



(11)

EP 2 672 006 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
13.05.2015 Bulletin 2015/20

(51) Int Cl.:
D21H 11/14 (2006.01) **D21H 15/00** (2006.01)
D21B 1/08 (2006.01) **D21J 3/00** (2006.01)

(21) Application number: **12380029.4**

(22) Date of filing: **08.06.2012**

(54) **METHOD OF MANUFACTURING LIGHT BLOCKS OR PROFILES, PLANT FOR IMPLEMENTING SAID METHOD, AND OBTAINED PRODUCT**

VERFAHREN ZUR HERSTELLUNG VON LEICHTEN BLÖCKEN ODER PROFILEN, ANLAGE ZUR DURCHFÜHRUNG DES VERFAHRENS, UND ERHALTENES PRODUKT

PROCÉDÉ DE FABRICATION DE BLOCS OU PROFILES LEGERES, PLANTE POUR LA MISE EN OEUVRE DUDIT PROCÉDÉ, ET PRODUIT OBTENUE

(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**

(43) Date of publication of application:
11.12.2013 Bulletin 2013/50

(73) Proprietor: **González Olmos, Telesforo
03202 Elche Alicante (ES)**

(72) Inventor: **González Olmos, Telesforo
03202 Elche Alicante (ES)**

(74) Representative: **Torner Lasalle, Elisabet et al
Torner, Juncosa I Associats, S.L.
C/Gran Via de les Corts Catalanes, 669 bis 1r 2a
08013 Barcelona (ES)**

(56) References cited:
EP-A1- 0 927 614 DE-A1- 4 342 678

EP 2 672 006 B1

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

Field of the art

[0001] The present invention concerns a method for manufacturing lightweight blocks or profiles, whether it be from the reutilisation of scraps of corrugated cardboard or, optionally, other corrugated cardboard waste materials, such as powder and chips, generated by corrugated cardboard manufacturing and/or handling companies, or from cutting up into pieces new or reused corrugated cardboard sheets. The present invention also concerns a facility for implementing said method, and the obtained products.

Background of the invention

[0002] Corrugated cardboard is generally made of a number of alternate flat paper layers and corrugated paper layers, the two outer layers always being flat. The one or more corrugated inner paper layers form an internal fluted structure that confers to the corrugated cardboard great mechanical resistance, in addition to other interesting physical properties.

[0003] In cardboard manufacturing and/or handling companies, corrugated cardboard scraps and other waste materials are produced, for example, as a result of cutting, die-cutting, sanding and bending processes, among other operations, on corrugated cardboard sheets. The scraps of corrugated cardboard that are considered to be useful for the present invention are those corrugated cardboard scraps that preserve their mechanical properties. This includes both leftover scraps of corrugated cardboard, coming from cardboard manufacturing and/or handling companies, that preserve their mechanical properties but not their formal or aesthetic quality, whereby they are unable for their normal exploitation and marketing, and corrugated cardboard scraps obtained by cutting up into pieces new corrugated cardboard sheets. EP0927614 shows an example of a preparing process of cardboard or similar agglomerates, the basic product of which is cardboard or paper having a recyclable nature.

[0004] The percentage of scraps and other waste materials in a factory of corrugated cardboard is very high. Traditionally, the scraps of corrugated cardboard, together with defective corrugated cardboard sheets, are recycled by shredding and wetting them until a mush is formed from which recycled paper or cardboard can be manufactured. Nevertheless, this recycling process is expensive and energetically inefficient relative to the reutilisation method proposed by the present invention, since the latter makes unnecessary some of the processes for obtaining the mush, as well as the use of chemicals to bleach the paper or cardboard used in some recycled paper or cardboard applications.

[0005] Document ES 1007170 U discloses an automatic paper and cardboard baling press that comprises

a tunnel-like structure that is fed with paper and cardboard scraps in bulk from a hopper and through an opening on the upper surface of the tunnel. A hydraulic group actuates a rod attached to a pushing piston guided along the tunnel, which pushes the scraps of paper or cardboard into the tunnel, shaping a block that is pressure-compacted against a flap that shuts off an outlet. The pressing tunnel includes lateral and upper pressers that condition the block to be bundled by a needle through-guide shaping a paper or cardboard bale or bundle of a predetermined size, which is removed through the outlet once the flap is opened.

[0006] Since the purpose of the press described in the aforementioned document ES 1007170 U is to compact the corrugated cardboard scraps until their volume is reduced to a minimum in order to facilitate the transport and storage thereof, for example until the time of turning them into mush for their recycling, the pressure used in the press is high enough to crush the inner flutes of the corrugated cardboard and expel the air contained therein, which has the shortcoming of eliminating the strength characteristics of corrugated cardboard and producing a very heavy bale. In addition, since there are no adhesive elements, once the bale is untied, it comes apart, because the compacted scraps that form it become separated.

Disclosure of the invention

[0007] According to a first aspect, the present invention provides a method for manufacturing lightweight blocks or profiles that comprises, first of all, the step of mixing and agglomerating scraps of corrugated cardboard with a bonding agent until an isotropic agglomerate is formed, the physical characteristics of which do not depend on the direction. The cardboard scraps used have a predetermined maximum size, which to a large extent ensures the presence of the flutes that form the internal structure of the corrugated cardboard. In addition, the degree of humidity of the isotropic agglomerate is controlled so that it is low enough to ensure that the paper that the corrugated cardboard is made of will not go soft to the extent of losing its mechanical resistance.

[0008] Next, the method of the present invention comprises the step of compacting said isotropic agglomerate by applying a pressure low enough not to crush the flutes in the internal structure of the corrugated cardboard until compacted blocks or profiles are formed, and, finally, drying said compacted blocks or profiles by applying heat until lightweight blocks or profiles are obtained that can be used directly or can be subsequently machined to confer on them specific configurations for particular uses.

[0009] Since, throughout the entire process, the corrugated cardboard scraps maintain the mechanical resistance provided by the flutes of their internal structure, and the scraps are randomly oriented in all directions, the lightweight blocks and profiles obtained through the method of the present invention are extremely lightweight

and mechanically resistant, and they have high capacity of thermal isolation and interesting acoustic properties. In addition, due to the fact that the scraps in the mix are randomly oriented in all directions, the lightweight blocks and profiles are isotropic, since they present the same physical properties, for example mechanical resistance to stress, compression, torsion, bending and shear, rigidity or flexibility, elasticity, isolation capacity, acoustic properties, etc., in every point of the body and in all directions.

