



(22) **Date de dépôt/Filing Date:** 2007/01/11

(41) **Mise à la disp. pub./Open to Public Insp.:** 2007/07/26

(62) **Demande originale/Original Application:** 2 637 244

(30) **Priorités/Priorities:** 2006/01/20 (US60/760,500);
2006/08/21 (US11/507,366); 2006/08/31 (US11/514,303)

(51) **Cl.Int./Int.Cl.** **C08J 5/06** (2006.01),
A47G 27/00 (2006.01), **C08J 3/20** (2006.01),
C08K 3/26 (2006.01), **C08K 3/36** (2006.01),
C08K 7/02 (2006.01), **C08L 75/04** (2006.01),
E04C 2/24 (2006.01), **E04F 13/16** (2006.01),
E04F 15/00 (2006.01)

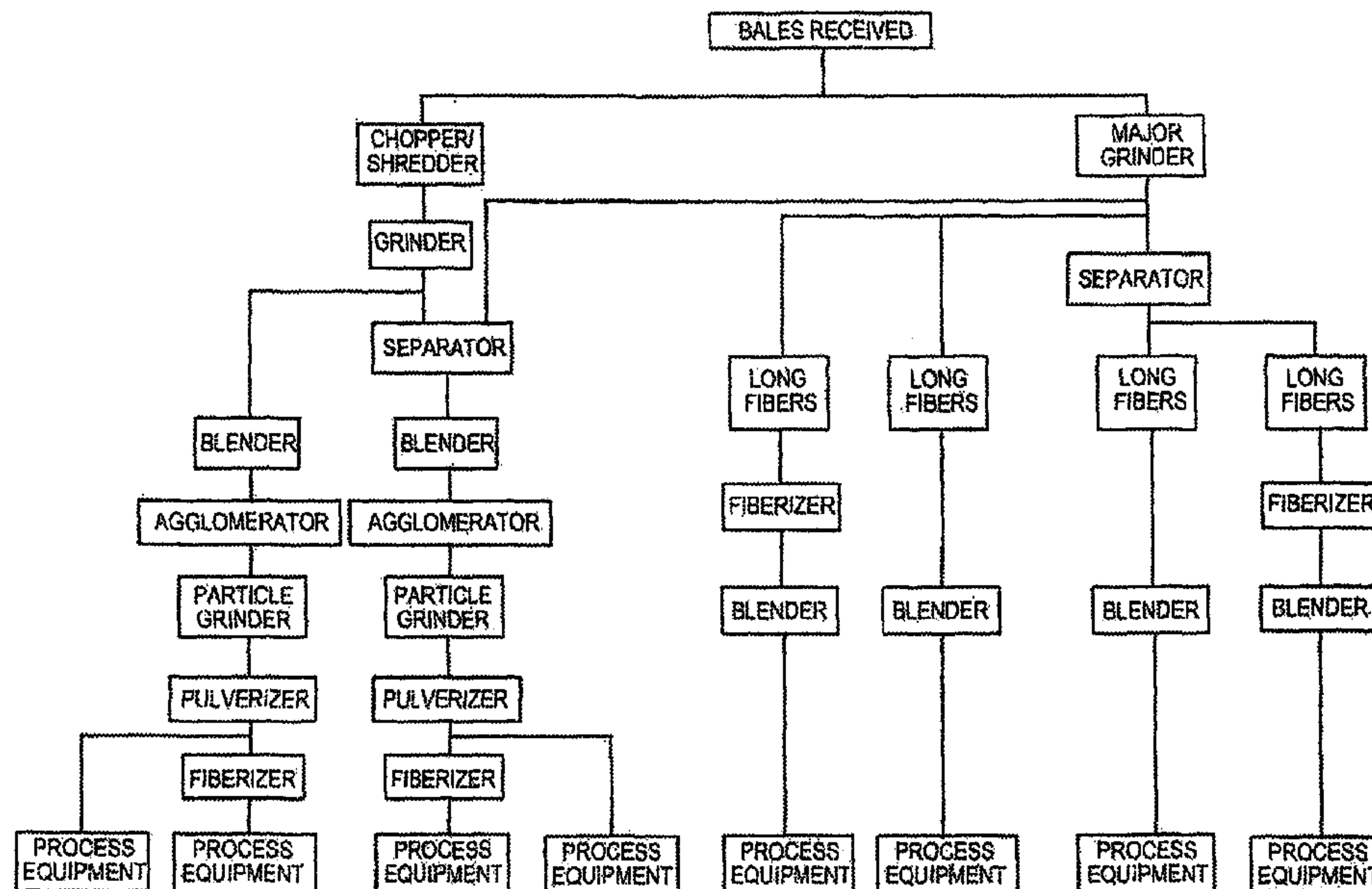
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(54) **Titre :** COMPOSITE CONSTITUE DE DECHETS DE REVETEMENTS DE SOL

(54) **Title:** CARPET WASTE COMPOSITE



(57) **Abrégé/Abstract:**

A composite material produced from carpet waste and a binding agent, in intimate association, which material includes 25% and 99% carpet waste and between 1 and 25% binding agent. A method for manufacturing the composite material is also disclosed.



Abstract:

A composite material produced from carpet waste and a binding agent, in intimate association, which material includes 25% and 99% carpet waste and between 1 and 25% binding agent. A method for manufacturing the composite material is also disclosed.

CARPET WASTE COMPOSITE

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BACKGROUND

The general field of this invention is natural and manmade fiber composites which are used in various industrial and consumer applications.

Natural and manmade fiber composites can be used in building construction, industrial applications, consumer goods, automotive products, and other industries requiring moisture or thermal resistance with various physical properties, such as low moisture absorbance and low thermal distortion. The ability to build composites of this nature, while controlling physical properties such as strength, stiffness, ductility, impact resistance, and hardness, opens a variety of application opportunities.

Additionally, there is growing pressure to re-utilize waste streams which are high in volume and low in degradability. In particular the manufacture, installation, use and (eventually) replacement of floor covering products, especially carpeting, produces a large amount of waste product. Carpet waste from new carpet production, post-consumer landfill or other used carpet applications is a several billion pound-per-year waste problem. The industry generally uses the term "selvedge" for waste material generated during the manufacturing process while other forms of manufacturing and installation waste are sometimes termed "scrap". We use the term carpet waste to cover all types of waste produced by the manufacture, installation, use and replacement of floor covering products. Often, carpet waste is not recycled, but rather is disposed of by land-filling or burning.

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SUMMARY

We have discovered a composite material produced from carpet waste and a binding agent.

The first aspect of this invention is a process for converting carpet waste with or without additional fibers and/or fillers and combining it with binding agents to produce a composite material. More specifically the invention is its general form features a composite material comprising carpet waste and a binding agent in intimate association, where the

composite material includes between 25% and 99% carpet waste and between 1 and 25% binding agent.

In accordance with one aspect of the invention, there is provided a composite material comprising: carpet waste comprising a combination of nylon fibers, polyester fibers, and polypropylene fibers exhibiting different physical and processing properties; an added inorganic filler; and a binding agent in intimate association, the composite material comprising between 25% and 99% carpet waste and between 1% and 25% binding agent, wherein (i) the binding agent comprises one or more of methylenediphenyldiisocyanate (MDI), urea formaldehyde (UF), melamine urea formaldehyde (MUF), and phenol formaldehyde (PF); and (ii) the composite material comprises fibers consisting essentially of a highest melting point fiber of the carpet waste.

Preferably, the sum of the carpet waste and the binding agent are between 50% and 99% of the total material, and the composite material also includes from 0-50% natural fibers or manmade fiber fibers (such as oriented fiberglass), or a combination of manmade and natural fibers. The composite material may also include at least one inorganic filler such as calcium carbonate or silica. Additionally, the composite material may also include special additives that result in favorable physical property attributes. Flame retardants and/or mold inhibitors can be added at levels of 0-25% (preferably levels of 0-10%) of the total material. Flame retardants that could be used, but are not limited to, are Occidental's Dechlorane Plus, Ferro's Pyrochek 68PB, and Great Lakes PO-64P. The flame retardants may or may not also require a Sb302 synergizer to be used. Mold Inhibitors that could be used at the same levels, include but are not limited to, are Zinc Borate and Rohm & Haas Vinyzene mold inhibitor. Scientifically, the carpet waste includes all carpet components substantially without segregation from one another. For example, the carpet waste comprises carpet backing in an amount equal to at least 10% (by weight) of the composite material and/or it comprises carpet face polymers, such as nylon, polyester, polypropylene and wool.

Also preferably, the modulus of elasticity of the composite material is at least 55,000 PSI by ASTM test D790, more preferably at least 100,000 PSI by ASTM test D790. Preferably the modulus of rupture of the composite material is at least 600 PSI by ASTM

D790, more preferably between 1000 and 2500 PSI by ASTM D790. Preferably the density of the composite material is at least 30 pounds per ft³.

