Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).
Description

Technical Field:

[0001] The present invention relates to an improvement in or relating to a method and apparatus for making pallets for lifting, storing, carrying, loading, and unloading heavy goods, used with a forklift.

Background Art:

[0002] Among conventional pallets, wooden pallets are widely used. Such wooden pallets are strong, but are so heavy they are difficult to handle. The making of massive wooden pallets seriously wastes forest resources. Furthermore, it is prescribed and required by a law that imported timbers be fumigated 8 hours at the temperature of 100°C to kill harmful insects, resulting in more expense.

[0003] Metal pallets are lighter than wooden pallets, but more expensive. Still disadvantageously, they are apt to rust, becoming poor in sanitary condition.

[0004] Synthetic resin pallets made of high-density polyethylene or polypropylene do not rust or corrode, thus remaining in good sanitary condition. Such synthetic resin pallets, however, are not light in weight, and are easy to slide. Still disadvantageously, resin pallets do not burn well, and thus cannot be easily disposed of. Metal moulds required in moulding resin pallets are very expensive, accordingly requiring a huge amount of investment.

[0005] In the hope of solving such problems, the inventor of the present invention has proposed that pallets are made of coconut fibres, which are generally discarded as wastes, and a patent for pallets of coconut fibres has been issued (Japan Patent No. 2778897).

[0006] Such pallets of coconut fibres can be made as follows: unwoven fabric, which is made of coconut fibres tangled randomly in all directions, is impregnated with resin and such resin-impregnated unwoven fabric is heated and pressed with a metal mould to be shaped into a pallet. The thermal conductivity of the resin-impregnated unwoven fabric, however, is so low that it may take three to four minutes to make a single pallet when heating the material at a temperature ranging from 200°C to 230°C.

[0007] Further disadvantageously, the temperature of the metal mould is apt to rise higher at the centre than at its circumference that is cooled by the surrounding atmosphere. Therefore, it is difficult to heat the metal mould evenly, resulting in uneven heating of the material of pallets.

[0008] Nearest prior art document US-A-4 517 147 discloses a method of making a panel comprising preparing unwoven fabric of randomly tangled plant fibres; impregnating the unwoven fabric with resin to provide a sheet of base material; sandwiching and pressurising the sheet of base material between upper and lower metal platens; and heating the sheet of base material thus sandwiched by hot gas from the platens to shape the sheet of base material into a panel.

[0009] One object of the present invention is to provide a method and apparatus for making pallets of high quality in short time with an increased efficiency.

Summary of the Invention:

[0010] According to the present invention from one aspect, there is provided a method for making pallets from plant fibres comprising the steps of:

- preparing unwoven fabric of randomly tangled plant fibres;
- impregnating the unwoven fabric with resin to provide a sheet of base material;
- sandwiching and pressurising the sheet of base material between upper and lower metal moulds having a plurality of hot-air vents made throughout their confronting areas;
- heating the sheet of base material thus sandwiched by hot air blowing from one metal mould to the other metal mould, hot air circulating and passing through between the upper and lower moulds via the hot-air vents, to shape the sheet of base material into a pallet with recesses formed on its surface in consequence of the hot-air vents.

[0011] The randomly tangled plant fibres may be prepared by separating the plant fibres from crushed shells of hard-shelled nut-like fruits such as coconut shells and oily coconut shells, or from certain plants such as jute. It is a characteristic that practically all types of plant fibres can be used according to the present invention.

[0012] According to the present invention from another aspect, there is provided apparatus for making pallets comprising: upper and lower metal moulds confronting each other; a plurality of hot-air vents made throughout confronting areas of both the upper and lower metal moulds; and hot-air generating means having a hot-air outlet and a hot-air inlet to which the hot-air vents of the upper and lower metal moulds respectively are connected, thereby permitting hot air to circulate and pass through between the upper and lower metal moulds for providing a pallet with recesses formed on its surface in consequence of the hot-air vents.

[0013] Additional hot-air vents could be provided in the circumferences of said moulds.