[0010] The lightweight blocks or profiles of the present invention will be more or less rigid or more or less flexible depending on the type of bonding agent used to make the agglomerate. For example, a bonding agent that includes a rubber- or polyurethane-based adhesive or an epoxy adhesive will provide relatively flexible and/or elastic lightweight blocks or profiles, whereas a bonding agent that includes an adhesive based, for example, on acrylic products will provide relatively rigid lightweight blocks or profiles.

[0011] The corrugated cardboard scraps used can be leftover scraps coming from a corrugated cardboard manufacturing and/or handling facility or they can be expressly formed from the cutting up into pieces of new or used corrugated cardboard sheets. When, in the method of the present invention, one wishes to reuse scraps of corrugated cardboard exceeding the predetermined maximum size, the method comprises the previous step of shredding the scraps of corrugated cardboard until they are cut down to said predetermined maximum size before proceeding to mix and agglomerate them.

[0012] Another advantage of the method of the present invention is that it allows reusing scraps of corrugated cardboard that otherwise would be wasted or recycled to form new cardboard, with much higher power consumption. Optionally, the method of the present invention comprises adding to the mixture, in addition to the scraps of corrugated cardboard, powder, chips and other corrugated cardboard particles generated in corrugated cardboard manufacturing and/or handling processes as a material to be mixed and agglomerated together with the bonding agent.

[0013] Preferably, the agglomerate includes scraps of corrugated cardboard of several sizes. In a merely illustrative example, 50% or more by weight of the scraps have a maximum size of 3×3 cm, and a small percentage of the scraps, for example from 5% to 10% by weight, can have larger sizes, with a maximum dimension, for example, of up to 20 or 30 cm. This way, medium-sized and small scraps fill the gaps between the larger scraps, and the powder, the chips and other corrugated cardboard particles fill the gaps between the medium-sized and small scraps.

[0014] In general, the bonding agent comprises an adhesive product and a solvent liquid, which can be water or another solvent. By controlling the amount of solvent relative to the amount of adhesive product and the weight of the corrugated cardboard scraps employed in the ag-

glomerate, a mushy bonding agent and a controlled degree of humidity are achieved so as not to soften the paper that the corrugated cardboard is made of. When water is used in the process of formation of the agglomerate, the water can be water coming from a supply network or recycled water coming from a cardboard manufacturing and/or handling company that has integrated the method and/or the facility of the present invention.

[0015] Similarly, as for the heat to be applied in the drying step, the present invention envisages the use of residual heat from a boiler in the corrugated cardboard factory or residual heat recovered from some corrugated cardboard manufacturing or handling process in addition to or instead of other heat sources, such as electrical resistors, gas burners or burners of petroleum derivatives, with considerable energy savings and a reduction of pollutant emissions.

[0016] The method of the present invention comprises compacting the agglomerate in a mould, whereby compacted blocks are obtained, which, once dried, form separate lightweight blocks, or compacting the agglomerate in an extruder, whereby compacted profiles are obtained, which, once dried, form long lightweight profiles, which are preferably cut to pieces in an additional step before drying. Both the lightweight blocks and the lightweight profiles can be used directly or can be subsequently machined.

[0017] In addition to the type of bonding agent, there are other factors that also influence the physical properties of the lightweight blocks or profiles obtained, such as, for example, the type or types of cardboard used, the size or sizes of the scraps, the percentage of the different components used in the agglomerate, that is, the percentage of corrugated cardboard scraps, the percentage of other corrugated cardboard waste materials, the percentage of adhesive, the percentage of solvent, etc., relative to the total volume or weight of the wet or dry agglomerate, and the thermal treatment applied in the drying of the agglomerate, that is, the time-temperature curve in the drying oven, among others.

[0018] According to a second aspect, the present invention provides a facility for implementing a method for manufacturing said lightweight blocks or profiles. The facility comprises at least one mixer provided with means for mixing and agglomerating scraps of corrugated cardboard of a predetermined maximum size with a bonding agent until an isotropic agglomerate is formed, at least one compactor provided with means for compacting said agglomerate by applying a compacting pressure until compacted blocks or profiles are formed, and at least one drying oven provided with means for applying heat to said compacted blocks or profiles until they are dry, thereby obtaining lightweight blocks or profiles.

[0019] The mixer of the present invention includes means, such as, for example, a humidity probe, to control the degree of humidity of the isotropic agglomerate to a degree low enough so as not to destroy the mechanical resistance of the paper that the corrugated cardboard is

made of, and the compactor comprises means, such as a pressure limiter, to control said compacting pressure so as not to crush the flutes of the internal structure of the corrugated cardboard. This way, the scraps of corrugated cardboard preserve their lightness and mechanical properties in the obtained lightweight blocks or profiles.

[0020] Optionally, when the corrugated cardboard scraps to be reused exceed the predetermined maximum size, the facility of the present invention further comprises at least one shredder provided with means for shredding the scraps of corrugated cardboard until they are cut down to said predetermined maximum size before they are fed to said mixer. The mixer can be a linear mixer or a planetary mixer, or the facility can combine mixers of both types. The compactor can be an extruder provided with a die to form continuous or long compacted profiles or a mould compactor provided with a mould to form separate compacted blocks, or the facility can combine compactors of both types.

[0021] Optionally, the facility can also include a separator for separating corrugated cardboard scraps according to their size. For example, a vibrating bed is capable of separating scraps of corrugated cardboard according to their weight and to the frequency and/or amplitude of the vibration. In this case, the corrugated cardboard scraps to be used for the obtainment of the products of the present invention will have a range of sizes selected between a predetermined maximum size and a predetermined minimum size.

[0022] In general, when the facility includes an extruder, a saw found at the outlet thereof is arranged to cut the continuous or long compacted profiles into separate profile pieces of an appropriate length to fit in the drying oven. Nevertheless, the drying oven can alternatively be a continuous drying oven that the compacted continuous profile coming from the extruder would go through in order to produce a continuous lightweight profile that would be cut into pieces of the desired length by means of a saw arranged downstream of the drying oven.

[0023] According to a third aspect, the present invention provides a product obtained from scraps of corrugated cardboard. The product comprises at least one body formed by an isotropic agglomerate of scraps of corrugated cardboard of a predetermined maximum size joined to each other by an adhesive product, wherein said scraps of corrugated cardboard in said isotropic agglomerate have an internal structure provided with flutes formed by at least one corrugated sheet of paper. In an embodiment, the product has the shape of a profile with a constant cross-section obtained by extrusion. In other embodiments, the product can have multiple configurations obtained by moulding. In yet further embodiments, the product can even have complex configurations obtained by machining starting from an initial body obtained by moulding or extrusion.