In accordance with another aspect of the invention, there is provided a method of manufacturing a composite material comprising: a) providing carpet waste comprising a
5 combination of nylon fibers, polyester fibers, and polypropylene fibers exhibiting different physical and processing properties; b) preparing the carpet waste by subjecting the carpet waste to size-reduction treatment; c) combining the size-reduced carpet waste with an inorganic filler and a binding agent comprising one or more of:
methylenediphenyldiisocyanate (MDI), urea formaldehyde (UF), melamine urea
10 formaldehyde (MUF), and phenol formaldehyde (PF); and d) subjecting the carpet waste, inorganic filler and binding agent combination to pressure and elevated temperature in a confined geometry to produce a composite material comprising carpet waste, inorganic filler, and binding agent in intimate association, the composite material comprising between 25% and 99% carpet waste and between 1% and 25% binding agent, wherein the composite
15 material comprises fibers consisting essentially of a highest melting point fiber of the carpet waste.

Preferably the size reduction step comprises one or more of the following processes: chopping; shredding; grinding; contaminant separating; palletizing; agglomerating; pulverizing; fine grinding; and/or fiberizing the carpet waste. (For example, the carpet waste
20 and configured to densify the material.)

The size-reduced carpet waste and binder are combined in a drum to coat the waste with binder. The binder/carpet waste combination is subjected to heat and pressure in a continuous belted press or in a stationary press.

Optionally, a further layer is applied to a surface of the composite sheet thus
25 manufactured, for example, the further layer is a laminated layer or a foil-transfer layer, or the further layer is a paint, a stain or a polymeric compound. The further layer may be molded or embossed to create a patterned surface on the composite material. Optionally, the further layer may be a wood veneer, a synthetic veneer, and/or a polymeric sheet. The surface of the composite material is prepared by means of mechanical or chemical methods,

followed by foil or film lamination of the further layer. The further layer may include a hot-stamped layer.

The composite material thus formed maybe thermoformed into a desired shape. The further layers may be a foil or film laminate.

5 At least one layer of the composite material may be sanded.

In accordance with another aspect of the invention, there is provided a method of manufacturing a composite material comprising: a) providing carpet waste; b) preparing the carpet waste by subjecting the carpet waste to size-reduction treatment; c) combining the size-reduced carpet waste with an inorganic filler and a binding agent comprising one or
10 more of: methylenediphenyldiisocyanate (MDI), urea formaldehyde (UF), melamine urea formaldehyde (MUF), and phenol formaldehyde (PF); d) subjecting the carpet waste, inorganic filler, and binding agent combination to pressure and elevated temperature in a confined geometry to produce a composite material comprising carpet waste, inorganic filler, and binding agent in intimate association, the composite material comprising between 25%
15 and 99% carpet waste and between 1% and 25% binding agent; and e) applying a layer to a surface of the composite material, wherein the layer is molded or embossed to create a patterned surface on the composite material.

In accordance with another aspect of the invention, there is provided a method of manufacturing a composite material comprising: a) providing carpet waste; b) preparing the
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25 confined geometry to produce a composite material comprising carpet waste, inorganic filler, and binding agent in intimate association, the composite material comprising between 25% and 99% carpet waste and between 1% and 25% binding agent; and e) applying a layer to a surface of the composite material, wherein the layer comprises a foil or film laminate.

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carpet waste by subjecting the carpet waste to size-reduction treatment; c) combining the size-reduced carpet waste with an inorganic filler and a binding agent comprising one or more of: methylenediphenyldiisocyanate (MDI), urea formaldehyde (UF), melamine urea formaldehyde (MUF), and phenol formaldehyde (PF); d) subjecting the carpet waste,
5 inorganic filler, and binding agent combination to pressure and elevated temperature in a confined geometry to produce a composite material comprising carpet waste, inorganic filler, and binding agent in intimate association, the composite material comprising between 25% and 99% carpet waste and between 1% and 25% binding agent; e) preparing the surface of the composite material and subjecting the surface of the composite material to mechanical or
10 chemical preparation; and f) applying a layer to a surface of the composite material, wherein the layer comprises a foil or film laminate.

In accordance with another aspect of the invention, there is provided a method of manufacturing a composite material comprising: a) providing carpet waste; b) preparing the carpet waste by subjecting the carpet waste to size-reduction treatment; c) combining the
15 size-reduced carpet waste with an inorganic filler and a binding agent comprising one or more of: methylenediphenyldiisocyanate (MDI), urea formaldehyde (UF), melamine urea formaldehyde (MUF), and phenol formaldehyde (PF); d) subjecting the carpet waste, inorganic filler, and binding agent combination to pressure and elevated temperature in a confined geometry to produce a composite material comprising carpet waste, inorganic filler,
20 and binding agent in intimate association, the composite material comprising between 25% and 99% carpet waste and between 1% and 25% binding agent; and e) applying a layer to a surface of the composite material, wherein the layer comprises a hot-stamped layer.

In accordance with another aspect of the invention, there is provided a method of manufacturing a composite material comprising: a) providing carpet waste; b) preparing the
25 carpet waste by subjecting the carpet waste to size-reduction treatment; c) combining the size-reduced carpet waste with an inorganic filler and a binding agent comprising one or more of: methylenediphenyldiisocyanate (MDI), urea formaldehyde (UF), melamine urea formaldehyde (MUF), and phenol formaldehyde (PF); d) subjecting the carpet waste, inorganic filler, and binding agent combination to pressure and elevated temperature in a
30 confined geometry to produce a composite material comprising carpet waste, inorganic filler,

and binding agent in intimate association, the composite material comprising between 25% and 99% carpet waste and between 1% and 25% binding agent; and e) applying a layer to a surface of the composite material, wherein at least one of the layer and the surface is sanded.

In accordance with another aspect of the invention, there is provided a method of
5 manufacturing a composite material comprising: a) providing carpet waste; b) preparing the carpet waste by subjecting the carpet waste to size-reduction treatment comprising one or more of: chopping; shredding; grinding; contaminant separating; pelletizing; agglomerating; pulverizing; fine grinding; and fiberizing; and spinning and forcing the carpet waste under pressure through orifices sized and configured to densify the size-reduced carpet waste; c)
10 combining the size-reduced carpet waste with an inorganic filler and a binding agent comprising one or more of: methylenediphenyldiisocyanate (MDI), urea formaldehyde (UF), melamine urea formaldehyde (MUF), and phenol formaldehyde (PF); and d) subjecting the carpet waste, inorganic filler, and binding agent combination to pressure and elevated temperature in a confined geometry to produce a composite material comprising carpet
15 waste, inorganic filler, and binding agent in intimate association, the composite material comprising between 25% and 99% carpet waste and between 1% and 25% binding agent.

In accordance with another aspect of the invention, there is provided a composite material comprising: carpet waste comprising a combination of nylon fibers, polyester fibers, and polypropylene fibers exhibiting different physical and processing properties; an added
20 inorganic filler; a binding agent in intimate association with the carpet waste, wherein the binding agent comprises one or more of methylenediphenyldiisocyanate (MDI), urea formaldehyde (UF), melamine urea formaldehyde (MUF), and phenol formaldehyde (PF); and a layer on a surface of the composite material, wherein (i) the layer is molded or embossed to create a patterned surface on the composite material, (ii) the composite material
25 comprises between 25% and 99% carpet waste and between 1% and 25% binding agent, and (iii) the composite material comprises fibers consisting essentially of a highest melting point fiber of the carpet waste.

In accordance with another aspect of the invention, there is provided a composite material comprising: carpet waste comprising a combination of nylon fibers, polyester fibers,
30 and polypropylene fibers exhibiting different physical and processing properties; an added

inorganic filler; a binding agent in intimate association with the carpet waste, wherein the binding agent comprises one or more of methylenediphenyldiisocyanate (MDI), urea formaldehyde (UF), melamine urea formaldehyde (MUF), and phenol formaldehyde (PF); and a layer on a surface of the composite material, wherein (i) the layer comprises a foil or film laminate, (ii) the composite material comprises between 25% and 99% carpet waste and between 1% and 25% binding agent, and (iii) the composite material comprises fibers consisting essentially of a highest melting point fiber of the carpet waste.

In accordance with another aspect of the invention, there is provided a composite material comprising: carpet waste comprising a combination of nylon fibers, polyester fibers, and polypropylene fibers exhibiting different physical and processing properties; an added inorganic filler; a binding agent in intimate association with the carpet waste, wherein the binding agent comprises one or more of methylenediphenyldiisocyanate (MDI), urea formaldehyde (UF), melamine urea formaldehyde (MUF), and phenol formaldehyde (PF); and a layer on a surface of the composite material, wherein (i) the layer comprises a hot-stamped layer, (ii) the composite material comprises between 25% and 99% carpet waste and between 1% and 25% binding agent, and (iii) the composite material comprises fibers consisting essentially of a highest melting point fiber of the carpet waste.