Brief Description of Drawings:

[0014] Fig. 1 illustrates an apparatus for making pallets according to one preferred embodiment of the present invention;

Fig. 2 is a perspective view of one example of pallet made according to the present invention;
As shown in Fig. 3, a front view of two pallets of Fig. 1 laid on each other, integrally connected together; Fig. 4 is a perspective view of another example of pallet made according to the present invention; Fig. 5 illustrates an apparatus according to another embodiment of the present invention for making flat plate members; Fig. 6 illustrates an apparatus according to still another embodiment of the present invention for making rod-like members each having a "U"-shape in its cross section; and Fig. 7 is a side view of a series connection of rod-like members each having a "U"-shape in its cross section.

[0015] In making pallets according to the present invention, plant fibres are separated from plant shells of hard-shelled nut-like fruits such as coconuts and oily coconuts, or from certain plants such as jute by using a fibre-separating machine. Thick firm felt-like unwoven fabric is then prepared with the so separated plant fibres randomly tangled. Prior to separating the fibres, the shells of coconuts and oily coconuts are crushed by using a crushing machine and further fragmented as needs arise by using a fragmenting machine.

[0016] The unwoven fabric is impregnated evenly with liquid thermosetting resin, such as phenolic resin, acrylic resin, urethane resin, urea resin, melamine resin or resorcinol resin, to provide a sheet of base material. For example, unwoven fabric of 1.0 to 3.0 kg/m² is impregnated with the liquid thermosetting resin of 10 to 30 weight-percent. Dilution of the liquid thermosetting resin with a solvent such as water or alcohol at the weight ratio of 1:1 to 1.2 makes the viscosity of the resin decrease to the extent that the unwoven fabric may be easily impregnated with the resin.

[0017] The unwoven fabric can be impregnated with the resin by spraying it onto the opposite sides of the unwoven fabric with the aid of an increased pressure of air. Otherwise, the unwoven fabric is soaked in a bath of the resin, and then squeezed by sandwiching between upper and lower pressuring rolls thereby easily forming the sheet of base material with a required rigidity. The amount of resin-impregnation can be controlled by adjusting the distance between the upper and lower pressuring rolls. The strength of the resin-impregnated sheet of base material can be controlled by changing the amount of the solvent or the dilution rate of the resin.

[0018] In addition to thermosetting resins, thermoplastic resin such as vinyl acetate, polypropylene, polyethylene, or olefin resin can be equally used. Pulverized resin can be used too, but liquid resin is easier to evenly impregnate the unwoven fabric.

[0019] The resin-impregnated unwoven fabric is then sandwiched between upper and lower metal moulds to be heated and pressed as described above to form the sheet of base material.

[0020] As shown in Fig. 1, the upper metal mould 1 and the lower metal mould 2 have through-holes 3a and 3b respectively, opened to disperse overall. The through-holes 3a and 3b have hot-air vents 4a and 4b respectively extending from them, which are approximately 1 cm in diameter. The hot-air vents 4a and 4b are arranged at the rate of one vent per 5 x 5 cm² all over confronting surfaces of the upper and lower metal moulds 1 and 2 (400 vents over an area of 1 x 1 m²). Additional hot-air vents 4a and 4b can be provided in the circumference of the metal moulds, since this area is cooled by surrounding atmosphere.

[0021] The through-holes 3a are connected to a hot-air outlet 5a of a boiler 5 (hot-air generating means) via a conduit 6. Likewise, the through-holes 3b are connected to a hot-air inlet 5b of the boiler 5 via a conduit 6. Hot air generated by the boiler 5 is circulated through the hot-air outlet 5a, the conduit 6, the through-holes 3a, the hot-air vents 4a, the hot-air vents 4b, the through-holes 3b, the conduit 6, and the hot-air inlet 5b in this order so that the hot air passes through the resin-impregnated sheet of base material sandwiched between the upper and lower metal moulds 1 and 2. A pallet can be moulded in approximately one minute, provided that the upper and lower metal moulds 1 and 2 have 10 to 50 kgf/cm² of pressurizing force and the boiler 5 generates hot air ranging at the temperature between 180°C to 200°C.