[0024] By virtue of the excellent physical properties of the material made from corrugated cardboard scraps,

the products of the present invention have multiple applications in fields such as transportation, packaging, decoration, soundproofing, thermal isolation, etc.

5 Brief description of the drawings

[0025] The above and other features and advantages will be more apparent from the following description of exemplary embodiments with reference to the attached drawings, in which:

Fig. 1 is a schematic layout arrangement of a facility according to an embodiment of the second aspect of the present invention, which is useful for implementing the method of the first aspect of the present invention;

Figs. 2 and 3 are perspective views of products according to different embodiments of the third aspect of the present invention obtained by moulding;

Fig. 4 is a perspective view of a product in the shape of a profile with a constant cross-section according to another embodiment of the third aspect of the present invention obtained by extrusion;

Figs. 5 and 6 are top and bottom perspective views, respectively, of a product in the shape of a pallet according to yet another embodiment of the third aspect of the present invention;

Figs. 7 and 8 are top and bottom perspective views, respectively, of a product in the shape of a shipping box according to another embodiment of the third aspect of the present invention; and

Figs. 9 and 10 are top and bottom perspective views, respectively, of a product in the shape of a case or coffin according to another further embodiment of the third aspect of the present invention.

Detailed description of embodiments

[0026] Referring first to Fig. 1, there is shown a facility for implementing a method for manufacturing lightweight blocks or profiles according to an embodiment of the present invention. Preferably, the facility is located adjacent to a corrugated cardboard manufacturing and/or handling plant and it comprises a couple of raw material storing silos 60, 61 where corrugated cardboard waste materials coming from the plant are stored. The first silo 60 receives corrugated cardboard scraps of various sizes through a first in-feed conveyor 62 and the second silo 61 receives corrugated cardboard powder and other corrugated cardboard particles through a second in-feed conveyor 63.

[0027] Next, the facility comprises a couple of mixers 80, 81, and the corrugated cardboard scraps from the first silo 60 and the corrugated cardboard powder and other corrugated cardboard particles from the second silo 61 are selectively loaded into the mixers 80, 81 through conveyors 64, 65, 66, which can be pneumatic conveyors or other types of conveyors. Before feeding them to the

mixers, the corrugated cardboard scraps from the first silo 60 go through a shredder 70 provided with means to shred the corrugated cardboard scraps until they are cut down to a predetermined maximum size, where, for example, at least 50% by weight of the scraps have a maximum size of approximately 3×3 cm.

[0028] The mixers 80, 81 include means for mixing and agglomerating corrugated cardboard scraps of said predetermined maximum size, the corrugated cardboard powder and the other corrugated cardboard particles with a bonding agent until an isotropic agglomerate is formed, wherein the corrugated cardboard scraps are randomly oriented in all directions.

[0029] One of the mixers can be, for example, a linear mixer 80 and the other can be a planetary mixer 81. The linear mixer 80 is of a continuous production type and it comprises, for example, a container wherein two parallel axes provided with blades are arranged that, while rotating in opposite directions, keep on mixing the components fed through its top in one end and keep on pushing the agglomerated mix until it leaves the other end through a hatch. The planetary mixer 81 is of a batch production type and it comprises a container closed with a lid wherein a planetary gear reduction box is installed that causes blades to rotate that keep on mixing the components.

[0030] The mixers 80, 81 are configured in such a way that, when they mix the agglomerate components, they will not crush the corrugated cardboard scraps, so that the flutes constituting their internal structure remain whole.

[0031] The bonding agent includes an adhesive product dissolved in a solvent liquid, and the mixers 80, 81 further include means, such as a humidity probe, for controlling the degree of humidity in said isotropic agglomerate so that the paper that the corrugated cardboard is made of will not go soft, thereby preserving its mechanical resistance. The adjustment of the degree of humidity is effected, for example, measuring out the proportions of the solid and liquid components in the agglomerated mix.

[0032] A number of intermediate conveyors 67, 68, 69 carry the still wet agglomerate coming from the mixers 80, 81 to a couple of compactors 90, 91 provided with means for compacting the isotropic agglomerate by applying a compacting pressure. For example, one of the compactors is an extruder 90 provided with a chamber wherein a worm gear or the like actuated by an electric motor pushes the agglomerate through a die in order to form continuous or long compacted profiles, whereas the other is a mould compactor 91 provided with a mould and a pusher actuated by a dynamic fluid cylinder that compresses the agglomerate into the mould so as to form separate compacted blocks.

[0033] Both compactors 90, 91 include means for controlling the compacting pressure, for example adjusting the torque of the electric motor used to move the worm gear or the pressure of the dynamic fluid used to move the pusher so as not to crush the flutes of the internal structure of the corrugated cardboard when forming the

compacted blocks or profiles. Optionally, the compaction can be carried out with the provision of heat if deemed necessary. As a result of the compaction, the agglomerate generally loses liquid, which can be again recycled back to the mixers.

[0034] The relatively humid compacted blocks and compacted profiles coming from the compactors 90, 91 are conducted to respective drying ovens 100 by means of corresponding belt conveyors 71, 72. Since the compacted profiles produced by extruder 90 are continuous or have a long length, the facility includes a saw 110 arranged to cut said continuous or long compacted profiles into separate pieces of an appropriate length to fit in the corresponding drying oven 100.

[0035] The drying ovens 100 are provided with means for applying heat to the compacted blocks or profiles until they are dry, that is, until their degree of humidity is reduced to a predetermined minimum, whereby lightweight blocks and lightweight profiles are obtained that are transported by means of an out-feed conveyor 73. The heat source for the drying ovens 100 can be, for example, electrical resistors, gas burners or burners of petroleum derivatives, and additionally or alternatively it is possible to use the residual heat from a boiler in the corrugated cardboard factory or residual heat recovered from some corrugated cardboard manufacturing or handling process.

[0036] The lightweight blocks and lightweight profiles obtained can be utilised directly or after they have been subsequently machined. In case of opting for subsequent machining, the facility includes one or more machine tools (not shown), such as, for example, millers, lathes, groovers, drills, borers and computerised numerical control machining centres, which might receive the lightweight blocks and profiles from the out-feed conveyor 73. The machine tools can be adapted to the great ease of machining offered by the product of the present invention.

