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PROCESS OF MOLDING ARTICLES HAVING AS BINDER VEGETABLE-TANNED LEATHER AND RESULTING ARTICLE

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This invention relates to an improved process of manufacturing compositions and composite materials, and of gluing together all sorts of material with collagen containing substances as binding agent.

Collagen is not soluble in water, its resistance to it being increased by tanning and hardening agents. When applied as animal glue, collagen was transformed into a water-soluble state. When attempts were made to use its binding properties in leather, the tanning constituents were first extracted, and thereupon its collagen containing constituents were transformed into a water-soluble state.

The invention consists in providing a glue which is not soluble in water, by finely dividing collagen containing material, such as it occurs in hide, skin and other material of animal origin, including its tanned modifications like leather, and collagen itself. The collagen containing material is uniformly distributed on or among a base material and bound together, with or without tanning, hardening, and/or other additional substances, under application of heat and of pressure. Useful compositions and composite material can be provided in this way.

In the course of manufacture the collagen containing material, more particularly vegetable tanned leather, is exposed to a heat treatment in the presence of an agent like water, whereby it loses its structural form, and is transformed into a non-fibrous state. This change impairs the inherent strength properties of the material, but in spite of its unchanged insolubility in water it imparts to it the particular ability to exert, under suitable conditions, its binding action with respect to other substances. The loss of structure, e. g. of vegetable tanned leather can easily be controlled by a grinding process. Leather which has not been subjected to such heat treatment resists grinding, and is transformed into fibres only, whereas a material which has been dried after the wet heat treatment is easily reduced to a fine powder. The heat treatment may be carried out with water, near the boiling point, or in an autoclave. A material which after grinding and subsequent heat treatment retains its fibrous structure may not be in a suitable state.

In the presence of water and at an elevated temperature, the heat treatment may at once become effective when applied to sufficiently divided material, e. g. to vegetable tanned leather which has been disintegrated in a mill or in a cutting machine, and has then been heated up

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with water, and when applied to shoe leather dust or to small or thin pieces of leather. A coarse material like scrap cuttings from the heavy leather industry resists disintegration by wet heat into a non-fibrous state, and can therefore be advantageously subjected to a complementary mechanical and wet heat treatment, e. g. the cuttings are heated up in boiling water for about 10 minutes; after milling the dry hard pieces, viz. those parts which have remained fibrous, are sieved away, again treated with hot water for a minute or two and thereupon the whole lot is ground to the required degree of fineness. The expensive grinding of heavy leather is thereby avoided.

The collagen containing material may be applied as a powder, as a suspension or as a colloidal solution; also as fibres or filaments, or as thin glue films. When used in its non-tanned modification, it may advantageously be freed from the bulk of the substances not suitable to be transformed into leather. It may be applied to the base material in the state of the natural fibre, or in its non-fibrous state. The degree of division of the binding agent, together with the uniformity of its distribution on or among the base material has an influence on the results of the gluing process. The necessary degree of division varies according to circumstances, e. g. the sort of constituents which form the glue, the additional substances, and the base material, their proportions and shape, and the heat and pressure which have been applied, etc.

As a powder, suspension or colloidal solution the binder has a wide field of application; a suitable fibrous powder being hide powder, or shoe leather dust. Excellent results are obtained with a powder in a non-fibrous state, more particularly of vegetable tanned leather. With decreasing size of the particles the adhesive properties are generally improved, a powder passing a 50 mesh sieve already exhibiting outstanding binding properties. A further decrease up to about 150 mesh and more, may favourably influence the properties of the finished product. The binding action on the other hand may also be improved if the base material, which itself may consist of particles the main size of which is large compared with that of the binder, is freed from particles of approximately the same size as that of the binding agent.

Suitable filaments may be obtained in various ways, e. g. by grinding natural leather to a fine grade. Such fibrous material has the property to refelt after milling. Part of the base material

may be added during milling, or the fibres may be mixed with the base material as they come from the mill, to ensure a thorough mixture.

A thin glue film may be obtained for instance from thin pieces of vegetable tanned leather, from felted fibres, from powder or the like deposited on a cloth, etc., which have been subjected to heat and pressure. The film may be formed in the presence of suitable plasticising and softening agents, and of other substances, like fillers, lubricants, etc.