In accordance with another aspect of the invention, there is provided a composite material comprising: carpet waste comprising a combination of nylon fibers, polyester fibers, and polypropylene fibers exhibiting different physical and processing properties; an added inorganic filler; a binding agent in intimate association with the carpet waste, wherein the binding agent comprises one or more of methylenediphenyldiisocyanate (MDI), urea formaldehyde (UF), melamine urea formaldehyde (MUF), and phenol formaldehyde (PF); and a layer on a surface of the composite material, wherein (i) at least one of the layer and the surface is sanded, (ii) the composite material comprises between 25% and 99% carpet waste and between 1% and 25% binding agent; and (iii) the composite material comprises fibers consisting essentially of a highest melting point fiber of the carpet waste.

In accordance with another aspect of the invention, there is provided a composite adapted for use as a building material, the composite comprising: processed carpet waste, wherein the processed carpet waste comprises (i) a reduced amount of inorganic filler present

within an unprocessed carpet waste; and (ii) a melted polypropylene and an unmelted nylon; an added inorganic filler; and between about 2% and about 10% binding agent by weight of the composite.

5 In accordance with another aspect of the invention, there is provided a method of manufacturing a composite adapted for use as a building material, the method comprising the steps of: applying heat and pressure to a processed carpet waste, an added inorganic filler, and a binding agent to form the composite at a temperature and for a time period sufficient to melt a plurality of materials comprising the processed carpet waste; and cooling the composite while applying pressure to the composite.

10 In accordance with another aspect of the invention, there is provided a method of manufacturing a composite adapted for use as a building material, the method comprising the steps of: applying heat and pressure to a processed carpet waste, an added inorganic filler, and a binding agent to form the composite material; and cooling the composite material while applying pressure to the composite material; wherein the step of applying heat and pressure
15 occurs in a first cycle press, and wherein the step of cooling the composite while applying pressure occurs in a second cycle press.

In accordance with another aspect of invention, there is provided a method of manufacturing a composite adapted for use as a building material, the method comprising the steps of: processing a carpet waste to obtain a processed carpet waste; applying heat and
20 pressure to the processed carpet waste, an added inorganic filler, and a binding agent to form the composite; and actively cooling the composite while applying pressure to the composite, wherein the composite is cooled under pressure for a time period and to a reduced temperature sufficient to reduce warping of the composite.

In accordance with another aspect of invention, there is provided a composite building
25 material comprising: a processed carpet waste comprising a reduced amount of inorganic filler relative to an amount present within an unprocessed carpet waste; and a binding agent in intimate association with the processed carpet waste.

In accordance with another aspect of invention, there is provided a method of producing a composite building material, the method comprising the steps of: providing a processed carpet waste comprising a reduced amount of inorganic filler relative to an amount present within an unprocessed carpet waste; mixing the processed carpet waste with a binding agent to produce a carpet waste mixture; and heating and pressing the carpet waste mixture to form the composite building material.

In accordance with another aspect of invention, there is provided a composite building material comprising: a carpet waste; an inorganic filler in addition to any filler present within the carpet waste and any synthetic fiber filler; and a binding agent in intimate association with the carpet waste and the inorganic filler.

In accordance with another aspect of invention, there is provided a method of producing a composite building material, the method comprising the steps of: providing a carpet waste; providing an inorganic filler, wherein the inorganic filler is in addition to any filler present within the carpet waste and any synthetic fiber filler; mixing the carpet waste and the inorganic filler with a binding agent to produce a carpet waste mixture; and heating and pressing the carpet waste mixture to form the composite building material.

In accordance with another aspect of invention, there is provided a composite building material comprising: a sheet having a first exterior surface and a second exterior surface defining a thickness, the sheet comprising a substantially homogeneous mixture from the first surface across the thickness to the second surface, the sheet comprising: a carpet waste; an added inorganic filler; and a binding agent in intimate association with the carpet waste and the added inorganic filler, wherein at least one of the first exterior surface and the second exterior surface comprises at least one surface feature selected from the group consisting of a molded patterned surface, an embossed patterned surface, and a hot-stamped layer.

In accordance with another aspect of invention, there is provided a method of producing a composite building material, the method comprising: providing a carpet waste; providing an inorganic filler; mixing the carpet waste and the inorganic filler with a binding agent to produce a carpet waste mixture; and heating and pressing the carpet waste mixture to

form the composite building material comprising a sheet having a first exterior surface and a second exterior surface defining a thickness, the sheet comprising a substantially homogeneous mixture from the first surface across the thickness to the second surface, wherein at least one of the first exterior surface and the second exterior surface comprises at least one surface feature selected from the group consisting of a molded patterned surface, an embossed patterned surface, and a hot-stamped layer.

The details of one or more embodiments of the invention are set forth in the accompanying drawings and the description below. Other features, objects, and advantages of the invention will be apparent from the description and drawings, and from the claims.

DESCRIPTION OF DRAWINGS

Fig. 1 is flow chart depicting the types of size reduction equipment and the variety of size reduction procedures depending on the final carpet waste material form required for the process equipment. Fig. 2 depicts steps for coating the carpet waste material with the bonding agent and subsequent forming process.

Fig. 3 depicts steps for finishing the composite board product.

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DETAILED DESCRIPTION

A generic composition of the carpet waste product produced by the invention follows:

	<u>Material Description</u>	<u>Percent of material in composition</u>
	Carpet Waste	25% - 99%
10	Binding Agents	1% - 25%
	Wood or natural fibers, Synthetic fibers; Inorganic fillers, Reinforcing fillers	0% - 50%
	Flame Retardants	0% - 25%
15	Mold Inhibitors	0% - 25%

There are two basic steps in the production of composite material from carpet waste. Fig. 1 shows the types of equipment and the variety of procedures depending on the final form required for the Process Equipment. The final form may also be dependent on the desired finished composite product and physical properties to be attained in the process.

First, the carpet waste is processed as described below to reduce its size. Then the size-reduced carpet waste is mixed with a binder to produce material that is subjected to temperature and/or pressure, by a panel/sheet/board process, to yield composite material.

Below we describe both steps in detail. We then describe post-manufacture treatments for the composite material.

Carpet Waste Size Reduction

The carpet waste is made up of selvedge, post-industrial carpet waste, post-consumer waste carpet, or waste carpet reclaimed from landfills. These materials will be in baled form to begin the size reduction phase of the pre-processing. The bales vary in size but usually represent about 1000 lb. to 2000 lb.

The first step is to reduce the waste to a manageable size for the rest of the process. Either a combination of a shredder/chopper and grinder, or a major capacity grinder is used to process the materials to smaller sizes. The shredder/chopper will reduce the selvedge or carpet waste to chunks approximately three inches square (3" x 3"). The shredded material then passes through a grinder which further reduces the chunks a fiber fluff material with a

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5 diameter of the fibers similar to the diameter of the original carpet fibers and a length of about $\frac{3}{4}$ " to 1".

The waste optionally can be run through a separator which acts as a hammer mill/cyclone to remove the dirt from the carpet waste. In this step some of the carpet backing containing inorganic fillers may also be removed. The slightly size reduced
10 material, due to the hammer mill effect, is ready for the next step, the agglomeration process. The dirt and carpet backing materials that have been removed from the small chunks are then disposed.

The fiber fluff, regardless of the use of the separator or not, optionally can be blended with other materials such as wood or natural fibers, synthetic fibers (i.e. fiberglass),
15 inorganic fillers, other reinforcing fillers, flame retardants and mold inhibitors. The fiber fluff material or the blended material is then conveyed to the agglomeration step.

The agglomeration of the above materials occurs inside the agglomerator. The materials enter a horizontal drum containing a revolving rotor. The rotor is shaped so as to force the fiber fluff or blends against the drum wall. The drum wall is perforated so that, as
20 the rotor forces the contained materials against the perforated wall, the material is forced through the perforations forming strands of a fixed diameter. On the outside of the drum are stationary knives which cut the strands into a fixed length. During this process the material is heated by friction to a temperature that remains below the melting point of the highest melting point material in the blend. The temperature is controlled by the speed of the rotor,
25 the diameter of the perforations, and the thickness of the drum wall.

The granules that are formed in the agglomeration step are cylindrical in shape and approximately $\frac{1}{8}$ inch in diameter and $\frac{1}{8}$ to $\frac{1}{4}$ inch long. The diameter and length of the granules can be changed by changing the diameter of the holes in the drum wall and/or changing the speed of the knives rotation. Because the granules are hot when they are
30 formed and cut to length some of the granules are stuck to one another. Therefore, for better size consistency, the granules next pass through a grinder which breaks the granules away from each other. This grinder step may also be used to reduce the size of the granules.

The granules may be further reduced in size by a pulverizer. If the final desired dimension is less than $\frac{1}{8}$ inch the pulverizer is used to reduce the particle size to 8-16
35 mesh. This is the equivalent of 0.04 inch to 0.10 inch.

