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ART OF PRODUCING COMPRESSED PRODUCTS

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The present invention relates to the art of molded fibrous products, and more particularly to a fuming process of manufacturing molded or compressed fibrous products by the use of heat and pressure and to products made by said process.

It is an object of the present invention to provide an improved procedure whereby compressed or molded fibrous products can be manufactured in a simple, commercial, practical and economic manner.

A further object of the invention is to provide a process which involves fuming of the mass of fibrous material under treatment with a medium incorporated with a special binding substance during the fabrication of molded or compressed products.

It is also within the contemplation of my invention to provide a novel process which produces a product having substantial strength and resistance, particularly with respect to durability to withstand the action of moisture or water without disintegration or other deleterious effects.

Another object of the invention is to provide an improved process whereby products of a diverse nature, including wall boards, panel boards, parquette flooring, veneered products, telephone and radio appliances, furniture products and the like, can be made in a satisfactory and industrial manner.

Other objects and advantages of the invention will become apparent from the following description.

Generally speaking, my invention contemplates the incorporation within a mass of fibrous material of a fuming medium or agent which is adapted to permeate substantially the entire mass when the latter is subjected to heat. In conjunction with my fuming agent I prefer to use a binder of a special type to insure a reliable, thorough and secure bond between various fibers constituting the mass undergoing treatment. Pressure is applied to fibrous material having a fuming agent and a binder associated therewith during and/or after the application of heat to cause the fuming and permeation of the fibrous mass. After a predetermined pressure has been reached, pressure is maintained for a certain period to cause a desired compression of the material into a relatively stable condition. The compressed fibrous material, usually in a mold, is withdrawn from the pressure apparatus after termination of the pressure period and is preferably allowed to cool to atmospheric conditions. When cooled the compressed product is tough and strong and is capable of being subjected to various well known operations of construction, such as sawing, nailing, drilling, and many others well known to one skilled in the art.

My improved process can be carried out in any appropriate apparatus and under a variety of suitable conditions. Although it is possible to modify various factors to suit particular conditions, a general statement will now be made setting forth satisfactory and suitable ranges of ingredients of my new compressed product and of operation required in carrying out my process to produce a compressed product say, for example, about 18″ x 18″. Fibrous material of suitable nature is first prepared by preferably loosening the fibers from each other. A mass of the fibrous material ranging from about 1000 grams to about 1200 grams is weighed out. This mass is then treated with about 50 c. c. to about 250 c. c. of a liquid fuming agent so as to soak the fibers fairly uniformly. A liquid binding material is then applied to the thus treated fibrous material in amount within a range from about 65 c. c. to about 150 c. c. The fibrous material now containing a fuming agent and a binding material is uniformly distributed in a mold or other suitable container having a bottom and top plate and appropriate vents for the escape of the fuming agent and other volatile products. After proper arrangements are made, the mold or the like is placed in a heated press, such as a heated hydraulic press, and is subjected to a temperature within a range from about 300° F. to about 400° F. and to a pressure of about 200 pounds per square inch to about 2000 pounds per square inch. The fibrous mass may be left in a suitable period of time extending from about several minutes to about fifteen minutes. Upon the

expiration of this period the mold is withdrawn from the press and is preferably allowed to cool. After it has cooled the compressed mass is withdrawn as a relatively dense, strong and tough block which is durable and resistant to various atmospheric influences and adaptable to diverse operations of fabrication and of construction.

A typical example of my invention will now be given merely for the purposes of illustrating the invention and for the purpose of a better understanding of the invention by those skilled in the art.

About 1000 grams of saw-dust, wood-shavings or the like are spread upon a table and about 100 c. c. of gasoline are sprinkled evenly on the saw-dust, for example. The thus-wetted saw-dust is then treated with about 100 c. c. of a liquid binder whose composition will be given hereinafter. A steel mold 18″ x 18″ having vents therein is then prepared for the reception of the saw-dust containing a fuming agent (gasoline in this instance) and a liquid binder material. The mold is closed and is placed in a heated hydraulic press. After the plunger has been brought into proper position, the temperature is increased to say about 400° F. This heat causes the fuming agent to permeate the entire mass of saw-dust and to escape through the vents in the mold. Upon completion of or during the fuming operation the plunger is moved so as to increase the pressure on the mass of saw-dust to say about 1500 pounds per square inch. The application of heat is no longer continued and the pressure is maintained for say approximately 15 minutes. After this period of time has elapsed the mold is withdrawn from the hydraulic press and is preferably allowed to cool to atmospheric temperature. Upon cooling the mold is then opened and the compressed product removed. This product is particularly useful as a strong and resistant wall board.