[0022] When the so moulded pallet 7 having 1100 x 1100 mm² in size and 3 to 10 mm in thickness is made from 1.5 to 3.5 kg/m² of unwoven felt-like fabric, the pallet 7 can withstand a load of 10 tons. The pallet 7 further has recesses 8 formed by hot air blown from the hot-air vents 4a onto the confronting surface of the pallet 7. Thus, the pallet 7 has an irregular surface due to the recesses 8, thereby preventing goods from slipping off from the pallet.

[0023] As seen from Fig. 2, a fork lift can insert its fork not only from the front but also from the either side of the pallet 7.

[0024] It is preferred that plant fibres to be used are obtained from low-cost and abundant resources, such as coconut shells, oily coconut shells, and jute. Harmful insects are often found in such plant fibres, but they can be exterminated during manufacturing process, in which hot air of approximately 180°C to 200°C passes through the base material. No extra treatment is therefore required for killing the harmful insects.

[0025] As seen from Fig. 3, two pallets may be laid on each other to be connected as a whole so that the so provided pallet can be reversed for use on either side, permitting a fork lift to insert its fork from any of four directions.

[0026] The present invention is not limited to wavy-surfaced pallets as described above. Another example of pallets according to the present invention may comprise flat plate members 9 and rod-like members 10 having a "U" shape in its cross section as shown in Fig. 4.

[0027] The flat plate members 9 can be formed by using upper and lower metal moulds 12 having flat pressing
A method for making pallets (7) from plant fibres.

Claims

1. A method for making pallets (7) from plant fibres comprising the steps of:

   preparing unwoven fabric of randomly tangled plant fibres;
   impregnating the unwoven fabric with resin to provide a sheet of base material;
   heating the sheet of base material thus sandwiched by hot air blowing from one metal mould (1) to the other metal mould (2), hot air circulating and passing through between the upper and lower moulds (1,2) via the hot-air vents (4a,4b), to shape the sheet of base material into a pallet (7) with recesses (8) formed on its surface in consequence of the hot-air vents (4a,4b).

2. A method for making pallets according to claim 1, wherein the randomly tangled plant fibres are prepared by separating the plant fibres from crushed shells of hard-shelled nut-like fruits such as coconut shells and oily coconut shells, or from certain plants such as jute.

3. Apparatus for making pallets (7) comprising: upper and lower metal moulds (1,2) confronting each other; a plurality of hot-air vents (4a,4b) made throughout confronting areas of both the upper and lower metal moulds (1,2); and hot-air generating means (5) having a hot-air outlet (5a) and a hot-air inlet (5b) to which the hot-air vents (4a,4b) of the upper and lower metal moulds respectively are connected, thereby permitting hot air to circulate and pass through between the upper and lower metal moulds (1,2) for providing a pallet (7) with recesses (8) formed on its surface in consequence of the hot-air vents (4a,4b).

4. Apparatus for making pallets according to claim 3, wherein additional hot-air vents are provided in the circumferences of said metal moulds (1,2).

Industrial Applicability:

As mentioned above, the present invention provides a method for making pallets using plant fibres, the method comprising the steps of preparing unwoven fabric of randomly tangled plant fibres; impregnating the unwoven fabric with resin to provide a sheet of base material; sandwiching and pressurizing the sheet of base material between upper and lower metal moulds having a plurality of hot-air vents made throughout their confronting areas; heating the sheet of base material thus sandwiched by hot air blowing from one metal mould to the other metal mould, so that hot air circulates and passes through between the upper and lower moulds via the vents, to shape the sheet of base material into a pallet with recesses formed at a surface of the pallet in consequence of the hot-air vents. Therefore, heat is efficiently conducted through the base material with hot air passing through, thereby shortening manufacturing time to produce a pallet. Furthermore, the recesses can prevent goods from slipping off the pallet.