One last optional step may now be performed, to fiberize the granules or the pulverized particles. The fiberizing is a mechanical roughing of the surface so that the

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5 surface takes on a "fuzz" like characteristic. This can be an important final preparation for the composite product process described below in the Process Description. The material, whether granule or pulverized particle, whether fiberized or not, is now sent on to the composite production process.

10 An alternative method for initial size reduction is to use a major capacity grinder which reduces the carpet waste to fibers approximately $\frac{1}{4}$ inch to 1 inch in length and approximately $\frac{1}{32}$ inch to $\frac{1}{8}$ inch in diameter. These random sized fibers are ready for the agglomeration process or for alternative actions not requiring agglomeration.

15 Regardless of the process direction, the next step is to pass the material through a separator. This is the same equipment and effect as described above. As above, this is an optional step in the material preparation phase being described here. The fibers may now go through the agglomeration process in the exact same manner as described above, or the fibers may pass directly to the fiberizer equipment. Again the fiberizer acts to change the surface characteristics of the fibers giving them a "fuzz" surface with greater surface area and a different bulk density. The fiberizing step may not be required for all end uses of the composite products.

20 Whether the fibers have been fiberized or not, they will pass through a blender where wood or natural fibers, synthetic fibers (i.e. fiberglass), inorganic fillers, mineral fillers (if any), flame retardants, and mold inhibitors may be added. Once the blending of the fibers and added materials is complete, the blend is ready for the composite product Process.

25 The composite product composition is controlled by controlling the above steps. Significantly, it typically is not necessary to separate or classify the various materials contained in selvedge or carpet waste. Most carpet surface materials are nylons, polyester, polypropylene, or wool. The backing material is usually polypropylene and/or highly filled synthetic latex. These materials exhibit considerably different physical properties and processing properties. The entire waste product may be used regardless of the differences in the materials. However, if desired, the carpet waste can be separated by face fiber type and processed. For example, a panel can be made of 100% Nylon 6 face fiber carpet waste. A panel can also be made by blending different face fiber carpet waste together at a controlled ratio of each type to create a panel. For example, a panel could be made of 50% Polyester face fiber carpet waste and 50% Polypropylene face fiber carpet waste.

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5 The waste carpet, having been made into an agglomerate, a fiberized agglomerate, a pulverized agglomerate, or a fiberized, pulverized agglomerate, becomes the base material for the composite product. Waste fiber or fiberized waste fiber may also be used to manufacture a composite product. The whole range of materials in carpet waste may be part of the composition.

10 The other major part of the composition is a binding agent. The binding function can be accomplished using methylenediphenyldiisocyanate (MDI), urea formaldehyde (UF), melamine urea formaldehyde (MUF), phenol formaldehyde (PF) or a combination thereof. Other binders may be used depending on factors such as compatibility, cost and environmental issues. The binding agent acts as a glue for the fibers or agglomerated
15 materials to give the basis for the composite products. The ratio of the binding agent to the fibers or particles is a determinant in the physical properties attained in the Process. Further, the physical properties are modified by the use of wood and natural fibers, synthetic fibers, inorganic fillers, reinforcing fillers, flame retardants and mold inhibitors.

 The binding agent and carpet waste materials comprise at least 50% of the
20 composition and may make up 100% of the final product. The binding agent content is between 1% and 25% leaving the remainder of the material to be carpet waste and added materials. The added materials, wood and natural fibers, synthetic fibers, inorganic fillers, reinforcing fillers, flame retardants, and mold inhibitors may make up to 50% of the total composition. However, the basic material is usually a 9:1 ratio of carpet waste to binding
25 agent with any added materials being around 25% of the carpet waste/binding agent content.

 In summary, the composition of carpet waste and binding agent (with or without additive materials) can be used to make a wide range of composite products. The carpet waste includes all of the carpet product including all the different types of face fibers and the carpet backing.

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Coating the Carpet Waste Material with the Binding Agent

 The carpet waste material may have the form of granules (pellets or particles), or of the fibrous waste material or fiberized versions of the granules or fibrous material. The carpet waste materials are generally loaded into a large rotating drum or a drum with
35 rotating mixing blades or a resination blow line. Other materials such as natural fiber fillers, inorganic fillers, flame retardants, and mold inhibitors may be loaded with the carpet waste material. If the material is loaded into a drum, then water and/or a binding agent are

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5 sprayed out of the head inside of the drum to thoroughly coat the materials. While the drum and/or blades are spinning and causing the material held within to become evenly distributed, the spray head is releasing a fine mist of water or binding agent. This results in a thoroughly coated material. Water is usually sprayed into the drum to achieve a desired moisture content for the material and prepare the material for the binding agent. The
10 binding agent is usually sprayed after the water to make sure that it reacts and thoroughly coats the material in the drum. For the resination blow line method, the material is blown through a tube that has water and binding agent introduced into it. The blowing action cause the air to become turbulent which allows the water and binding agent to evenly coat the material. The binding agent is applied in this manner to the granules or fibers at a
15 concentration of 1% to 25% of the total weight of the granules plus any other additives. (Throughout the description, the terms granules or fibers can include additives in addition to the carpet waste.) The binding agent adheres to the granules and fibers, giving each granule or fiber a binding agent surface coating. The binding agent dries rapidly under ambient conditions, allowing the granules or fibers to continue to flow without adhering to
20 one another. The granules or fibers with the binding agent coating then pass on to the next step in the process which is the preparation of the carpet waste composite material for the Board.

Preparing for the Board Forming Process

25 The binding agent coated composite material is conveyed to the Mat Forming Station which includes conveyors, metering scales, spreader heads and a control management system. The mat forming station employs spreading equipment to distribute the composite material onto a forming belt so that the spread material becomes a mat which has a uniform thickness, width and density. Board properties are mainly determined by the
30 shape of the carpet waste composite particles/fibers and by their position in the formed mat. For this reason the spreading equipment is finely tuned to produce the proper shape and size of the mat. The Forming station can distribute more than one type of material for a multi-layered board. For example, the spreader head in the forming station could spread a mat of fibers on the forming belt, then a second spreader head could spread a mat of pellets on top
35 of the fibers, then a third spread head could spread a top layer of fibers onto the pellets. Many different combinations of materials can be spread onto the forming belt to make various types of boards. The number of layers per board can be varied also. For example, a

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5 board could be manufactured to have CW fiber skins and a fiberglass core or a board could be manufactured to have CW pellet skins, CW fiber underlayers and a CW pellet core. After the mat is spread formed, the forming belt then transports the mat into the pre-heater or directly into a Pre-Press. The pre-heater continuously transfers the mat and subjects the composite material to microwaves or injects hot air and/or steam into the mat before it
10 enters the Board Forming process. The temperature of the mat is elevated from about 65°F to about 200°F before entering the board forming process. This rapid heat transfer to the carpet waste is accomplished by microwaves or by the injection of a steam/air mix (moist air) alternately from either surface into the mat. The steam condenses during this process, transferring the heat into the mat. The pre-heater may also pre-press or compress the
15 material before it enters the board forming process. The heated mat is then transferred by an intermediate belt conveyor to the compression section of the infeed end of a continuous roll press or into a cycle press which is the beginning of the board-forming process.

If a cycle or stationary press is used instead of a continuous roll press, then pre-heating of the mat is usually skipped and steam injection may be used during the sheeting
20 process in the cycle press or the steam injection can be skipped.

The Board Forming Process employs a Cycle Press or Continuous Roll Press. Both types of equipment use pressure and temperature to form a board, panel or sheet from the Carpet Waste Composite Material that is coated with a binding agent.

The Cycle press may have single or multi-daylight openings. The composite
25 material is transferred into the cycle press where it is subjected to temperature and pressure from a top and bottom platen that condenses the mat to a determined height and allows the binding agent reaction to take place bonding the mat together to form a Board. The mat may have steam injected through it while in the cycle press to ensure a thorough heating and bonding of the composite material. The platens may have a pattern engraved into them to
30 give the boards surface a structured pattern. The Cycle press may also use a cooling cycle to reduce the temperature of the board before it exits the press.

Carpet waste composite boards have been manufactured using a cycle press. The operating conditions and settings are shown in Chart 1 attached hereto.

The continuous roll press is a double belted press capable of maintaining a range of
35 temperatures and pressures on the mat to allow the binding agent reaction to take place, binding the mat together. The preferred type of belt for the continuous roll press is made of steel but other materials may be used. The press has the capability of reaching temperatures

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5 of 65°F to 550°F to allow the heat to transfer throughout the mat. Similarly, varying pressures are used to squeeze the granule layer or the fiber mat to the desired thickness and density of the final product.