[0037] The corrugated cardboard powder, chips and other particles produced in the machining operations are preferably sucked up and/or collected and conveyed towards the raw material storing silos 60, 61 to be used again in the formation of lightweight blocks and/or profiles.

[0038] This way, the embodiment of the facility according to the second aspect of the present invention described in relation to Fig. 1 allows for implementing the method for manufacturing lightweight blocks and profiles according to the first aspect of the present invention, which, in brief, comprises the steps of mixing and agglomerating scraps of corrugated cardboard of a predetermined maximum size with a bonding agent until forming an isotropic agglomerate, controlling the degree of humidity of said isotropic agglomerate in order not to destroy the mechanical resistance of the paper that the corrugated cardboard is made of, compacting said agglomerate until compacted blocks or profiles are formed by applying a controlled compacting pressure so as not to

crush the flutes of the internal structure of the corrugated cardboard, and drying said compacted blocks or profiles by applying heat until lightweight blocks or profiles are obtained.

[0039] Figures 2 to 10 show different examples of products 1-6 according to the third aspect of the present invention that are obtained by the method and/or the facility of the present invention. All the products obtained have the common feature of at least one body formed by an isotropic agglomerate of reutilised scraps of corrugated cardboard of a predetermined maximum size joined to each other through an adhesive product, wherein said scraps of corrugated cardboard in said isotropic agglomerate are randomly oriented in all directions and have an internal structure provided with flutes formed by at least one corrugated sheet of paper. For example, 50% or more by weight of the scraps have a maximum size of 3×3 cm.

[0040] Consequently, the physical characteristics of the products according to the present invention are extraordinary lightness, surprising mechanical properties, interesting acoustic properties and high thermal isolation capacity.

[0041] Figures 2, 3 and 4 show different products 1, 2, 3 obtained directly at the exit of the drying ovens 100 that are suitable to be used as is, or they can be subsequently configured through machining to adapt them to specific uses.

[0042] The first product 1, shown in Fig. 2, is a lightweight block in the shape of a parallelepiped with six flat faces 1a that can be obtained both from a compacted profile formed by the extruder 90 and from a compacted block formed by the mould compactor 91 in the facility of Fig. 1. Obviously, the parallelepiped might have different proportions from those shown in Fig. 2, so that the first product 1 might alternatively have the shape of a relatively thin plate, an elongated bar with square or rectangular cross-section, a cube, etc.

[0043] The second product 2, shown in Fig. 3, is a lightweight block that has a complex shape suitable to be obtained from a compacted block formed by the mould compactor 91 in the facility of Fig. 1. The second product 2 has an essentially cubic shape with a widely rounded edge 2a, and it presents in one of its faces a square cross-section cavity 2b.

[0044] The third product 3, shown in Fig. 4, is a lightweight profile 3a having a constant cross-section in the shape of "H", which can be obtained from a compacted profile formed by the extruder 90 in the facility of Fig. 1. It will be understood that, alternatively, through the utilisation of different dies, the extruder 90 will be able to produce profiles of a large variety of cross-sections, including profiles with a closed cross-section.

[0045] The first, second and third products 1, 2, 3 can have multiple uses, for example as a filler, as buffers for the packaging of fragile products in boxes and the like, as a thermal isolation material, as an acoustic conditioning material, etc.

[0046] Figures 5 to 10 show different products 4, 5, 6 obtained from lightweight blocks similar to those described above in relation to Figs. 1 and 2, obviously initially provided with adequate proportions, and subsequently conformed by machining.

[0047] The fourth product 4, shown in Figs. 5 and 6, is a pallet comprising a flattened body that defines a platform 4a on its top and several crossing grooves 4b on its bottom, which are sized to receive the forks of a forklift or the like from any of the four sides of the pallet. The body is obtained from a lightweight block similar to that of Fig. 2 and the grooves 4b are machined by means of a groover.

[0048] The fifth product 5, shown in Figs. 7 and 8, is a shipping box made up by a first body 5a defining a container and a second body 5b forming a lid for said container. The first body 5a has an essentially cubic shape with a large cavity 5c in its top, a perimetric step 5d around said cavity 5c and a pallet structure 5e in its bottom, whereas the second body 5b has the shape of a plate whose dimensions match those of the first body 5a, with an undercut 5f in its bottom face fitting in said perimetric step 5d of the first body 5a.

[0049] The first and second bodies 5a, 5b of the fifth product 5 are obtained from respective lightweight blocks similar to that of Fig. 2, such that the cavity 5c and the undercut 5f are moulded surfaces, whereas the perimetric step 5d and the pallet structure 5e are machined by means of a groover or a computerised numerical control machining centre.

[0050] The sixth product 6, shown in Figs. 9 and 10, is a case or coffin made up by a first body 6a defining a first container part and a second body 6b forming a second container part. The first and second bodies 6a, 6b have the shape of respective parallelepipedic plates having similar dimensions. The first body 6a has a first complex configuration cavity 6d in its bottom face, specifically adapted to the contours of a part of the object to be contained, and the second body 6b has a second complex configuration cavity 6c in its top face specifically adapted to the contours of another part of the object to be contained. In addition, the second body 6b has grooves 6e formed in its bottom face configuring a pallet structure. Lugs 6f protruding from the top face of the second body 6b are inserted into corresponding holes 6g formed in the lower face of the first body 6a when both first and second bodies 6a, 6b are coupled.

[0051] The first and second bodies 6a, 6b of the sixth product 6 are obtained from respective lightweight blocks similar to that of Fig. 2, and the first and second cavities 6c, 6d with complex configurations, the grooves 6e and the holes 6g are machined by means of a miller, a groover or a drill, respectively, or preferably, by means of a computerised numerical control machining centre. The lugs 6f are preferably additional elements inserted into corresponding holes, although they might optionally be obtained by machining.

[0052] A person skilled in the art will be able to intro-

duce modifications and variations to the embodiments shown and described without departing from the scope of the present invention as defined in the attached claims.

Claims

1. A method for manufacturing lightweight blocks or profiles comprises the steps of:

mixing and agglomerating scraps of corrugated cardboard of a predetermined maximum size with a bonding agent until an isotropic agglomerate is formed, and controlling the degree of humidity of said isotropic agglomerate in order not to destroy the mechanical resistance of the paper that the corrugated cardboard is made of; compacting said agglomerate until compacted blocks or profiles are formed by applying a controlled compacting pressure so as not to crush flutes in the internal structure of the corrugated cardboard; and drying said compacted blocks or profiles by applying heat until lightweight blocks or profiles are obtained.

