UNITED STATES PATENT OFFICE.

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WATER AND FIRE RESISTING FIBER-BOARD AND PROCESS OF MANUFACTURE.

1,280,400. Specification of Letters Patent. Patented Oct. 1, 1918.

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To all whom it may concern:

Be it known that I, ALBERT L. CLAPP, a citizen of the United States, and resident of Marblehead, in the county of Essex and State of Massachusetts, have invented an Improvement in Water and Fire Resisting Fiber-Board and Processes of Manufacture, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

The object of my present invention is to produce fiber-board which will be both fire and water resisting by a novel process of preparing the stock for manufacture into such fiber-board. A further object is to use materials which will be economical, capable of easily being treated, mixed and handled and a process which may be carried out economically in a beater engine when the stock is being mixed and rendered into pulp without separate treatments, to render the resulting product both waterproof and fire-resisting. In carrying out my improved process of manufacture I have discovered that the preparation of a suitable sizing compound from vegetable material such as tree bark, tanbark waste, peat moss, waste flax straw, salt-marsh hay, corn stocks, sawdust, sea-weed and all like materials which are partially soluble in caustic soda, caustic potash, or their equivalents, when mixed with the fibrous stock in the beater engine and precipitated by any suitable agent such as alum, aluminium surfate, or other metallic salts, results in both waterproofing and substantially fireproofing the finished fiber-board made from such pulp. To make this sizing compound from tree barks, such as hemlock, oak, elm and the like, as well as from peat moss, hay, straw, corn stock, sawdust, sea-weed and the like, I first boil the bark in a solution of caustic soda, cooking a considerable quantity, say from 300 to 500 lbs., in a suitable vessel or tank. The solution of caustic soda must be sufficiently strong to readily act upon the bark, and I have found that 300 gallons of a 2% solution will be suitable for 300 to 500 lbs. of bark. When the bark is properly cooked, a very large percentage is rendered soluble, being from 30 to 50% of the total amount of bark used. This entire mixture of dissolved and undissolved bark material may be dumped into the beater engine where the charge of fibrous cellulose such as wood pulp, jute, hemp rags, old papers, leather scraps or the like stock for the finished board is being prepared (usually about 1,000 lbs.) for a charge, and the bark mixture is thoroughly mixed with the beater charge, sufficient water being used in the beater to aid in rendering the same into suitable pulp. I then add, in the beater, a sufficient amount of alum, aluminum sulfate, or metallic salts, to cause the soluble compound to be precipitated upon and among the fiber of the pulp, using approximately from 50 to 75 lbs. of such precipitant for a beater charge. The soluble matter thus precipitated acts as a sizing as well as waterproofing and substantially fireproofing the pulp and resulting fiberboard made therefrom, the undissolved matter further aiding in the fireproofing of the material. The entire stock and pulp in the beater engine is then beaten out to the desired degree of fineness and subsequently run on a wet machine, cylinder machine, or formed into sheets by pressure, rolls, or any other suitable manner, which sheets are dried and calendered.

It will be understood that I may thus size, waterproof and fireproof any sort of pulp, wood, jute, rags, paper, leather, etc., or any combination of these various stocks, since my process is equally applicable and beneficial to all such mixtures. An important feature of the process is the simultaneously sizing, waterproofing and fireproofing of an entire beater charge by such inexpensive materials as the dissolved and partially dissolved compounds from bark, peat moss, hay, cornstock, sawdust, sea-weed and the like, and I am enabled to employ a relatively large proportion of such sizing compound and still the resulting fiberboard will be tough, pliable and of first-class commercial grade. The employment of animal sizing, in large quantities, on the contrary, or rosin, would cause the finished board to be too hard, and such animal sizing fail entirely in the fireproofing feature which is so important a characteristic of my process.

A further important and advantageous feature of my improved process is that by varying the proportions of the sizing compound and the fiber stock a very large range in variety of resulting fiberboards, for different purposes, can be manufactured. In fact, the capability of the sizing compound

which I have discovered by utilizing bark, moss, sea-weed, hay, cornstock, sawdust, and the like, to mix uniformly throughout the fibrous stock of the charge in the beater, each apparently having an affinity for the other and rendering a homegeneous product, constitutes a remarkable feature of my discovery. I have found that by using a relatively larger proportion of the sizing compound than that suggested above, an excellent building board can be made, which is both waterproof, windproof, vermin-proof and fire-resisting. With other suitable proportions a product suitable for counter boards can be made, and by the use of considerable leather stock scrap, a very good and desirable waterproof fiberboard suitable for the manufacture of boot and shoe heels can be made. Other possibilities in the variation of the proportions for particular work desired, will readily occur to those skilled in this art, by varying the proportions of the sizing compound, and the stock used. Thus in the case of using peat as a sizing, I have found that a much larger proportion of the material is dissolved out, being from 60 per cent. to 70 per cent. of the peat employed and with this peat sizing compound added to the beater charge, the resulting product may be advantageously employed in the manufacture of various kinds and grades of building boards. I also find that the use of peat is specially advantageous in the fire-resisting characteristics of the resulting product. It will also be understood that I may combine with any of the foregoing mixtures a small amount of rosin or animal size in order to produce a harder surfaced board where the same is desirable.