A collagen containing material available in large quantities is leather scrap. It is of little value to the glue manufacturer, is no bearer of contaminations from micro-organisms, and contains already useful tanning agents. Leather which has not, or has only partly been tanned with minerals, like vegetable tanned leather, has proved to be particularly useful.

The base material may be chosen from among a great variety of substances. Compositions e. g. may be provided with waste material from the timber, paper and textile industry, from bark, more particularly cork bark, hair, etc. Natural leather itself, more particularly mineral tanned material, may also be used as base material. Also asbestos fibres and other inorganic material may be used as base material, in any desired combinations and proportions. A thin glue film may be used to bind together sheeted wood material, leather, etc. Tanning and hardening agents and other substances may be added to the binding agent or base material. They may be contained in the base material, or be introduced into the composition at any stage of the manufacturing process. Added tanning agents may also be of inorganic nature. Water repellant substances and lubricants, pigments, dyes, carbohydrates, natural resins, thermosetting and thermoplastic substances in general, bitumen, rubber and the like may be introduced in small quantities to modify the results. The base material for compositions is mixed with the binding agent in a dry state, or in the presence of any amount of water, the mixture being perfectly stable in the cold, without becoming sticky. The ligno-cellulosic material may have a water content of 50–100%, but it may also be mixed with the binder in a beater. During manufacture water and other volatile substances escape through routes provided for that purpose. After drying the finished article is entirely heat resistant.

The material may be pressed into sheets or be shaped by known moulding processes, etc. with a hot press of the type used in the plastic and plywood industry, more particularly with a multiplaten press. A hot bath of a high boiling liquid of organic nature in which clamped pieces which have to be glued together are immersed is another example of the way the binding action can be carried out, a further one being by extrusion.

The original properties of a base material are almost completely retained when transformed into a composition with amounts of 5–20% of the binding agent. The density of the composition varies widely according to the applied pressure. A flexible material is obtained with cotton waste, a resilient one with cork bark and a flame proof one with asbestos fibres.

Examples

(1) 1000 gr. of ground vegetable tanned leather are treated for three minutes in 2500 cc. of boiling water. After setting the leather is poured into 1500 cc. of cold water. After cooling down

the granular leather is separated from the water, squeezed out, air dried and easily milled into a fine grade, most of which will pass a 60 mesh sieve, about 30% passing a 120 mesh sieve. The remaining hot and cold liquors are used again for the next batch. 10 parts of this powder, 0.6 part of aluminium stearate and 0.2 part of resin, all passing a 60 mesh sieve, are thoroughly mixed. 100 parts of hemlock chips are wetted with 50 parts of water, dusted with the powder, whereupon the mixture appears to be dry. It is shaped into a board and heated up in a hydraulic press to about 320° Fahrenheit; a specific pressure of about 15 lb. per sq. in. is applied. After setting the material is dry and is taken out from the press. The resulting board has a density of about 25 lb. per cubic foot, its modulus of rupture being about 900.

(2) 12 parts of hide powder, which have been sieved through an 80 mesh sieve, are mixed with 1 part of lead stearate in powder form. 100 parts of oak shavings which are retained by an 8 mesh sieve are wetted with 40 parts of water, and the powder is gently admixed. The composition is heated up to 300° Fahrenheit at a specific pressure of 300 lb. per sq. in. The resulting board is fairly strong, has low water adsorption, and is not attacked by fungi.

(3) Sole leather cuttings are heated in an autoclave with water until the dry pieces are quite hard, and disintegrated in a mill. Fibrous parts are sieved away from the ground material and are again reheated for a short while with water, and dried. Together with the bulk which has already lost its fibrous structure by the first heat treatment it is reduced to a powder, which altogether passes a 100 mesh sieve. 12 parts of this powder, 0.6 part of aluminum stearate, and 0.3 part of resin are added to 100 parts of deal shavings which are retained by a 2 mesh sieve and have also been wetted. Under a pressure of 260 lb. per sq. in., a hard board of about 56 lb. per cubic foot is obtained, the modulus of rupture of which is about 7000. When in this example wood wool from spruce is used as base material the properties are further improved.