The continuous roll press consists of a press structure which takes up the horizontal forces resulting from the belt tensioning. There are many frame units whose number
10 depends on the length of the press and pressure that is needed. Cylinders are used for the exertion of pressure arranged at the frame units in various combinations, a certain number of which are suitable for opening the press. There are top and bottom heated platens which the roller rods and belts travel over. The press has an infeed head to guide the roller rods, belts and mat to be pressed. The roller rods are located between the heated platens and the
15 belts. The mat is located between the two belts. Two drums are located at each end of the press for the belts to travel around. Drum scrapers are used to keep the mat between the belts. A release agent may be sprayed onto the belts to keep the mat from sticking to the belts and exit the press. A control system regulates the operation of the press such as the speed of the belts, temperature, pressure, thickness of the mat, etc.

20 The continuous roll press transfers heat to the binding agent-coated composite material. The heat activates the binding agent coating on the materials which are then pressed to a lesser thickness by the continuously moving belts. As the material moves between the belts through the infeed section, the thickness dimension is reduced as well as continually heated. The temperature of the binding agent-coated granules or the binding
25 agent-coated fibers is maintained above the activation temperature of the binding agent. Under the pressure of the platens which are set at a predetermined height, the granules or fibers adhere to each other forming a continuous sheet product. This final thickness determines the density of the material as well. The density is determined by the initial thickness of the un-bonded mat entering the continuous press and the final thickness as the
30 newly formed composite product exiting the press.

If the temperature of the continuous press belts or stationary press platens are heated up to 230 °C or above, a thin but dense outer skin can be formed in the panel. This outer skin can help improve physical properties in the panel, such as the modulus of elasticity (MOE) and the modulus of rupture (MOR).

35 After the mat has been heated and pressed to the desired height and density in a continuous press, a cooling section may be employed to cool the panel before it exits the continuous press. Due to the nature of the polymer materials being pressed, cooling the

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5 panel in the press under pressure helps maintain board flatness and avoid warping. The panel is generally cooled to at least 120 °C before exiting the continuous press. A Stationary Press may also use a cooling cycle to cool the board before it exits the stationary press. However, this additional cooling time creates a longer cycle time to create a panel. So, a secondary stationary press may employed for cooling only. For example, a panel may
 10 be formed under heat and pressure in the first press, then transferred to a second stationary press to be cooled. A panel may be formed in either type of press and cooled in a secondary process after it exits the press.

The Board Finishing Process

15 After the binding of the material and desired height dimension of the mat has been reached in a continuous roll press, a Board is formed which is in the shape of a continuous ribbon. When the ribbon exits the press it undergoes a continuous edge trimming operation to reach the desired width and then it is cross-cut to a pre-selected length. The ribbon is transported through the trimming and cross-cutting operations by a roller conveyor and
 20 pinch rollers. The board that has been cut to a predetermined width and length is then transported to a cooling station. The cooling station can employ a variety of different machines such as a Star Cooler with subsequent stacking or a stacking roller conveyor. One of the most common types is the star cooler with subsequent stacking. The Star Cooler is a large diameter wheel with multiple rows of spoked arms extending from the wheel. The
 25 arms lift each Board from the conveyor and allow the Boards to rotate with the wheel and be air cooled. If needed, the continuous roll press can have a cooling section near the exit. This will cool the board before it exits the press eliminating the need for further cooling. The Board is then conveyed to a stacking operation and stored for future use. The Boards are now ready to be shipped or they can go through a variety of decorating alternatives.

30 In a cycle press, the board can be manufactured to finished size or slightly oversized. If it is oversized, then it is cut to finish dimensions after it exits the press. The Platens in the cycle press can have a patterned surface to give the board a structured surface such as a wood grain pattern.

35

Decorating the Composite Product

As the composite product exits the Process as described above, it may be of varying thicknesses from less than 1/8 inch up to 2 inches. Since the last step in the Process is the

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5 cutting to length of the composite product, the first step in finishing the product is cutting to final width. Figure 3 shows the finishing and decorating steps that may be employed following cutting to final width.

The composite product can now be molded to change the profile to take on the shape required in the finished product. The molding is done on a cutting machine of different
10 designs. The most common of which is the rotating knives device. This machine allows for the setting of the knife blades to adjust the cut to the desired profile. Another common device is the router which cuts a specific groove or grooves (routes) into the surface of the composite product. The router has the same effect as the molder in that it changes the initial profile out of the Process into the desired profile required for the final product.

15 The profile may also be changed using thermoforming methods. In this case the composite product is placed in a mold of the desired profile and with heat and pressure the product takes on the shape of the mold. This profile change offers an additional decorating capability in that the desired color and/or pattern may be on a transfer foil placed in the mold. With the application of the heat and pressure during the process, the color and/or
20 pattern are transferred from the carrier foil to the composite product. Thus at the end of the thermoforming process, the composite product has the desired profile and also the desired decoration.

The composite product may be embossed after the Process. The embossing is accomplished with an embossing plate or roll. The plate or roll has the pattern to be
25 transferred to the product on the surface of the plate or roll. This surface is heated to a temperature that will soften the surface of the composite product. Then the plate or roll is pressed on to the surface of the product to give the desired pattern transfer. As the surface of the composite product cools, the embossed pattern becomes fixed on the surface of the composite product. The embossed composite product is now ready to be coated; or if no
30 coating is required for the end-use product, it is ready for packaging.

All composite products that will be decorated pass through the sander (the equipment described above). This smoothing of the surface prepares the product for coating, transfers, and laminating.

The sanded or embossed composite product may be coated with primers, finish
35 paints, or stains. The application of the coatings employs the various, conventional spray techniques using exhaust systems to remove the excess spray and solvents. Either

penetrating or film-forming coatings are applicable, and the choice is dependent on the desired finished product appearance and application.

The sanded composite product can also act as a core to which decorative and protective layer(s) may be hot stamped from a foil or film or lamina led, to achieve the improved physical and visual enhancement over the current inventions.

The composite product may be decorated using transfer foils. Once again the product requires sanding to smooth the surface. An adhesive layer is applied to die profile using a conventional application technique. The transfer foil has the desired color and/or pattern on a polymeric substrate. The foil is brought into contact with the surface of the product using stamping equipment designed for the specific application. Using heat and pressure the color and/or pattern are transferred from the foil to the product. The heat required for the transfer activates an adhesive layer on the surface of the profile ensuring bonding of the decoration to the profile. With the color and/or pattern now on the composite product, the spent foil is then collected for disposal; and the finished product has the desired decorated effect.

Another decorating method which may be employed is lamination. Several materials may be used as the laminate surface, such as, wood veneers, synthetic veneers, foils, films, and polymeric sheets.

The application of rigid laminates like wood veneers is done using conventional laminating equipment. Generally, an adhesive system (either a wet adhesive system or a hot-melt adhesive system) employing a primer and an adhesive is applied to the substrate. The rigid surface laminate is then laid on to the substrate and temperature and pressure are applied. After the temperature-pressure step the laminated product is then set for a fixed period of time to allow the adhesive system to cure. In the case of the composite product, the composite product is the substrate. The adhesive system, usually a hot-melt adhesive, is applied to the composite product. The rigid veneer is then placed on the adhesive layer forming a sandwich of composite product, adhesive, and rigid laminate. The sandwich is then pressed to secure the bond of the laminate to the composite product. After curing the laminated product with the desired decorative appearance is ready for packing,

Another laminating technique used with the composite product is foil laminating. This technique can be referred to as wrapping wherein the composite product profile is

5 wrapped in the decorative foil. After the composite product profile has been sanded the profile passes through a wrapping device. This device takes the foil wrap from a coil then applies the adhesive (and primer, if required) to the foil. In a continuous process the foil wrap is then passed over the composite product profile. Using a series of rollers, the foil wrap is shaped to the composite product profile. The foil wrap may incorporate in addition to its decorative elements an integral topcoat material for physical property enhancement. This integrated element may be polyurethane, acrylic, or other protective materials. If, however, the foil wrap integrates only the decorative elements, then the wrapped composite product will require a topcoat for certain applications.

10 If the end-use product application requires significant surface property enhancements, such as abrasion resistance, a topcoat may be added to the decorating process. The topcoat can be polyurethane, acrylic, or other protective material that, will impart better physical properties to the surface of the wrapped finished product. The topcoat may be spray applied or hot melt applied. If spray applied, the wrapped composite product will pass
15 through a spray applicator and then may or may not pass through a curing device such as ultra- violet radiation. If the topcoat is hot melt applied, then a layer of polyurethane is applied to flat surfaces of the decorated composite product. The cure process for this type of material is time dependent and could take several days depending on the hot melt topcoat chosen for a specific end-use application for the completed finished product.

20 A number of embodiments have been described. Nevertheless, it will be understood that various modifications may be made thereto. The invention, rather, is defined by the claims.