2. The method according to claim 1 **characterised in that** it comprises the step of shredding the scraps of corrugated cardboard until they are cut down to said predetermined maximum size before said mixing and agglomerating step.

3. The method according to claims 1 or 2 **characterised in that** it comprises adding corrugated cardboard powder and other corrugated cardboard particles to the scraps of corrugated cardboard and the bonding agent in said mixing and agglomerating step.

4. The method according to claims 1, 2 or 3 **characterised in that** said bonding agent comprises at least one adhesive product and one solvent liquid.

5. The method according to claims 1 or 2 **characterised in that** at least 50% by weight of the scraps of corrugated cardboard in the agglomerate have a maximum size of approximately 3×3 cm, and 5% to 10% by weight of the scraps of corrugated cardboard in the agglomerate have a maximum dimension from 3 to 30 cm.

6. The method according to any one of the preceding claims **characterised in that** it comprises compacting the agglomerate in a mould until compacted blocks are obtained that, once dried, will result in lightweight blocks, or in an extruder until compacted profiles are obtained that, once dried, will result in lightweight profiles.

7. The method according to claim 6 **characterised in that** it comprises the additional step of machining said lightweight blocks or lightweight profiles.

8. A facility for implementing a method for manufacturing lightweight blocks or profiles comprising:

at least one mixer (80) provided with means for mixing and agglomerating scraps of corrugated cardboard of a predetermined maximum size with a bonding agent until an isotropic agglomerate is formed, and means for controlling the degree of humidity in said isotropic agglomerate in order not to destroy the mechanical resistance of the paper that the corrugated cardboard is made of;

at least one compactor (90, 91) provided with means for compacting said isotropic agglomerate by applying a compacting pressure, and means for controlling said compacting pressure so as not to crush flutes in the internal structure of the corrugated cardboard until compacted blocks or profiles are formed; and at least one drying oven (100) provided with means for applying heat to said compacted blocks or profiles until drying them, thereby obtaining lightweight blocks or profiles.

9. The facility according to claim 8 **characterised in that** it further comprises at least one shredder (70) provided with means for shredding the scraps of corrugated cardboard until they are cut down to said predetermined maximum size before they are fed to said mixer (80).

10. The facility according to claim 9 **characterised in that** it further comprises at least one vibrating bed provided with means for separating scraps of corrugated cardboard according to their weight.

11. The facility according to claim 8 **characterised in that** said compactor (90, 91) is selected between an extruder (90) provided with a die to form continuous or long compacted profiles and a mould compactor (91) provided with a mould to form separate compacted blocks.

12. A product obtained from scraps of corrugated cardboard comprising at least one body formed by an isotropic agglomerate of scraps of corrugated cardboard of a predetermined maximum size joined to each other through an adhesive product, wherein said scraps of corrugated cardboard in said isotropic agglomerate have an internal structure provided with flutes formed by at least one corrugated sheet of paper.

13. The product according to claim 12 **characterised in**

that said body has one or more moulded surfaces.

14. The product according to claim 12 **characterised in that** said body has the shape of a profile with a constant cross-section. 5
15. The product according to any one of claims 12 to 14 **characterised in that** said body has one or more machined surfaces that provide a complex configuration. 10

Patentansprüche

1. Verfahren zur Herstellung von leichten Blöcken oder Profilen, umfassend folgende Schritte: 15

das Mischen und das Agglomerieren von Wellpappeschnitzeln mit einer vorgegebenen maximalen Größe mit einem Bindemittel bis ein isotropes Agglomerat gebildet wird, und das Regulieren des Feuchtigkeitsgrads des genannten isotropen Agglomerats, um die mechanische Festigkeit des Papiers, aus welchem die Wellpappe besteht, nicht zu zerstören; 20

das Verdichten des genannten Agglomerats bis verdichtete Blöcke oder Profile gebildet werden, unter Anwendung eines regulierten Verdichtungsdrucks, um die Wellen in der inneren Struktur der Wellpappe nicht zu zerdrücken; und 25

das Trocknen der genannten verdichteten Blöcke oder Profile unter Anwendung von Hitze bis leichte Blöcke oder Profile erhalten werden. 30

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** es den Schritt des Zerkleinerns der Wellpappeschnitzel bis sie bis zu der genannten vorgegebenen maximalen Größe geschnitten werden, vor dem genannten Schritt des Mischens und Agglomerierens umfasst. 35 40

3. Verfahren nach den Ansprüchen 1 oder 2, **dadurch gekennzeichnet, dass** es das Hinzufügen von Wellpappepulver und anderen Wellpappepartikeln zu den Wellpappeschnitzeln und von Bindemittel in dem genannten Schritt des Mischens und Agglomerierens umfasst. 45

4. Verfahren nach den Ansprüchen 1, 2 oder 3, **dadurch gekennzeichnet, dass** das genannte Bindemittel mindestens ein haftendes Produkt und eine Lösungsmittel-Flüssigkeit umfasst. 50

5. Verfahren nach den Ansprüchen 1 oder 2, **dadurch gekennzeichnet, dass** mindestens 50 Gew.-% der Wellpappeschnitzel in dem Agglomerat eine maximale Größe von ca. 3 x 3 cm aufweist, und 5% bis 10 Gew.-% der Wellpappeschnitzel in dem Agglo- 55

merat eine maximale Abmessung von 3 bis 30 cm aufweisen.

6. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** es das Verdichten des Agglomerats in einer Form bis die verdichteten Blöcke erhalten werden umfasst, welche, wenn sie trocken sind, leichte Blöcke ergeben werden, oder in einer Strangpresse bis verdichtete Profile erhalten werden, welche, wenn sie trocken sind, leichte Profile ergeben werden.

7. Verfahren nach Anspruch 6, **dadurch gekennzeichnet, dass** es den zusätzlichen Schritt der Bearbeitung der genannten leichten Blöcke oder leichten Profile umfasst.