For the sake of simplicity the expression "vegetable material" will be used in a comprehensive sense in the claims, it being understood that said expression "vegetable material" is intended to include any of the materials specified in the specification for use in preparing the vegetable sizing, such as the barks of trees, tan bark waste, peat moss, peat, waste flax straw, salt-marsh hay, corn stocks, sawdust, seaweed, or similar materials, or a mixture of any of them.

My invention is further described and defined in the form of claims as follows:

1. That process of making a fire and water resisting fiberboard, which is characterized by treating vegetable material with a solution of caustic alkali so as partially to dissolve said material; mixing the solution and residue thus obtained with fibrous cellulose in water; treating the mixture thus obtained to reduce the fibrous cellulose and other solid matter therein to a finely divided state; forming the stock thus obtained into sheets; drying said sheets; and adding a metallic salt to the mixture at some time previous to forming the stock into sheets, to precipitate the vegetable material dissolved in the caustic alkali solution throughout the mixture to render the fiberboard obtained fire and water resisting.

2. That process of making a fire and water resisting fiberboard, which is characterized by treating vegetable material with a solution of caustic soda so as partially to dissolve said material; mixing the solution and residue thus obtained with fibrous cellulose in water; treating the mixture thus obtained to reduce the fibrous cellulose and other solid matter therein to a finely divided state; forming the stock thus obtained into sheets; drying said sheets; and adding a metallic salt to the mixture at some time previous to forming the stock into sheets, to precipitate the vegetable material dissolved in the caustic soda solution throughout the mixture to render the fiberboard obtained fire and water resisting.

3. That process of making a fire and water resisting fiberboard, which is characterized by treating vegetable material with a solution of caustic alkali so as partially to dissolve said material; mixing the solution and residue thus obtained with fibrous cellulose in water; treating the mixture thus obtained to reduce the fibrous cellulose and other solid matter therein to a finely divided state; forming the stock into sheets; drying said sheets; and adding a metallic salt to the mixture at some time previous to forming the stock into sheets, to precipitate the vegetable material dissolved in the caustic alkali solution, said precipitate and the undissolved vegetable material being distributed throughout the mixture and rendering the fiberboard fire and water resisting.

4. That process of making a fire and water resisting fiberboard, which is characterized by treating vegetable material with a solution of caustic alkali so as partially to dissolve said material; mixing the solution and residue thus obtained with fibrous cellulose in water; treating the mixture thus obtained to reduce the fibrous cellulose and other solid matter therein to a finely divided state; forming the stock thus obtained into sheets; drying said sheets; and adding aluminum sulfate to the mixture at some time previous to forming the stock into sheets, to precipitate the vegetable material dissolved in the caustic alkali solution throughout the mixture to render the fiberboard obtained fire and water resisting.

5. That process of making a fire and water resisting fiberboard, which is characterized by treating vegetable material with a solution of caustic alkali so as partially to dissolve said material; mixing the solution and residue thus obtained with fibrous cellulose in water; treating the mixture thus obtained to reduce the fibrous cellulose and

other solid matter therein to a finely divided state; forming the stock into sheets; drying said sheets; and adding aluminum sulfate to the mixture at some time previous to forming the stock into sheets, to precipitate the vegetable material dissolved in the caustic alkali solution, said precipitate and the undissolved vegetable material being distributed throughout the mixture and rendering the fiberboard fire and water resisting.

6. That process of making a fire and water resisting stock for fiberboard, which is characterized by treating vegetable material with a solution of caustic alkali so as partially to dissolve said material; mixing the solution and residue thus obtained with fibrous cellulose in water; treating the mixture thus obtained to reduce the fibrous cellulose and other solid matter therein to a finely divided state; and adding a metallic salt to the mixture at some time during the process to precipitate the vegetable material dissolved in the caustic alkali solution throughout the mixture and render the stock fire and water resisting.

7. That process of making a fire and water resisting fiberboard stock, which is characterized by treating vegetable matter with a solution of caustic soda so as partially to dissolve said material; mixing the solution and residue thus obtained with fibrous cellulose in water; treating the mixture thus obtained to reduce the fibrous cellulose and other solid matter therein to a finely divided state; and adding a metallic salt to the mixture at some time during the process to precipitate the vegetable material dissolved in the caustic soda solution throughout the mixture to render the stock fire and water resisting.

8. That process of making a fire and water resisting fiberboard stock, which is characterized by treating vegetable material with a solution of caustic alkali so as partially to dissolve said material; mixing the solution and residue thus obtained with fibrous cellulose in water; treating the mixture thus obtained to reduce the fibrous cellulose and other solid matter therein to a finely divided state; and adding a metallic salt to the mixture at some time during the process, to precipitate the vegetable material dissolved in the caustic alkali solution, said precipitate and the undissolved vegetable material being distributed throughout the mixture and rendering the stock fire and water resisting.