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CHART 1

Material - CW Fibers & Agglomerated Pellets	Weight-in [oz]	MDI Resin / content (2%-10%)	Humidity [%]	Target Density [pcf]	Designation of Presscycle	Specific Pressure [psi] (kN/m ²)	Cure Time relative to Thickness of Board [seconds per millimeter]	Temperature of Heating Plates [Degrees Fahrenheit]	Offset = a distance added to the presscycle mainly used to adapt to the structure bleech (mm)	Thickness of Board [inch]	Density of Board [pcf]	Remarks
Fibers	116.4	10%	3	70	m1238a20.20s	580.125848	19	392	10	0.500	86.2	Rough Woodstructure Pattern
Fibers	116.4	5%	3	70	m1238a20.20s	580.125848	19	392	8	0.492	69.9	Rough Woodstructure Pattern
Fibers	116.4	2%	3	70	m1238a20.20s	580.125848	19	392	6.5	0.504	68.0	Rough Woodstructure Pattern
Pellets	123.4	10%	5.2 / 2.94	70	m1238a20.20s	580.125848	19	392	6	0.476	78.0	3-Layer-Board Total Weights: Surface Layer = 40% Pellets, Core Layer = 60% Fibers
Fibers												
CW F	49.7	M 20 R	2.77	55	m0838a19.18s	580.125848	19	392	11.5	0.287	54.1	Area being Pressed (German abbr.: Pr. Fl.): 300mm x 300mm
Fibers	61.1	5%	2.9	55	m0838a19.18s	580.125848	19	392	5.7	0.285	55.2	Fine (Wood) Structure
Fibers	65.9	2%	2.9 / 2.72 / 3.95	55	m0838a19.18s	580.125848	19	392	5.7	0.291	71.2	Fine (Wood) Structure
Pellets	91.0	M 20 R		55	m1238a20.20s	580.125848	19	392	3.0	0.481	58.6	3-Layer-Board Total Weights: Surface Layer = 40% Fibers, Core Layer = 60% Pellets
"	114.6	10%	"	58	m1238a20.20s	580.125848	19	392	3.0	0.469	75.2	" (same as above)
"	107.6	10%	"	68	m1238a20.20s	580.125848	19	392	3.2	0.520	68.0	Cool down cycle within Press used for remainder
"	215.1	10%	"	68	m2538a19.19s	590.125940	19	392	3.2	0.888	68.2	SL = 40% Fibers, CL = 60% Pellets (of total weight)
"	215.1	10%	"	68	m2538a19.19s	590.125948	19	392	3.2	1.020	67.7	SL = 8% Fibers, CL = 91% Pellets (of total weight)
Pellets	102.3	10%	5.3	70	m1238a20.20s	280.062824	18	392	6	0.490	68.7	Smooth Surface
Pellets	74.1	7%	5.3	50	m1238a20.20s	280.062824	18	392	6	0.500	51.3	Smooth Surface
Pellets	104.0	5%	5.34	70	m1238a20.20s	280.062824	19	392	6	0.496	69.9	Smooth Surface
Pellets	72.3	2%	5.83	50	m1238a20.20s	290.062924	19	392	6	0.500	50.1	Smooth Surface

WHAT IS CLAIMED IS:

1. A composite building material comprising:
a carpet waste;
an inorganic filler in addition to any filler present within the carpet waste and any synthetic fiber filler; and
a binding agent in intimate association with the carpet waste and the inorganic filler.
2. The composite building material of claim 1, wherein the carpet waste comprises melted polypropylene fibers and unmelted polyester fibers.
3. The composite building material of claim 1, wherein the carpet waste comprises face fibers consisting essentially of a material selected from the group consisting of polyester, nylon, and polypropylene.
4. The composite building material of claim 1, further comprising a natural fiber filler.
5. The composite building material of claim 1, further comprising an exposed patterned surface on at least a portion thereof, the exposed patterned surface comprising at least one of an embossed surface and a colored surface.
6. The composite building material of claim 1, further comprising a coating, the coating comprising a material selected from the group consisting of a primer, a paint, and a stain.
7. The composite building material of claim 1, further comprising a sheet having a first exterior surface and a second exterior surface defining a thickness, the sheet comprising a substantially homogeneous mixture from the first surface across the thickness to the second surface.
8. The composite building material of claim 1, further comprising synthetic fiber filler in intimate association with the binding agent.

9. The composite building material of claim 1, characterized by an absence of synthetic fiber filler.
10. The composite building material of claim 1, further comprising a surface feature selected from the group consisting of a foil laminate, a film laminate, a sanded surface, a primer, a paint, and a stain.
11. The composite building material of claim 1, wherein the carpet waste comprises a combination of nylon fibers, polyester fibers, and polypropylene fibers exhibiting different physical and processing properties.
12. The composite building material of claim 1, wherein the composite building material comprises between 25% and 99% carpet waste and between 1% and 25% binding agent.
13. The composite building material of claim 1, wherein the binding agent comprises one or more of methylenediphenyldiisocyanate (MDI), urea formaldehyde (UF), melamine urea formaldehyde (MUF), and phenol formaldehyde (PF).
14. The composite building material of claim 1, wherein the composite building material comprises fibers consisting essentially of a highest melting point fiber of the carpet waste.
15. The composite building material of claim 1, wherein the sum of the carpet waste and the binding agent is between 50% and 99% of the total material.
16. The composite building material of claim 1, wherein the composite building material comprises from 0% to 50% man-made fiber fibers.
17. The composite building material of claim 1, further comprising oriented fiberglass.
18. The composite building material of claim 1, wherein the inorganic filler comprises calcium carbonate, silica or both.

19. The composite building material of claim 1, wherein the carpet waste includes all polymeric carpet components substantially without segregation from one another.
20. The composite building material of claim 1, wherein the carpet waste comprises carpet backing in an amount equal to at least 10% of the composite building material, by weight.
21. The composite building material of claim 1, wherein the carpet waste comprises at least two different carpet face polymers.
22. The composite building material of claim 21, wherein the carpet face polymers include one or more of: nylon, polyester, polypropylene and wool.
23. The composite building material of claim 1, wherein the binding agent is MDI.
24. The composite building material of claim 1, wherein the composite building material has a modulus of elasticity of at least 55000 PSI by ASTM test D790.
25. The composite building material of claim 1, wherein the composite building material has a modulus of elasticity of at least 100,000 PSI by ASTM test D790.
26. The composite building material of claim 1, wherein the composite building material has a modulus of rupture of at least 600 PSI by ASTM D790.
27. The composite building material of claim 1, wherein the composite building material has a modulus of rupture of between 1000 and 2500 PSI by ASTM D790.
28. The composite building material of claim 1, wherein a density of the composite building material is at least 30 pounds per ft³.

29. The composite building material of claim 1, wherein a density of the composite building material is from 40-80 pounds per ft³.
30. The composite building material of claim 1, further comprising a layer on a surface of the composite building material.
31. The composite building material of claim 30, wherein the layer is molded or embossed to create a patterned surface on the composite building material.
32. The composite building material of claim 30, wherein the layer comprises a laminate layer discrete from the carpet waste and the binding agent.
33. The composite building material of claim 30, wherein the layer comprises a foil or film laminate.
34. The composite building material of claim 30, wherein the layer comprises a hot-stamped layer.
35. The composite building material of claim 30, wherein at least one of the layer and the surface is sanded.
36. The composite building material of claim 1, wherein the composite building material comprises up to about 50% of the added inorganic filler.
37. The composite building material of claim 1, wherein the carpet waste comprises a processed carpet waste comprising (i) a reduced amount of inorganic filler relative to an amount present within an unprocessed carpet waste.
38. The composite building material of claim 1, wherein the carpet waste comprises melted polypropylene fibers and unmelted nylon fibers.

39. The composite building material of claim 1, wherein the binding agent is present in the composite building material in an amount from about 2% to about 10%, by weight of the composite building material.

40. The composite building material of claim 1, wherein the composite building material comprises about 5% binding agent, by weight of the composite building material.

41. The composite building material of claim 1, wherein the carpet waste comprises a material selected from the group consisting of wool, nylon, polyester, polypropylene, and combinations thereof.

42. The composite building material of claim 1, further comprising an additive selected from the group consisting of a fiberglass, a mold inhibitor, and combinations thereof.

43. The composite building material of claim 1, wherein the carpet waste comprises at least one of post-industrial waste carpet and post-consumer waste carpet.

44. The composite building material of claim 1, wherein the carpet waste comprises at least one of a pelletized carpet waste and a fiber carpet waste.

45. The composite building material of claim 1, further comprising sisal.

46. A method of producing a composite building material, the method comprising the steps of:

providing a carpet waste;

providing an inorganic filler, wherein the inorganic filler is in addition to any filler present within the carpet waste and any synthetic fiber filler;

mixing the carpet waste and the inorganic filler with a binding agent to produce a carpet waste mixture; and

heating and pressing the carpet waste mixture to form the composite building material.