The plant fibres may be prepared by separating them from crushed shells of hard-shelled nut-like fruits such as coconut shells and oily coconut shells, or from certain plants such as jute, thereby effectively reducing costs of raw materials.

With apparatus according to the present invention, hot air is circulated and reheated, thereby effectively reducing the amount of fuel required for a heat generating means. Since circumferences of the metal moulds can be cooled by the surrounding atmosphere, additional hot-air vents can be provided in these circumferences.

Patentansprüche

1. Verfahren zum Herstellen von Paletten (7) aus Pflanzenfasern, umfassend die Schritte:

   Vorbereiten von Vlies aus zufällig verwirrten Pflanzenfasern;
   Imprägnieren des Vlieses mit Harz zum Bereitstellen einer Schicht aus Basismaterial;
   Anordnen und Unterdrucksetzen der Schicht aus Basismaterial zwischen einer oberen und unteren Metallform (1,2) mit mehreren Heißluftöffnungen (4a,4b), die durch ihre gegenüberliegenden Bereiche ausgeführt sind;
   Erhitzen der so angeordneten Schicht aus Basismaterial durch Heißluft, die aus einer Metallform (1) zu der anderen Metallform (2) bläst, wodurch Heißluft über die Heißluftöffnungen (4a,4b) zirkuliert und zwischen der unteren Form und der oberen Form (1,2) durchströmt, um die
Schicht aus Basismaterial zu einer Palette (7) mit auf ihrer Oberfläche ausgeformten Vertiefungen (8) aufgrund der Heißluftöffnungen (4a, 4b) zu formen.

2. Verfahren zum Herstellen von Paletten nach Anspruch 1, wobei die zufällig verwirrten Pflanzenfasern vorbereitet werden durch Trennen der Pflanzenfasern von zerkleinerten Schalen von hartschalenigen nussartigen Früchten wie Kokosnusschalen und öligen Kokosnusschalen oder aus bestimmten Pflanzen wie etwa Jute.

3. Vorrichtung zum Herstellen von Paletten (7), umfassend; eine obere und untere Metallform (1, 2), die einander gegenüberliegen; mehrere Heißluftöffnungen (4a, 4b), die durch gegenüberliegende Bereiche sowohl der oberen als auch unteren Metallform (1, 2) ausgeführt sind; und Heißluftzirkulationsmittel (5) mit einem Heißluftauslass (5a) und einem Heißlufteinlass (5b), womit die Heißluftöffnungen (4a, 4b) der oberen bzw. unteren Metallform verbunden sind, wodurch Heißluft zirkulieren und zwischen der oberen und unteren Metallform (1, 2) durchströmen kann, um eine Palette (7) mit auf ihrer Oberfläche ausgeformten Vertiefungen (8) aufgrund der Heißluftöffnungen (4a, 4b) bereitzustellen.

4. Vorrichtung zum Herstellen von Paletten nach Anspruch 3, wobei zusätzliche Heißluftöffnungen in den Umfängen der Metallformen (1, 2) vorgesehen sind.

Renvendications

1. Procédé pour fabriquer des palettes (7) à partir de fibres végétales, comportant les étapes suivantes :

- préparer un non-tissé de fibres végétales enchevêtrées au hasard ;
- imprégné le non-tissé avec de la résine pour fournir une feuille de matériau de base ;
- mettre en sandwich et presser la feuille de matériau de base entre des moules métalliques supérieur et inférieur (1, 2) munis d'une pluralité de fentes de passage d'air chaud (4a, 4b) aménagées sur toutes leurs zones se faisant face ;
- chauffer la feuille de matériau de base ainsi prise en sandwich au moyen de l'air chaud diffusé d'un moule métallique (1) à l'autre moule métallique (2), l'air chaud circulant entre les moules supérieur et inférieur (1, 2) et les traversant par les fentes de passage d'air chaud (4a, 4b), pour façonner la feuille de matériau de base en une palette (7) présentant des renfoncements (8) formés sur sa surface par l'air chaud provenant des fentes de passage d'air chaud (4a, 4b).
REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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• US 4517147 A [0008]