9. That process of making a fire and water resisting fiberboard stock, which is characterized by treating vegetable material with a solution of caustic alkali so as partially to dissolve said material; mixing the solution and residue thus obtained with fibrous cellulose in water; beating out the mixture thus obtained to reduce the fibrous cellulose and other solid matter therein to a finely divided state; and adding aluminum sulfate to the mixture at some time during the process, to precipitate the vegetable material dissolved in the caustic alkali solution, said precipitate and the undissolved vegetable material being distributed throughout the stock and rendering the same fire and water resisting.

10. That process of making a fire and water resisting fiberboard stock, which is characterized by treating vegetable material with a suitable solvent so as partially to dissolve said material; mixing the solution and undissolved residue thus obtained with fibrous cellulose in water; treating the mixture thus obtained to reduce the fibrous cellulose and other solid matter therein to a finely divided state; and adding a metallic salt to the mixture at some time during the process to precipitate the vegetable material dissolved in the solvent, said precipitate and the undissolved residue of vegetable material being distributed throughout the mixture and rendering the stock fire and water resisting.

11. As an article of manufacture, a fire and water resisting fiberboard comprising fibrous cellulose and alkali treated vegetable material reduced to a finely divided state and thoroughly mixed together and having also thoroughly intermingled therewith a precipitate obtained by treating a solution of a part of the vegetable material in a caustic alkali with a metallic salt.

12. As an article of manufacture, a fire and water resisting fiberboard comprising fibrous cellulose and vegetable material that has been treated with a solution of caustic alkali partially to dissolve said vegetable material, the fibrous cellulose and undissolved residue of vegetable material being reduced to a finely divided state and thoroughly mixed and having thoroughly intermingled therewith a precipitate obtained by treating the caustic alkali solution of vegetable material with a metallic salt.

13. As an article of manufacture, a fire and water resisting fiberboard comprising fibrous cellulose and vegetable material that has been treated with a solution of caustic alkali partially to dissolve the same, the fibrous cellulose and undissolved residue of vegetable material being reduced to a finely divided state and thoroughly mixed and having thoroughly intermingled therewith a precipitate obtained by treating the caustic alkali solution of vegetable material with aluminum sulfate.

14. As an article of manufacture, a fire and water resisting fiberboard comprising a suitable fiberboard stock and vegetable material that has been treated with a solution of caustic alkali partially to dissolve the same, said fiberboard stock and undissolved residue of vegetable material being reduced to a finely divided state and thor-

oughly mixed and having thoroughly intermingled therewith a precipitate obtained by treating the caustic alkali solution of vegetable material with a metallic salt.

15. As an article of manufacture, a fire and water resisting fiberboard comprising fibrous cellulose and vegetable material that has been treated with a suitable solvent partially to dissolve said vegetable material, the fibrous cellulose and undissolved residue of vegetable material being reduced to a finely divided state and thoroughly mixed and having thoroughly intermingled therewith a precipitate obtained by treating the solution of vegetable material with a metallic salt.

16. As an article of manufacture, a fire and water resisting fiberboard comprising suitable fiberboard stock and vegetable material that has been treated with a suitable solvent partially to dissolve said vegetable material, the fiberboard stock and undissolved residue of vegetable material being reduced to a finely divided state and thoroughly mixed and having thoroughly intermingled therewith a precipitate obtained by treating the solution of vegetable material with a metallic salt.

17. That process of making fire and water resisting fiberboard, which is characterized by treating approximately 300 to 500 pounds of vegetable material with substantially 300 gallons of a relatively weak solution of caustic alkali so as partially to dissolve said material; mixing the solution and undissolved residue thus obtained with approximately 1000 pounds of fibrous cellulose or other suitable fiberboard stock; treating the mixture thus obtained to reduce the solid matter to a finely divided state; forming the stock thus obtained into sheets; treating said sheets; and adding approximately 50 to 75 pounds of a metallic salt at some time previous to forming the stock into sheets, to precipitate the vegetable material dissolved in the caustic alkali solution throughout the mixture.

18. That process of making stock for a fire- and water-resisting fiber-board, which is characterized by partially dissolving vegetable material in a suitable solvent; mixing the solution and residue thus obtained with a suitable fibrous stock; treating the mixture thus obtained, to reduce the solid matter therein to a relatively finely divided state; and at some time during the process treating the solution of vegetable material with a suitable precipitant to precipitate said vegetable material throughout the mixture, to render the product fire- and water-resisting.

19. A stock for the manufacture of a fire- and water-resisting fiber-board, comprising a suitable fibrous stock and a partial solution of vegetable material in a suitable solvent, said fibrous stock and the dissolved vegetable material being reduced to a relatively finely divided state and thoroughly mixed, and having thoroughly intermingled therewith a precipitate to render the finished fiber-board fire- and water-resisting, obtained by treating the solution of vegetable material with a suitable precipitant.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

ALBERT L. CLAPP.

Witnesses:
JAMES R. HODDER,
HAROLD J. CLARK.