47. The method of claim 46, wherein the carpet waste comprises unmelted polyester fibers and melted polypropylene fibers.
48. The method of claim 46, wherein the carpet waste comprises face fibers consisting essentially of a material selected from the group consisting of polyester, nylon, and polypropylene.
49. The method of claim 46, further comprising adding a natural fiber filler.
50. The method of claim 46, further comprising forming a patterned surface on at least a portion of the composite building material, the patterned surface comprising at least one of an embossed surface and a colored surface.
51. The method of claim 46, further comprising applying a coating on at least a portion of the composite building material, the coating comprising a material selected from the group consisting of a primer, a paint, and a stain.
52. The method of claim 46, further comprising actively cooling the composite building material under pressure.
53. The method of claim 46, further comprising modifying a cross-sectional profile of the composite building material using at least one of thermoforming, embossing, and cutting.
54. The method of claim 46, wherein heating and pressing comprises forming the composite building material into a sheet having a first exterior surface and a second exterior surface defining a thickness, the sheet comprising a substantially homogeneous mixture from the first surface across the thickness to the second surface.
55. The method of claim 46, further comprising adding synthetic fiber filler to the carpet waste mixture.

56. The method of claim 46, wherein the composite building material is characterized by an absence of synthetic fiber filler.

57. The method of claim 46, wherein the composite building material further comprises a surface treatment selected from the group consisting of a foil laminate, a film laminate, a sanded surface, a primer, a paint, and a stain.

58. The method of claim 46, wherein the carpet waste comprises a combination of nylon fibers, polyester fibers, and polypropylene fibers exhibiting different physical and processing properties.

59. The method of claim 46, further comprising preparing the carpet waste by subjecting the carpet waste to size-reduction treatment comprising one or more of: chopping; shredding; grinding; contaminant separating; pelletizing; agglomerating; pulverizing; fine grinding and fiberizing the carpet waste.

60. The method of claim 46, wherein the binding agent comprises one or more of: methylenediphenyldiisocyanate (MDI), urea formaldehyde (UF), melamine urea formaldehyde (MUF), and phenol formaldehyde (PF).

61. The method of claim 46, wherein the composite building material comprises between 25% and 99% carpet waste and between 1% and 25% binding agent.

62. The method of claim 46, wherein the composite building material comprises fibers consisting essentially of a highest melting point fiber of the carpet waste.

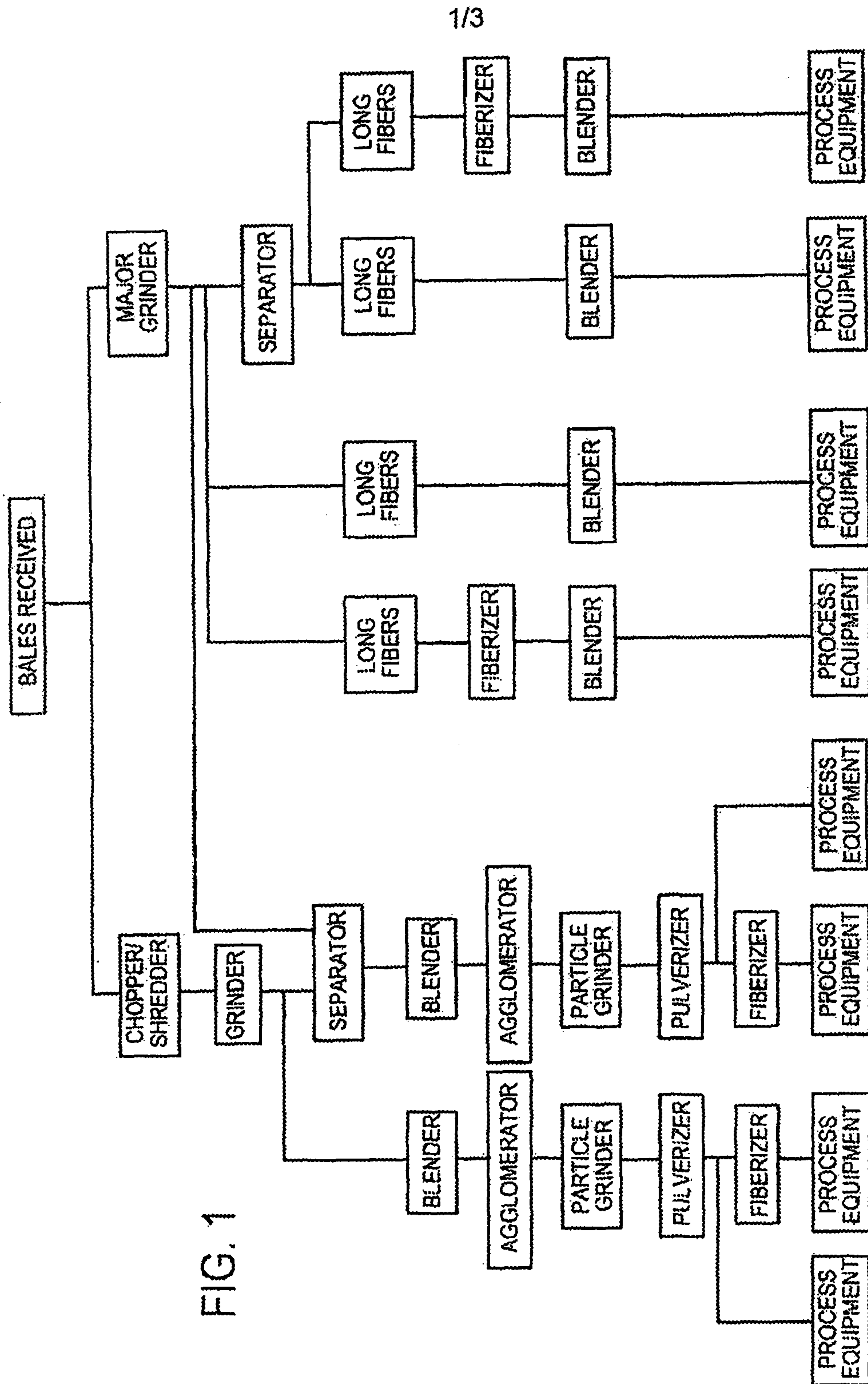
63. The method of claim 46, wherein the size-reduced carpet waste comprises granules that are subjected to spinning and are forced under pressure through orifices sized and configured to densify the size-reduced carpet waste.

64. The method of claim 46, wherein the mixing step comprises combining the carpet waste, the inorganic filler, and the binding agent in a drum to coat the carpet waste and the inorganic filler with the binding agent.
65. The method of claim 46, wherein the binding agent is MDI.
66. The method of claim 46, wherein heating and pressing comprises subjecting the carpet waste mixture to heat and pressure in a continuous belted press or in a stationary press.
67. The method of claim 46, further comprising applying a layer to a surface of the composite building material.
68. The method of claim 67, wherein the layer is a laminated layer or a foil-transfer layer.
69. The method of claim 67, wherein the layer is a paint, a stain or a polymeric compound.
70. The method of claim 67, wherein the layer is molded or embossed to create a patterned surface on the composite building material.
71. The method of claim 67, wherein the layer is a wood veneer, a synthetic veneer, or a polymeric sheet.
72. The method of claim 67, wherein the layer comprises a foil or film laminate.
73. The method of claim 67, further comprising preparing the surface of the composite building material and subjecting the surface of the composite building material to mechanical or chemical preparation.
74. The method of claim 67, wherein the layer comprises a hot-stamped layer.
75. The method of claim 67, wherein at least one of the layer and the surface is sanded.

76. The method of claim 67, wherein the layer is discrete from the carpet waste and binding agent.
77. The method of claim 46, further comprising thermoforming the composite building material into a desired shape.
78. The method of claim 46, further comprising pressing at least one of a plate or a roll onto the composite building material to form a patterned surface on the composite building material.
79. The method of claim 46, further comprising hot-stamping the surface of the composite building material.
80. The method of claim 46, further comprising embossing a surface of the composite building material.
81. The method of claim 46, further comprising cooling the composite building material.
82. The method of claim 46, wherein heating and pressing comprises melting a plurality of materials comprising the processed carpet waste.
83. The method of claim 46, further comprising at least one of chopping, shredding, grinding, contaminant separating, pelletizing, agglomerating, pulverizing, fine grinding, and fiberizing the carpet waste.
84. The method of claim 46, further comprising cooling the composite while applying pressure to the composite.
85. The method of claim 84, wherein (i) heating and pressing occurs in a first cycle press, and (ii) cooling while applying pressure occurs in a second cycle press.