In place of saw-dust or wood shavings various other fibrous materials may be used, such as excelsior and waste therefrom, corn stalks, bagasse, jute waste, paper pulp and a variety of similar materials. Similarly, gasoline can be replaced by benzol, alcohol, etc. although I prefer to use a non-hydrous organic agent.

The liquid binder referred to hereinabove is an organic one, preferably a phenol condensation product. I prefer to use a liquid binder made in the following manner with ingredients mentioned hereinafter.

I take about 1000 grams of resorcinal and mix it with about 1000 c. c. of 40% formaldehyde solution with steady shaking or agitation. The mixture is then heated to about 30° C. To this mixture about 3 grams of sodium sulfite are added at a slow rate, i. e. small amounts or portions at a time, and then the temperature is raised to about 75° C. to cause reaction between the ingredients. Subsequently the solution is quickly cooled to about 25° C. The liquid mass is now ready for use as a binder material in my process referred to hereinabove.

When veneered wood or products are to be made, the same procedure is followed as mentioned heretofore. In addition sheets of veneer 18″ x 18″ are taken and are first coated with gasoline and then with my binder material. The sheets are left to dry for a short time and after they are relatively dry, one sheet is placed in the bottom of the mold, a fibrous block or a treated fibrous mass or the like is then placed on the bottom sheet, and finally the second sheet is put on top of the saw-dust or the like. The mold is then closed and subjected to the aforementioned operations. In this instance, a compressed veneered product is produced which has a high polish and lustre. This veneered product is suitable for many uses in the building and furniture industries as well as in other fields.

My veneered product has been subjected to various tests. For instance, a piece or product was soaked in water for 60 to 90 days. The product was then removed from the water and placed on a heated radiator for several days. The water disappeared but the product was just as firm and strong as before the soaking with water. The same test piece was placed on a windowsill for several days but there was no change in appearance or strength. A similar test was performed with boiling water with similar results. Other compressed products now on the commercial market when subjected to the same tests disintegrated or lost their strength or even became useless.

It will be observed that I select a fuming agent which evaporates or fumes at a temperature lower than that at which the binder sets or hardens to firm solid condition so that the fuming agent permeates the entire mass and thence escapes therefrom before the binder hardens. In this manner the hardened or set binder provides a reliable and safe bond within various portions of the compressed product whereby a secure and stable article of commerce is produced. When water is present in the binder, as in the specific phenolic condensation binder which I have mentioned heretofore, the water also evaporates before the binder hardens and evaporates in such a manner that no blisters, pockets, voids or the like are formed within the compressed product. This latter feature is important because in many of the prior art processes the formation of blisters and the like caused by evaporating water or a solvent made the resultant products practically useless or of very little value. By the

use of my process this disadvantage is entirely overcome.

It will also be noted that the fibrous material which I can use in my process is by-product material from diverse industries in practically the same condition as it comes from these industries without the necessity of treating the by-product material chemically or physically. By the use of my process, consequently, I am able to dispense with expensive and extended operations which are necessary in the production of prior commercial products. In other words, the fibrous particles of saw-dust, wood-shavings, corn-stalks, bagasse, jute waste, excelsior and the like are used in the same state and condition as received as a by-product material in my process and are secured together by a surface bond of binder material between contacting surfaces.

I do not desire to become bound by any theory regarding my process but I believe that the following is a probable explanation of what occurs therein:

The fuming agent, gasoline herein, when added to a mass of fibrous material undergoing treatment evaporates or fumes at a lower temperature than the hardening or setting point of the binder so that the fuming permeates the entire mass of fibrous material and scours through the multiplicity of channels in said material in escaping from said mass. Subsequent to the evaporation or boiling of the fuming agent, water, if present in the binder, is then evaporated. Due to the aforesaid fuming, it is my belief that the binder is caused to flow more freely and thus to cover a large portion of the superficial surface or practically all of the surface of the fibrous material before hardening or setting of the binder so that upon subsequent hardening a better or more uniform bond is produced throughout the mass of material. I also believe that the fuming facilitates the removal of the water from the binder and the mass of fibrous material and assists in the formation of a better and more stable bond between the binder and contacting surfaces.