8. Anlage zur Ausführung eines Verfahrens zur Herstellung von leichten Blöcken oder Profilen, umfassend:

mindestens einen Mischer (80) versehen mit Mitteln für das Mischen und Agglomerieren von Wellpappeschnitzeln mit einer vorgegebenen maximalen Größe mit einem Bindemittel bis ein isotropes Agglomerat gebildet wird, und Mitteln für das Regulieren des Feuchtigkeitsgrads in dem genannten isotropen Agglomerat, um die mechanische Festigkeit des Papiers, aus welchem die Wellpappe besteht, nicht zu zerstören; 80

mindestens einen Verdichter (90, 91) versehen mit Mitteln für das Verdichten des genannten isotropen Agglomerats unter Anwendung eines Verdichtungsdrucks, 90 91

und Mitteln für das Regulieren des genannten Verdichtungsdrucks, um die Wellen in der inneren Struktur der Wellpappe nicht zu zerdrücken, bis verdichtete Blöcke oder Profile gebildet werden; und

mindestens einen Trocknungssofen (100) versehen mit Mitteln für die Anwendung von Hitze auf die genannten verdichteten Blöcke oder Profile bis sie trocken werden, wobei dadurch leichte Blöcke oder Profile erhalten werden. 100

9. Anlage nach Anspruch 8, **dadurch gekennzeichnet, dass** sie zusätzlich mindestens eine Zerkleinerungseinrichtung (70) umfasst, versehen mit Mitteln für das Zerkleinern von Wellpappeschnitzeln bis sie bis zu der genannten vorgegebenen maximalen Größe geschnitten werden, bevor sie dem genannten Mischer (80) zugeführt werden.

10. Anlage nach Anspruch 9, **dadurch gekennzeichnet, dass** sie zusätzlich mindestens ein Rüttelbett umfasst, versehen mit Mitteln für die Trennung von Wellpappeschnitzeln nach deren Gewicht.

11. Anlage nach Anspruch 8, **dadurch gekennzeichnet, dass** der genannte Verdichter (90, 91) aus einer Strangpresse (90) versehen mit einer Düse um durchgehende oder lange verdichtete Profile zu bilden und einem Formverdichter (91) versehen mit einer Form um gesonderte verdichtete Blöcke zu bilden, ausgewählt wird.
12. Produkt erhalten aus Wellpappeschnitzeln, umfassend mindestens einen Körper, welcher aus einem isotropen Agglomerat aus Wellpappeschnitzeln mit einer vorgegebenen maximalen Größe, die durch ein haftendes Produkt aneinander gefügt sind, gebildet ist, wobei die genannten Wellpappeschnitzel in dem genannten isotropen Agglomerat eine innere Struktur aufweisen, versehen mit Wellen, welche aus mindestens einem gewellten Papierbogen gebildet ist.
13. Produkt nach Anspruch 12, **dadurch gekennzeichnet, dass** der genannte Körper eine oder mehrere geformten Oberflächen aufweist.
14. Produkt nach Anspruch 12, **dadurch gekennzeichnet, dass** der genannte Körper die Gestalt eines Profils mit konstantem Querschnitt aufweist.
15. Produkt nach einem der Ansprüche 12 bis 14, **dadurch gekennzeichnet, dass** der genannte Körper eine oder mehrere bearbeitete Oberflächen aufweist, welche eine komplexe Ausbildung bereitstellen.

Revendications

1. Une méthode pour la fabrication de blocs ou de profils légers comportant les étapes suivantes:

mélanger et agglomérer des bouts de carton ondulé ayant une taille maximale prédéterminée au moyen d'un agent liant jusqu'à former un aggloméré isotrope et contrôler le degré d'humidité de cet aggloméré isotrope afin de ne pas détruire la résistance mécanique du papier dont le carton ondulé est fait;

compacter cet aggloméré jusqu'à former des blocs ou profils compactés en appliquant une pression de compactage contrôlée de sorte à ne pas écraser les cannelures de la structure interne du carton ondulé; et

sécher ces blocs ou profils compactés en appliquant de la chaleur jusqu'à obtenir des blocs ou profils légers.

2. La méthode conformément à la revendication 1, **caractérisée en ce qu'elle** comporte l'étape de déchiquetage des bouts de carton ondulé jusqu'à les ré-

duire à cette taille maximale prédéterminée avant ladite étape de mélange et d'agglomération.

3. La méthode conformément à la revendication 1 ou 2, **caractérisée en ce qu'elle** comporte l'addition de poudre de carton ondulé et autres particules de carton ondulé aux bouts de carton ondulé et l'agent liant dans cette étape de mélange et d'agglomération.

4. La méthode conformément à la revendication 1, 2 ou 3 **caractérisée en ce que** cet agent liant comporte au moins un produit adhésif et un liquide solvant.

5. La méthode conformément à la revendication 1 ou 2, **caractérisée en ce qu'elle** au moins 50% du poids des bouts de carton ondulé de l'aggloméré ont une taille maximale d'aux alentours de 3 x 3 cm, et 5% à 10% du poids des bouts de carton ondulé de l'aggloméré ont une taille maximale de 3 à 30 cm.

6. La méthode conformément à une quelconque des revendications précédentes, **caractérisée en ce qu'elle** comporte le compactage de l'aggloméré dans un moule jusqu'à obtenir des blocs compactés qui, une fois sec, deviendront des blocs légers ou dans une extrudeuse jusqu'à obtenir des profils compactés qui, une fois secs, deviendront des profils légers.

7. La méthode conformément à la revendication 6, **caractérisée en ce qu'elle** comporte l'étape complémentaire d'usinage de ces blocs légers ou profils légers.

