2. The process for the manufacture of claim 1, **characterized in that** the chipboard content in the source material is from 75 to 80% by weight.

3. The process for the manufacture of claim 1 or 2, **characterized in that** the chipboard content in the source material is from 78% to 80% by weight.
4. The process for the manufacture of claim 1, **characterized in that** the content of the MDF or HDF board waste in the source material is from 20 to 30% by weight.
5. The process for the manufacture of claim 1, **characterized in that** the content of the MDF or HDF board waste in the source material is 12% by weight.
6. The process for the manufacture of any one of claims 1-5, **characterized in that** the drying step is performed in a belt drier.

## Patentansprüche

1. Ein Verfahren zur Herstellung des Palettenblocks mit einer Dichte im Bereich von 600-750 kg/m<sup>3</sup>, umfassend ein teilchenförmiges Material, das mit einem Bindemittel verklebt ist, wobei das Bindemittel in Form eines Harnstoff-Formaldehyd-Harzes und einer MelaminFormaldehyd-Harz-Mischung (MUF) vorliegt, wobei das teilchenförmige Material einen Spanplattenabfall in Mengen von 70 bis 90 Gew.-% und einen MDF- oder HDF-Abfall in Mengen von 10 bis 30 Gew.-% enthält, umfassend folgende Schritte:
  - (a) Herstellen von Spänen aus dem Ausgangsmaterial,
  - (b) Aufladen der im Schritt (a) hergestellten Späne und deren Nachzerkleinerung,
  - (c) Trocknen der Späne vom Schritt (b),
  - (d) Sieben der im Schritt (c) vorbereiteten Späne,
  - (e) Puffern der Späne vom Schritt (d) und deren Dosieren,
  - (f) Kleben von Spänen mit dem Harnstoff-Formaldehyd-Harz und der Melamin-Formaldehyd-Harz-Mischung (MUF),
  - (g) Formpressen der geklebten Späne in Form von Streifen, wobei die Streifen längs zu den Blockformen geschnitten werden,
  - (h) Konditionierung und Lagerung der im Schritt (g) hergestellten Blöcke, **wobei** für die Herstellung der Späne in dem Schritt (a) das Material des Spanplattenabfalls und HDF oder als Ausgangsmaterial MDF-Plattenabfall verwendet wird, wobei der Spanplattenanteil von 70 bis 90 % und der Anteil des MDF- oder HDF-Plattenabfalls von 10 bis 30 Gew.-% beträgt, wobei der Spanplatten- und HDF/MDF-Abfälle bereits ausgehärtetes Bindemittel, wie das abgebundene Melaminharz, umfassen.
2. Das Verfahren zur Herstellung nach Anspruch 1, **dadurch gekennzeichnet, dass** der Spanplattengehalt im Ausgangsmaterial von 75 bis 80 Gew.-% beträgt.
3. Das Verfahren zur Herstellung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Spanplattengehalt im Ausgangsmaterial von 78 bis 80 Gew.-% beträgt.
4. Das Verfahren zur Herstellung nach Anspruch 1, **dadurch gekennzeichnet, dass** der Gehalt an MDF- oder HDF-Plattenabfällen im Ausgangsmaterial von 20 bis 30 Gew.-% beträgt,
5. Das Verfahren zur Herstellung nach Anspruch 1, **dadurch gekennzeichnet, dass** der Gehalt an MDF- oder HDF-Plattenabfällen im Ausgangsmaterial 12 Gew.-% beträgt.
6. Das Verfahren zur Herstellung nach einem der Ansprüche 1-5, **dadurch gekennzeichnet, dass** der Trocknungsschritt in einem Bandtrockner durchgeführt wird.