86. The method of claim 84, wherein (i) heating and pressing occurs in a first cycle press, and (ii) cooling while applying pressure occurs in the first cycle press.
87. The method of claim 46, wherein heating and pressing heats the composite building material to a temperature of about 65 °F to about 550 °F.
88. The method of claim 46, wherein the carpet waste comprises unmelted carpet waste.
89. The method of claim 46, wherein the composite building material comprises about 90% to about 98% carpet waste, by weight.
90. The method of claim 46, wherein the composite building material comprises about 95% carpet waste, by weight.
91. A composite building material manufactured according to the process of claim 46.
92. The method of claim 46, wherein the carpet waste comprises fibers comprising at least one of polypropylene, nylon, and polyester.
93. The method of claim 46, wherein heating and pressing comprises applying heat and pressure to the carpet waste, the inorganic filler, and the binding agent to form the composite building material at a temperature and for a time period sufficient to melt substantially all materials comprising the carpet waste.
94. The method of claim 46, further comprising actively cooling the composite building material while applying pressure to the composite building material, wherein the composite building material is cooled under pressure for a time period and to a reduced temperature sufficient to reduce warping of the composite.
95. The method of claim 94, wherein the step of actively cooling the composite while applying pressure cools the composite to a temperature of about 120 °C.

96. The method of claim 46, wherein the carpet waste comprises a reduced amount of inorganic filler relative to an amount present within an unprocessed carpet waste.
97. The method of claim 46, wherein the carpet waste comprises face fibers consisting essentially of a material selected from the group consisting of polyester, nylon, and polypropylene.
98. The method of claim 46, wherein the carpet waste mixture comprises sisal.



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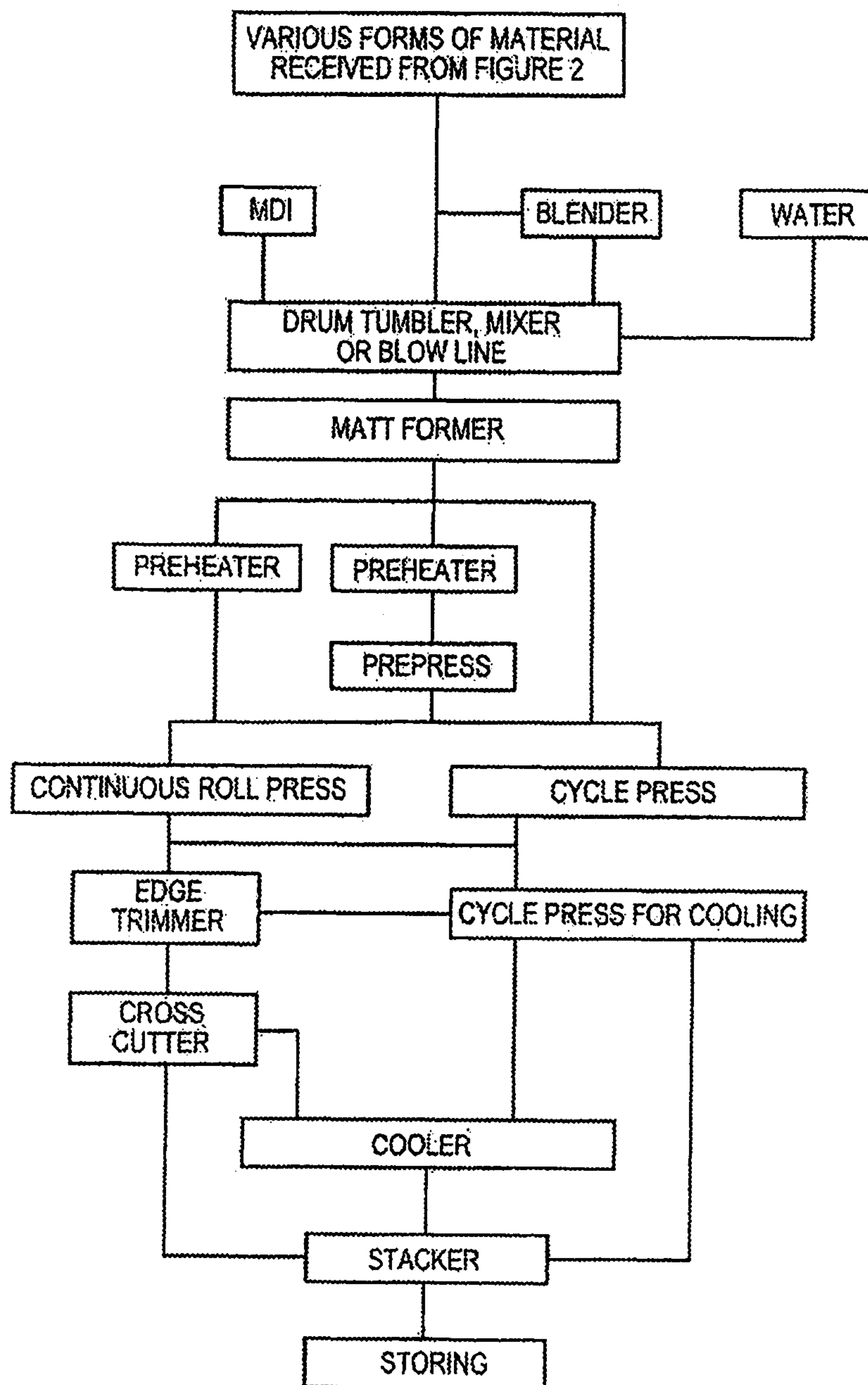
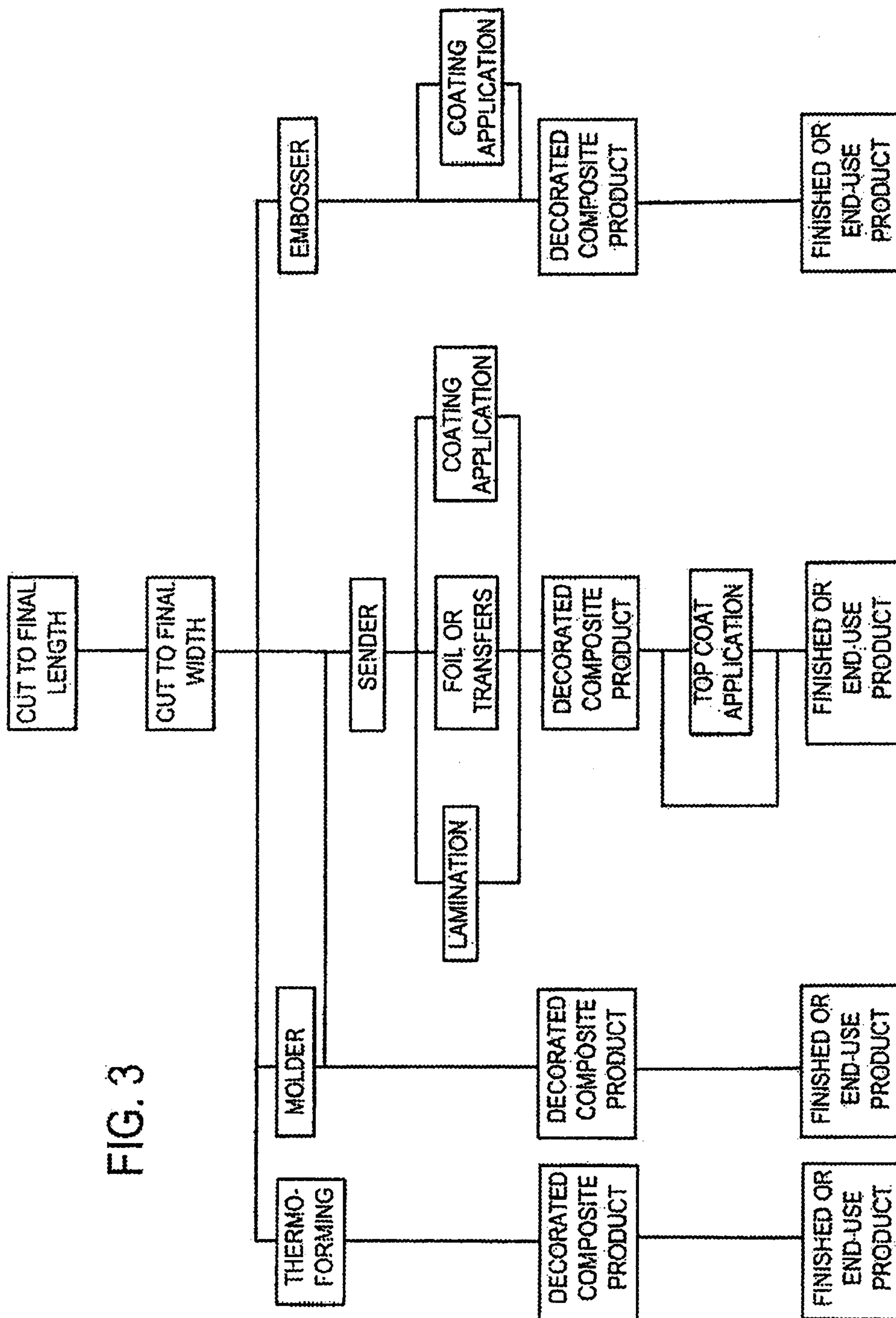


FIG. 2

*Patent Agents
Smart & Biggar*

3/3



Patent Agents
Smart & Biggar