8. Une installation pour la mise en oeuvre d'une méthode pour fabriquer des blocs ou de profils légers comportant:

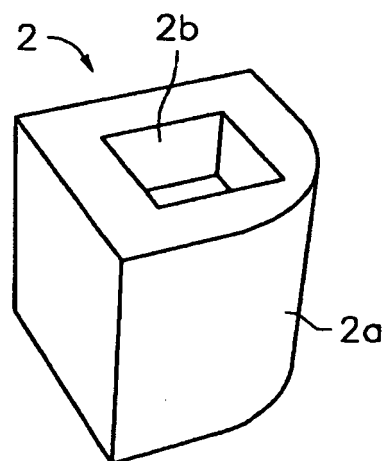
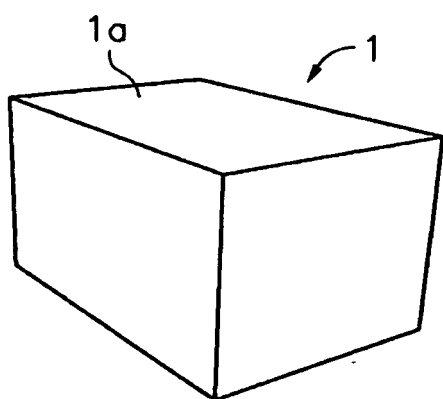
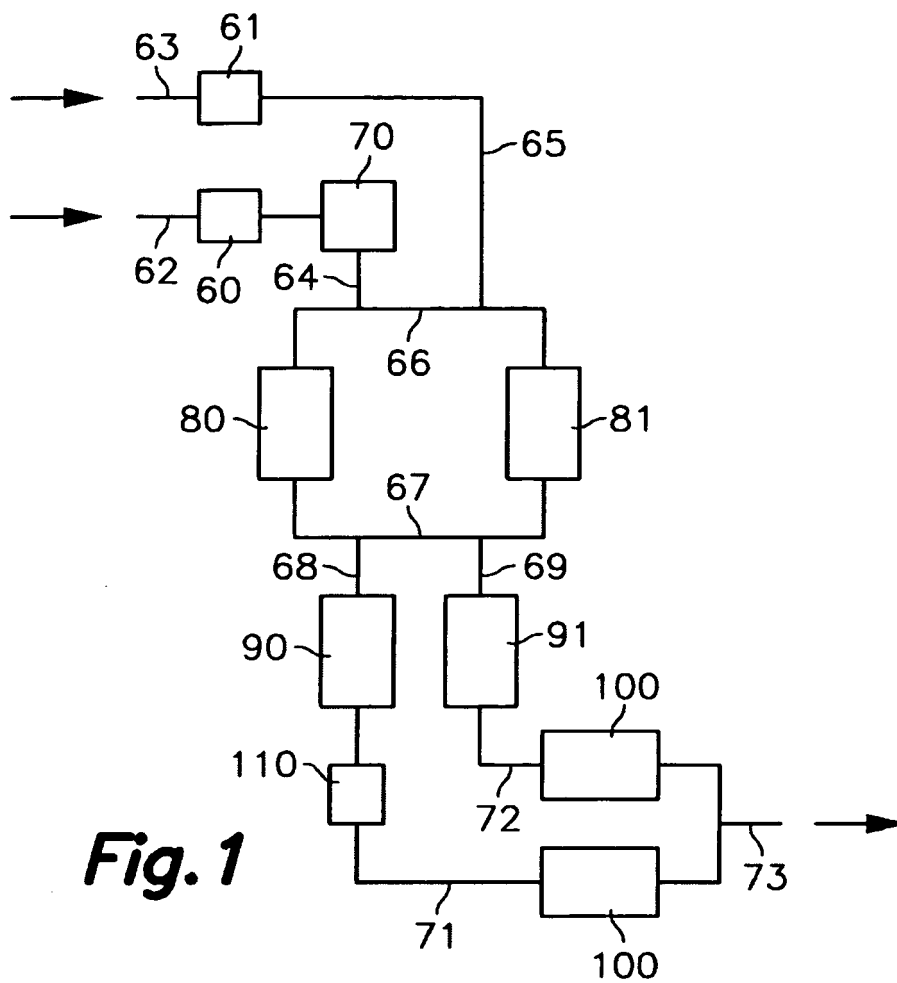
au moins un malaxeur (80) pourvu de moyens pour mélanger et agglomérer des bouts de carton ondulé ayant une taille maximale prédéterminée avec un agent liant jusqu'à former un aggloméré isotrope et des moyens pour contrôler le degré d'humidité de cet aggloméré isotrope afin de ne pas détruire la résistance mécanique du papier dont est fait le carton ondulé;

au moins un compacteur (90, 91) pourvu de moyens pour compacter cet aggloméré isotrope en appliquant une pression de compactage et des moyens pour contrôler cette pression de compactage de sorte à ne pas écraser les cannelures de la structure intérieure du carton ondulé jusqu'à ce que des blocs ou des profils compactés sont formés; et

au moins un four de séchage (100) pourvu de moyens pour appliquer de la chaleur à ces blocs ou profils compactés jusqu'à les sécher, en ob-

tenant ainsi des blocs ou profils légers.

9. L'installation conformément à la revendication 8, **caractérisée en ce qu'elle** comprend en plus, au moins une déchiqueteuse (70) pourvue de moyens pour déchiqueter les bouts de carton ondulé jusqu'à les réduire à cette taille maximale prédéterminée avant d'en alimenter ce malaxeur (80). 5
10. L'installation conformément à la revendication 9 **caractérisée en ce qu'elle** comporte au moins un lit vibrant pourvu de moyens pour séparer les bouts de carton ondulé selon leur poids. 10
11. L'installation conformément à la revendication 8 **caractérisée en ce que** ce compacteur (90, 91) est sélectionné entre une extrudeuse (90) pourvue d'une matrice pour former des profils compactés continus ou longs et un compacteur à moule (91) pourvu d'un moule pour former des blocs compactés séparés. 15
20
12. Un produit obtenu de bouts de carton ondulé comportant au moins un corps formé par un aggloméré isotrope de bouts de carton ondulé ayant une taille prédéterminée, unis les uns aux autres au moyen d'un produit adhésif, dans lequel ces bouts de carton ondulé de cet aggloméré isotrope possèdent une structure interne pourvue de cannelures formées par au moins une feuille en papier ondulé. 25
30
13. Le produit conformément à la revendication 12, **caractérisé en ce que** ce corps possède une ou plusieurs surfaces moulées. 35
14. Le produit conformément à la revendication 12, **caractérisé en ce que** ce corps a la forme d'un profil ayant une coupe transversale constante. 40
15. Le produit conformément à une quelconque des revendications 12 à 14, **caractérisé en ce que** ce corps possède une ou plusieurs surfaces usinées offrant une configuration complexe. 45
50
55