## Revendications

1. Un procédé de fabrication du bloc de palette avec la densité dans la plage de 600-750 kg/m<sup>3</sup> comprenant un matériau particulaire collé avec un matériau de liaison, ledit matériau de liaison étant sous la forme d'un mélange de résine urée-formaldéhyde et de résine mélamine-formaldéhyde (MUF), où le matériau particulaire contient des déchets de panneaux de particules de bois en quantités de 70 à 90% en poids et des déchets de MDF ou de HDF en

quantités de 10 à 30% en poids, qui comprend les étapes consistant à:

- (a) préparer des particules de bois à partir du matériau source,
- (b) charger les particules de bois préparées à l'étape (a) et les fragmenter secondairement,
- (c) sécher les particules de bois de l'étape (b),
- (d) tamiser les particules de bois préparées dans l'étape (c),
- (e) tamponner les particules de bois de l'étape (d) et les doser,
- (f) coller les particules de bois avec le mélange de résine urée-formaldéhyde et de résine mélamine-formaldéhyde (MUF),
- (g) moulage par compression des particules de bois collées sous forme de bandes, les bandes étant coupées dans le sens de la longueur des blocs,
- (h) conditionnement et stockage des blocs préparés à l'étape (g), où pour la fabrication des particules de bois dans l'étape (a), le matériau des déchets de panneaux de particules de bois et de déchets de panneaux HDF ou MDF est utilisé en tant que matériau source, la teneur en panneaux de particules de bois étant comprise entre 70 à 90% et la teneur en déchets de panneaux MDF ou HDF étant entre 10 à 30% en poids, où les panneaux de particules de bois et les déchets HDF/MDF comprennent un agent de liaison déjà durci, tel que la résine mélamine durcie.

2. Le procédé de fabrication selon la revendication 1, **caractérisé en ce que** la teneur en panneaux de particules de bois dans le matériau source est comprise entre 75 à 80% en poids.
3. Le procédé de fabrication selon la revendication 1 ou 2, **caractérisé en ce que** la teneur en panneaux de particules de bois dans le matériau source est comprise entre 78% à 80% en poids.
4. Le procédé de fabrication selon la revendication 1, **caractérisé en ce que** la teneur en déchets de panneaux MDF ou HDF dans le matériau source est comprise entre 20 à 30% en poids.
5. Le procédé de fabrication selon la revendication 1, **caractérisé en ce que** la teneur en déchets de panneaux MDF ou HDF dans le matériau source est de 12% en poids.
6. Le procédé de fabrication selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** l'étape de séchage est réalisée dans un séchoir à bande.

