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METHOD OF TREATING WASTE FIBROUS MATERIAL.

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To all whom it may concern:

Be it known that I, ISAAC NAYLOR, a subject of the King of England, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Methods of Treating Waste Fibrous Material, of which the following is a specification.

This invention relates to a method of treating waste fibrous material to produce an impervious solidified and fire resisting body as a substitute for wood for all the usages of the latter, and more particularly in the use of manufacturing kegs, barrels, drums, receptacles, crates, boxes, laths, flooring, roofing, shingles, wall boards, and for any other purposes for which a product derived from the hereinafter described method can be employed.

The term "fibrous waste" is to include banana stalks, corn stalks, rice hulls, bagasse, cotton and tobacco stalks, waste paper and any other character of waste fibrous materials.

The product derived from the method as hereinafter referred to, consists of a solidified impervious fire resisting body of unusual strength and hardness formed from a mass of comminuted contracted waste fibrous material having inherent binding and solidifying characteristics.

In carrying out the method for treating fibrous waste in accordance with this invention, a body or quantity of the fibrous waste material, such as banana stalks, corn stalks, rice hulls, bagasse or cotton or tobacco stalks, or waste paper, or any other waste fibrous material is first dried completely, after which it is subjected to a grinding action for the purpose of reducing the material into small particles. After the material has been reduced into small particles, it is sifted under the action of fluid pressure, and the mesh of the sifting element can be of any suitable size, according to the texture, weight and strength of the finished product desired. The density, strength and texture depend upon the smallness or largeness of the sifted particles. Therefore, the size of the mesh of the sifting element or screen is to be governed with respect to the texture, weight and strength of the product desired.

Certain waste fibrous materials have within them a pith or a short fiber, and during the process of grinding the pith or short fiber, becomes very minute, and in connection with the larger fibers broken down during the grinding action, to a small mesh size, acts as a filler so that the ultimate product is strong and unusually dense. The waste fibrous material which contains the pith or short fiber, is of the stalk family, however, any of the waste fibrous materials containing long or short fiber, or long fiber alone, can be reduced by the grinding action to a powder state.

After the waste fiber has been reduced to the fineness for the purpose desired, it is supplied to a large vat or tank treated with a solution in the proportions of half water and half silicate of soda of 40° Bé., whereby the solution will be of 20° Bé., in strength. This solution is run into the dry ground waste fibrous material in sufficient quantity to bring the material into a state of liquidation sufficient to mix with ease. In order that the ground waste fibrous material be thoroughly saturated, that is impregnated through and through, several vats or tanks can be employed, and the material run from one vat to the other and subjected to the solution during a state of agitation for a period of two or three hours, and after the agitating operation the saturated material is allowed to stand for a period of two or three hours.

After the saturated or impregnated material has stood for a period of two or three hours, it is subjected to dry steam for the purpose of evaporating the water off until the liquid remaining is reduced to a density of about 40° Bé., and after which it is agitated or stirred until the mass becomes of thick muddy consistency.

The thick muddy mass is then run into suitable mixing machines of that type employed in mixing dough for bread or crackers. After being supplied to the mixer, there is added to the mass one-third by weight of silicate of soda at a strength of 40° Bé. The mixer is then operated at a moderately high speed for a period of fifteen or twenty minutes, or for such time until the material assumes a dough-like consistency. At this point the speed of the mixer is reduced and the mixer is operated at low speed until the batch or mass has assumed a homogeneous state of a charac-

teristic that it will not break or crack when pressing or squeezing a handful of the mass.

When the mass has been brought to a homogenous state possessing the characteristics referred to, it is ready to pass through forming machines to produce an article of any desired shape or form, and after being submitted to the forming machines the material is discharged from such machine in a plastic condition, not elastic, but possessing a characteristic that it can be pulled or rolled to a degree without cracking, breaking or sticking. The formed article in plastic condition, whether such article is a keg, drum, barrel, wall boards, flooring, roofing, shingles or crates, is then subjected to hot live air impregnated with carbonic acid gas by passing the article at the desired rate of speed through a suitable enclosure to which is supplied the hot live air impregnated with carbonic acid gas. The carbonic acid gas with the hot air acts upon the material to release the silicate acid and other gaseous or vaporous matters, and in connection with the hot live air causes the contraction of the article, or rather the solidification thereof and thereby increases its density.

If the article after it has passed through the enclosure space provided with the hot live air impregnated with carbonic acid gas, has not become thoroughly dried, it is then dried in any suitable manner, as stored in drying sheds for such purpose.

The time of subjecting the material to the live hot air combined with the carbonic acid gas, depends upon the thickness of the body of the article, by way of example, an article having its body of a thickness of one-fourth inch would be subjected to the hot air and gas for a period of from twenty to thirty minutes. If the body of the article is thicker than that as stated, the period of subjecting the article to the hot air and gas would be greater. Further, the period to which the article is subjected to the hot air and gas also depends upon the density of the article when it first enters the enclosed space containing hot air and gas, because if the fiber is of a flour-like consistency the form of the article would be of greater density than if the article were of short comminuted particles.