(4) Equal parts of vegetable tanned leather scrap and of cotton waste are released from a mill as a fibrous material of a fine grade. 35 parts of this mixture are mixed with 100 parts of cotton waste, sprayed with 50 parts of water containing 1 part of lactic acid, and heated under pressure. The resulting carpet is fairly strong, and has favourable heat insulating properties.

(5) 100 parts of cork dust of 6 to 30 mesh size is mixed with 20 parts of shoe leather dust which has passed a 60 mesh sieve; 20 parts of water containing 1 part of glycerol and 1 part of lactic acid are added, and the mass is heated up under the application of very low pressure. The resulting composition has a low density but is fairly strong. When rubbed with glass paper it gets a velvet-like appearance. It may be turned into a heat insulating finish of favourable sound adsorption.

(6) 100 parts of hard wood saw dust of 10–30 mesh size are mixed with 10 parts of ground leather which has been exposed to boiling water. This leather is added as a hot suspension contained in 30 parts of water. After thorough mixture under admission of heat the mass is extruded as rods which are sawn into small pieces in the cold, to be shaped into buttons under heat and pressure. The hot mix may be modified by additional substances.

(7) 30 parts of shoe leather dust which pass a

6 mesh sieve and 70 parts of cotton waste are ground together. To 100 parts of the released fibrous mix there is added 20 parts of water containing 2 parts of glycerol and the hot mix is squeezed into thin sheets to be used like glue films.

(8) 100 parts of cork board dust, a waste product from the manufacture of baked cork boards, which has been freed from particles smaller than 40 mesh, is mixed with 40 parts of ground paper, and 20 parts of leather powder passing a 150 mesh sieve. This mixture is wetted with 30 parts of water containing 3 parts of glycerol and exposed to heat under very low pressure. After setting the composition is baked, as known for cork boards. The resulting board has a density of 15–20 lb. per cubic foot.

I claim:

1. A process of forming articles of manufacture comprising evenly distributing a binding agent consisting of finely divided particles of vegetable tanned leather in proportions of 5 to 20 per cent by weight among particles of a base-material the particle size of which is large in comparison with the particle size of the particles of binding agent, cementing the particles of the resulting mixture together under compression in a moist state at a temperature of not less than 300° Fahrenheit while permitting the escape of vapors developed during compression and heating.

2. A process according to claim 1 wherein the particles of base material consist of particles of lignocellulosic material.

3. A process according to claim 2 wherein the lignocellulose base material particles consist of wood particles.

4. A process of manufacturing sheet material according to claim 3 wherein the base material wood particles consist of wood shavings.

5. A process according to claim 1 including the step of screening the particles of the base material to eliminate particles of a size comparable to the size of the particles of binding agent before the particles of binding agent are evenly distributed among the particles of base material.

6. A process according to claim 1 including adding up to 50 parts of water per 100 parts of base material to the base material before cementing the mixture together.

7. A process of forming articles of manufacture comprising evenly distributing a binding agent consisting of particles of vegetable tanned leather in powder form of a particle size that will pass through a sieve of not less than 50 mesh per inch

in proportions of 5 to 20 per cent by weight among particles of a base material the particle size of which is large in comparison with the particle size of the powder, cementing the resulting mixture together under compression in a moist state at a temperature of not less than 300° Fahrenheit while permitting the escape of vapors developed during compression and heating.

8. A process according to claim 7 wherein the binding agent is applied as a suspension in water.

9. A process of forming articles of manufacture comprising heating particles of vegetable tanned leather in the presence of water at a temperature at least near its boiling point for a period just sufficient to eliminate the fibrous structure of the leather, drying the leather particles, disintegrating the leather particles into a powder, sifting the powder until it will pass through a sieve of not less than 50 mesh per inch, evenly distributing the sifted powder in proportions of 5–20 per cent by weight among particles of ligno-cellulosic material, the particle size of which is large in comparison with the particle size of the powder, cementing the resulting mixture together under compression in a moist state at a temperature of not less than 300° Fahrenheit while permitting the escape of vapors developed during compression and heating.

10. A water resistant composition in sheet form consisting essentially of ligno-cellulosic particles bound together by vegetable tanned leather particles, the particle size of which is small in comparison with the size of the ligno-cellulosic particles.

11. A composition according to claim 10 wherein the ligno-cellulosic particles consist of wood.

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