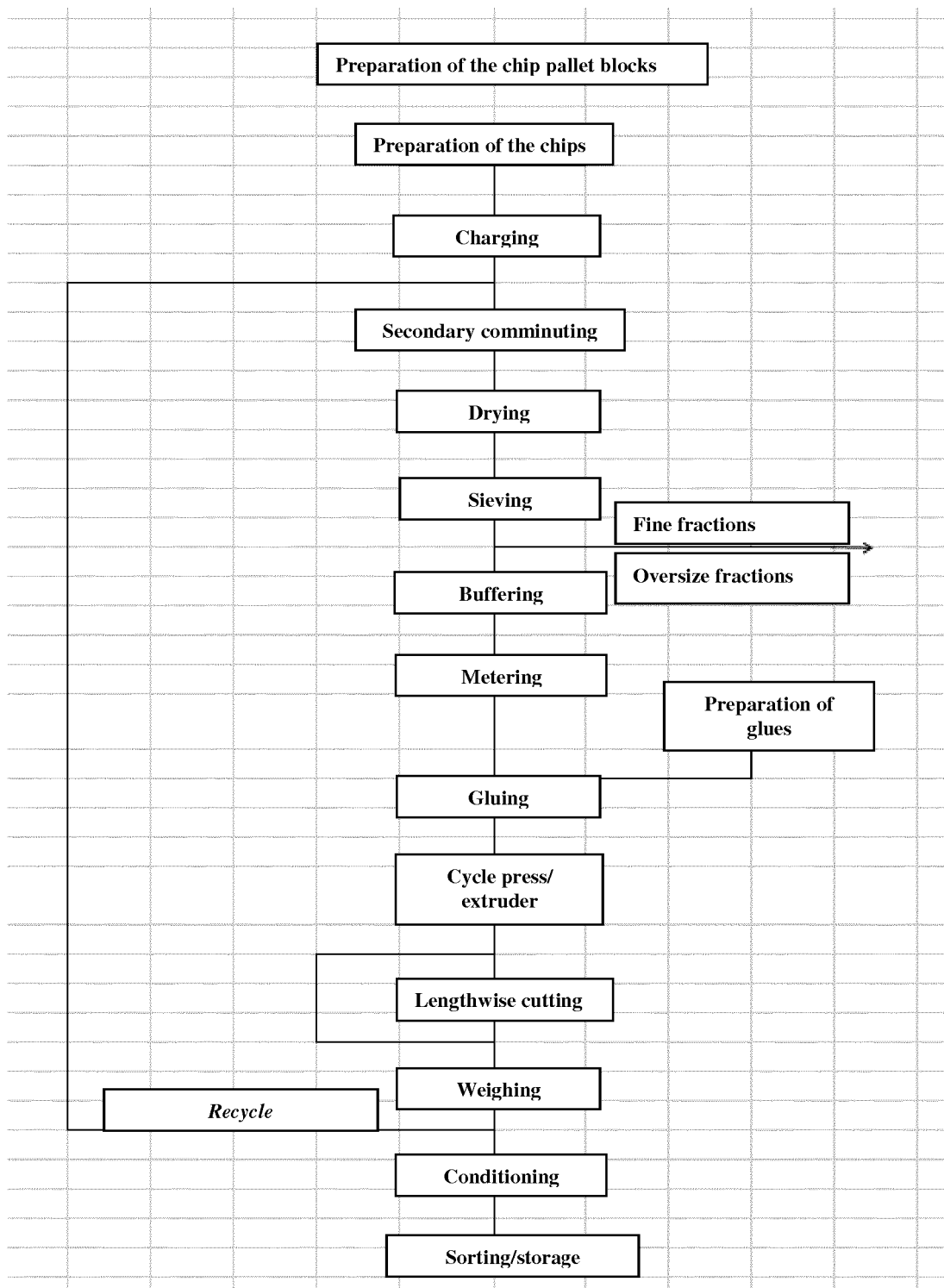


Fig. 1

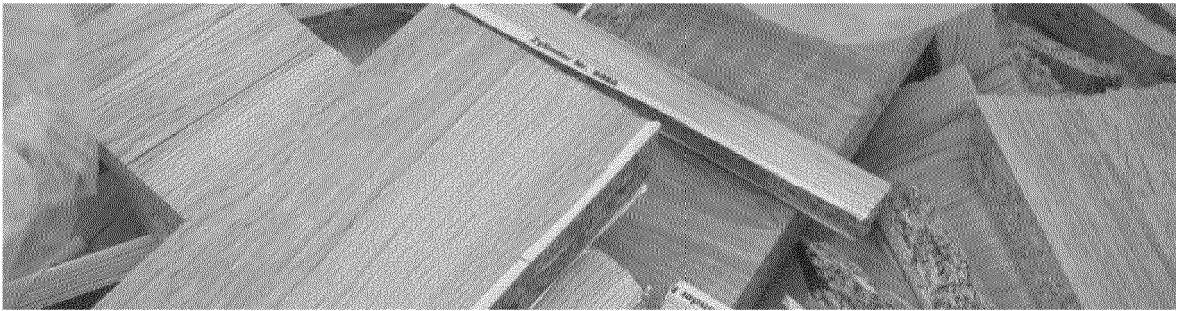


Fig. 2

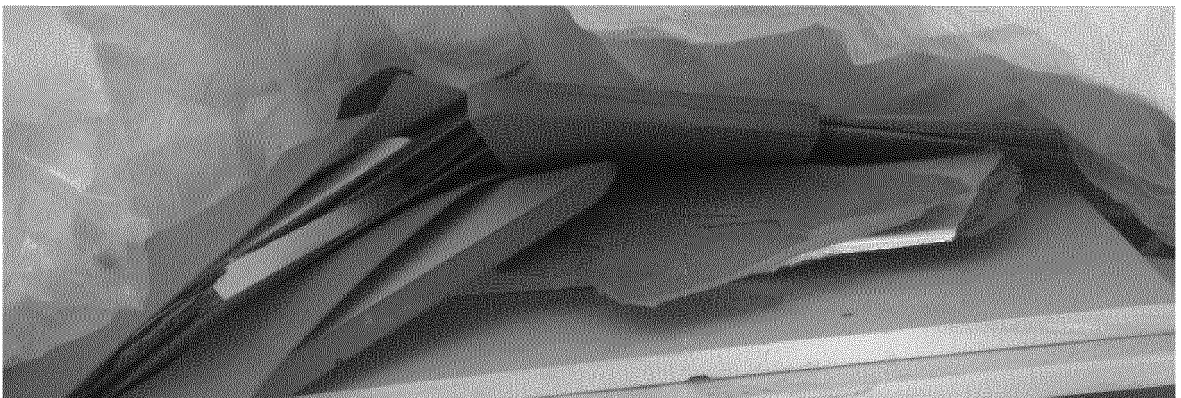


Fig. 3



Fig. 4

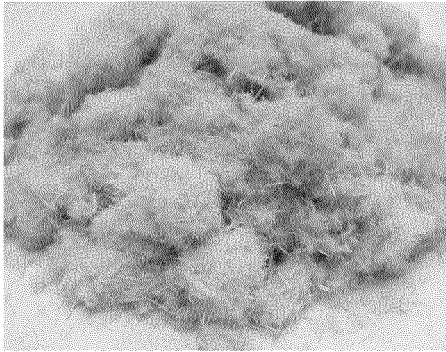


Fig. 5