After the formed article has been thoroughly dried, it is passed through a bath consisting of hot silicate of soda of 40° Bé., with the addition of 25% water, and it is conducted through the bath by the means of rollers. This bath provides the article with an impervious coating.

When the article is removed from the bath it is then thoroughly dried and then subjected to a bath consisting of 8% water and 1% bicarbonate of soda for the purpose of thoroughly setting the impervious coating. When subjecting the article to the bath, or water and bicarbonate of soda, it is carried through the bath through means of rollers, and the passage of the article through both of the baths is carried out very rapidly.

The resultant product from the foregoing method consists of an impervious solidified fire resisting body of unusual strength and hardness, free from all brittleness and obtained without the employment of external pressure to increase the density or to solidify the same, as the article or material inherently increases the density of solidification thereof by the contraction of the fibrous material during the removal of the silicate acid or gaseous or vaporous matter.

Although the preferred embodiment of a method of treating waste fibrous material to produce a substitue for wood, in accordance with this invention, is as described, yet it is to be understood that changes and modifications of the steps of the method can be resorted to which will fall within the scope of the claims hereunto appended.

What I claim is:—

1. A method of treating vegetable fibrous waste to produce a solidified body to form a substitute for wood, comprising the reducing of a body of vegetable fibrous waste into a mass of small particles, then thoroughly impregnating the particles of the mass with a solution of silicate of soda, then bringing the mass to a mud-like consistency, then kneading the mass with the addition thereto of silicate of soda to form a dough-like body of non-cracking characteristic, and then providing for the contraction and solidifying of said dough-like body by removing therefrom gaseous and other foreign matter, whereby the density of said body is increased, causing the contraction and solidification thereof.

2. A method of treating vegetable fibrous waste to produce a solidified body to form a substitute for wood, comprising the reducing of a body of vegetable fibrous waste into a mass of small particles, then thoroughly impregnating the particles of the mass with a solution of silicate of soda, then bringing the mass to a mud-like consistency, then kneading the mass with the addition thereto of silicate of soda to form a dough-like body of non-cracking characteristic, then providing for the contraction and solidifying of said dough-like body by removing therefrom gaseous and other foreign matter, whereby the density of said body is increased, causing the contraction and solidification thereof, and then forming the solidified body imperviable by subjecting it to an impervious rendering material.

3. A method of treating vegetable fibrous

waste to produce a solidified body as a substitute for wood, comprising the reducing of a body of vegetable fibrous waste into a mass of small particles, then thoroughly impregnating the particles of the mass with a solution of silicate of soda, then bringing the mass to a mud-like consistency, then kneading the mass with the addition thereto of silicate of soda to form a dough-like body of non-cracking characteristic, and then subjecting said dough-like body, while free of external pressure, to live hot air combined with carbonic acid gas to remove the gaseous and other foreign matter therefrom, thereby increasing the density of, drying and solidifying said body.

4. A method of treating vegetable fibrous waste to produce a solidified shaped body, comprising the reducing of a body of vegetable fibrous waste into a mass of small particles, then thoroughly impregnating the particles of the mass with a solution of silicate of soda, then bringing the mass to a mud-like consistency, then kneading the mass with the addition thereto of silicate of soda to from a dough-like body of non-cracking characteristic, then shaping the dough-like body, and then removing from the shaped dough-like body gaseous and other foreign matter to contract the body to increase the density thereto and to solidify the same.

5. A method of treating vegetable fibrous waste to produce a solidified body as a substitute for wood, comprising the subjecting of a mass of small particles of vegetable fibrous waste to an alkaline solution, then bringing such treated mass to a mud-like consistency, then kneading the mass with the addition thereto of an alkaline solution to form a dough-like body of non-cracking characteristic, and then subjecting said dough-like body while free of external pressure to live hot air combined with carbonic acid gas to remove therefrom gaseous and other foreign matter, whereby said body will have the density thereof increased, solidified and dried.

6. A method of treating waste vegetable fibrous material to provide a wood substitute, comprising the comminuting of the waste to provide a mass of small particles, then forming said mass into a shaped plastic dough-like body possessing a non-cracking characteristic, and then passing said shaped plastic dough-like body while free of external pressure through live hot air combined with carbonic acid gas to remove all gaseous and other foreign matter therefrom, whereby said body will have its density increased by contraction and further solidified and dried.

7. A method of treating waste vegetable fibrous material to provide a wood substitute, comprising the comminuting of the waste to provide a mass of small particles, then forming said mass into a shaped plastic dough-like body possessing a non-cracking characteristic, then passing said shaped plastic dough-like body while free of external pressure through live hot air combined with carbonic acid gas to remove all gaseous and other foreign matter therefrom, whereby said body will have its density increased by contraction and further solidified and dried, and then rendering said solidified body impervious.

In testimony whereof, I affix my signature hereto.

ISAAC NAYLOR.