When I use the term "vegetable fibres" in the specification or claims I intend to cover saw-dust, wood-shavings, excelsior waste, corn stalks, bagasse, jute fibers and other related fibers or fibers which have similar characteristics.

While I have given specific example of my improved process merely by way of illustration, it is to be understood that I am not to be confined to the exact steps nor the specific reagents given as they are to be regarded only as illustrative and typical. Various modifications may be made without departing from the nature of my invention as defined in the appended claims.

I claim:

1. The process of making compressed fibrous products which comprises impregnating a mass of porous fibrous material with a liquid fuming agent of organic nature, applying a binder to said fibrous material, subjecting said mass of fibrous material to heat of a character adapted to cause the evaporation of said fuming agent prior to the hardening of said binder, and compressing the said heated mass of fibrous material to produce a compressed stable product.

2. The process of making compressed fibrous products which comprises impregnating a mass of porous fibrous material with a liquid fuming agent of organic nature, applying a binder to said fibrous material, subjecting said mass of fibrous material to heat of a character adapted to cause the evaporation of said fuming agent prior to the hardening of said binder, and simultaneously with the application of said heat compressing the mass of fibrous material to a portion of its original size to produce a compressed stable product fibers of which are bonded together by the hardened binder.

3. The process of making compressed fibrous products which comprises impregnating a mass of porous fibrous material with a liquid fuming agent, incorporating a liquid phenolic condensation binder within said mass of fibrous material, filling into a mold said mass of fibrous material containing said liquid fuming agent and said liquid phenolic condensation binder, subjecting said mold to a fuming heat whereby the said fuming agent is caused to be evaporated and permeated throughout said fibrous mass, and applying pressure to said heated mass to cause a molding together of the fibrous parts into a compressed stable state.

4. The process of making compressed fibrous products which comprises spreading a mass of porous fibrous material into a bed, sprinkling said bed with gasoline, incorporating a liquid binder constituted of a liquid phenolic condensation product within said mass of fibrous material, filling said fibrous material containing gasoline and said binder into a mold, applying heat sufficient to cause fuming of said gasoline to permeate said mass of fibrous material and to escape therefrom through a multiplicity of channels in said fibrous mass prior to the hardening of said binder, maintaining heat sufficient to cause hardening of said binder, applying pressure to said mass of fibrous material before said binder has set to compress said mass into a compressed state, and continuing the application of said pressure until the compressed mass has assumed a stable condition.

5. The process of making compressed fibrous products which comprises spreading a mass of about 1000 to 1200 parts of porous fibrous material into a bed, sprinkling said bed with about 150 to 225 parts of gasoline,

incorporating about 50 to 125 parts of a liquid binder constituted of a liquid phenolic condensation product within said mass of fibrous material, filling said fibrous material containing gasoline and said binder into a mold, applying heat within a temperature range from 300° F. to 400° F. to cause fuming of said gasoline to permeate said mass of fibrous material and to escape therefrom through a multiplicity of channels in said fibrous mass prior to the hardening of said binder, maintaining heat sufficient to cause hardening of said binder, applying pressure of about 200 to 2000 pounds per square inch to said mass of fibrous material before said binder has set to compress said mass into a compressed state, and continuing the application of said pressure until the compressed mass has assumed a stable condition.

6. The process of making compressed fibrous products which comprises spreading a mass of about 1000 parts by weight of porous vegetable fibres into a bed, sprinkling said bed with about 90 parts by weight of gasoline, incorporaitng about 100 parts by weight of a liquid binder constituted of a liquid phenolic condensation product containing about 1000 parts by weight of resorcinal, about 1000 parts by weight of 40% formaldehyde and about 3 parts by weight of sodium sulfite within said mass of fibrous material, filling said fibrous material containing gasoline and said binder into a mold, applying heat with a temperature of about 400° F. to cause fuming of said gasoline to permeate said mass of fibrous material and to escape therefrom through a multiplicity of channels in said fibrous mass prior to the hardening of said binder, maintaining heat sufficient to cause hardening of said binder, applying pressure of about 1500 pounds per square inch to said mass of fibrous material before said binder has set to compress said mass into a compressed state, and continuing the application of said pressure until the compressed mass has assumed a stable condition.

In testimony whereof I have hereunto set my hand.

ADOLF HAWERLANDER.