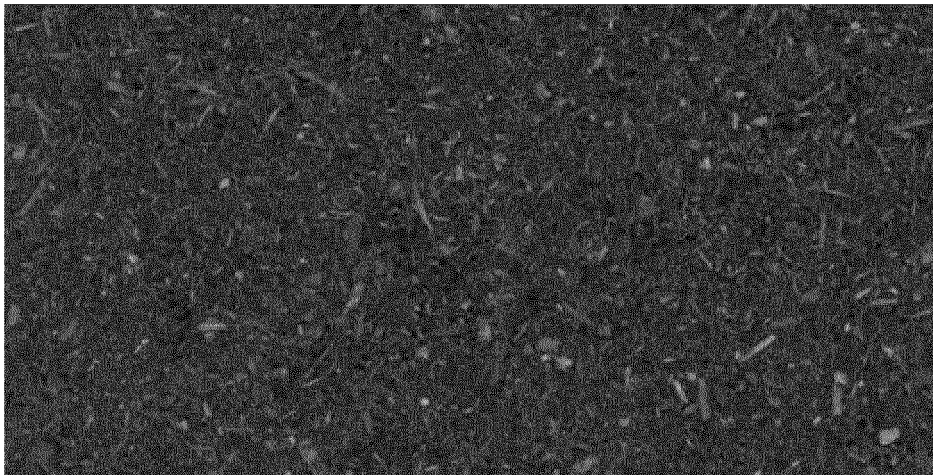


Fig. 6

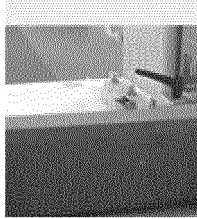


Fig. 7

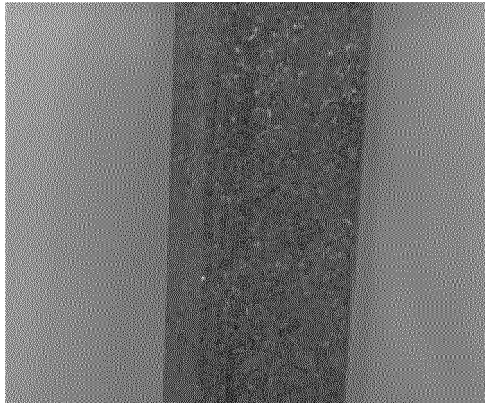


Fig. 8



Fig. 9

## REFERENCES CITED IN THE DESCRIPTION

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