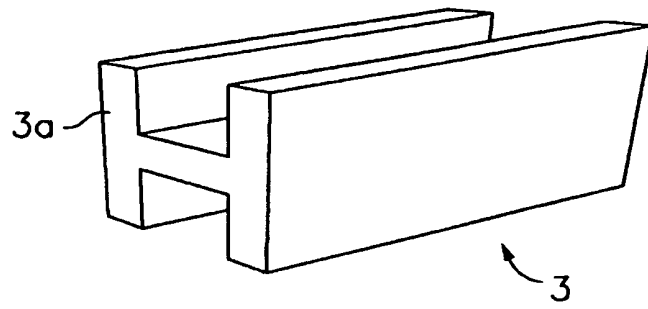


Fig. 4

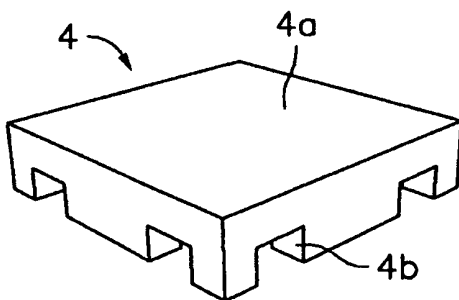


Fig. 5

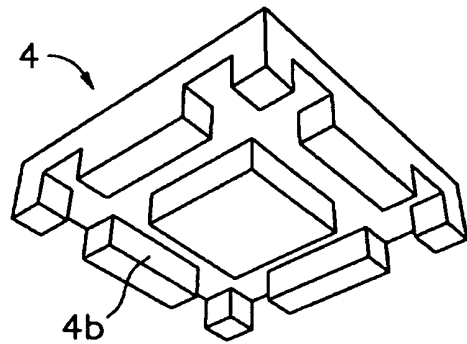


Fig. 6

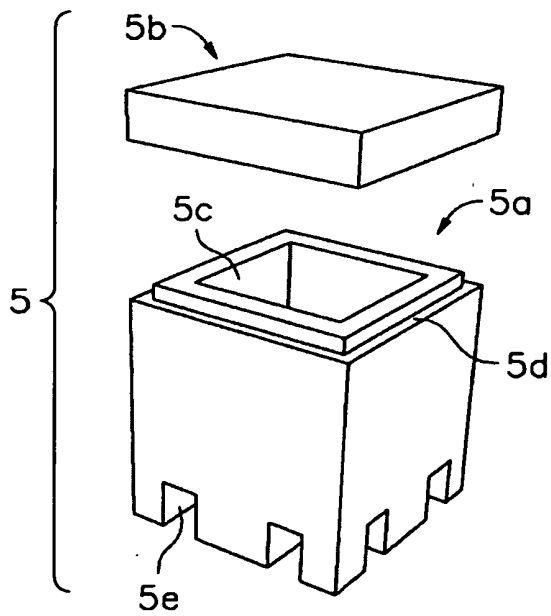


Fig. 7

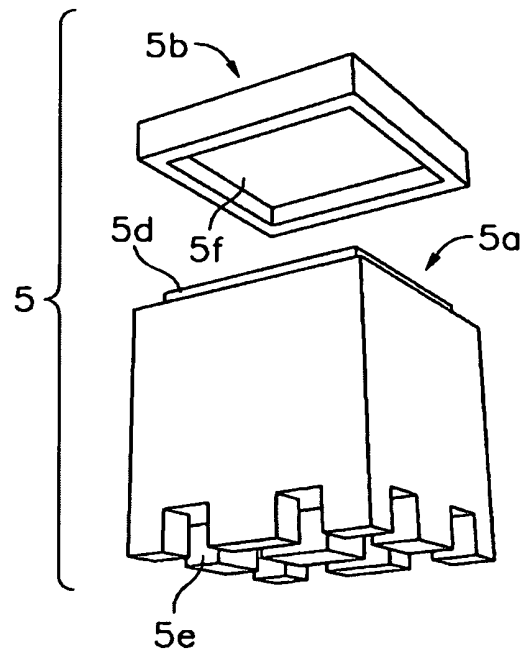


Fig. 8

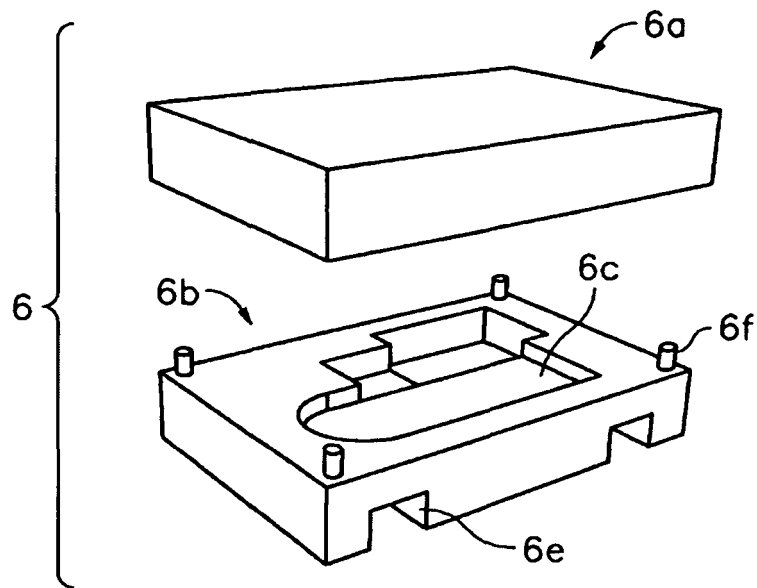


Fig. 9

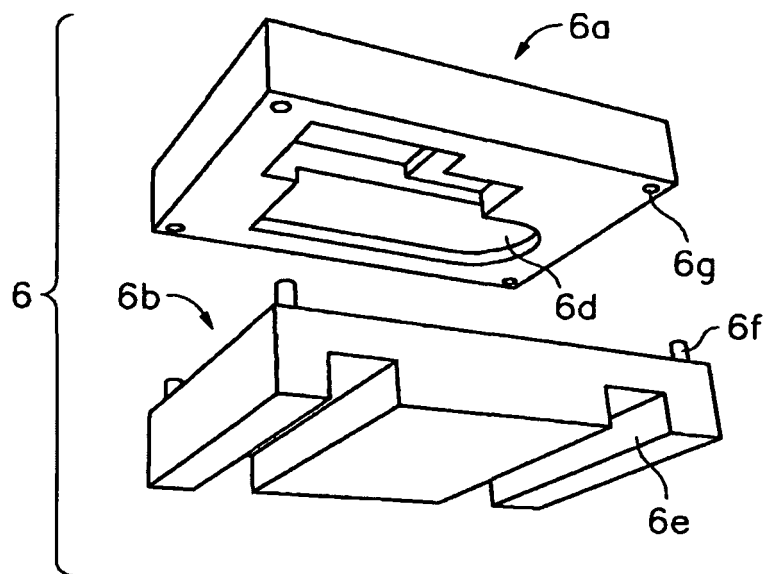


Fig. 10

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

- EP 0927614 A [0003]
- ES 1007170 U [0005] [0006]