Patented Aug. 31, 1926. 1,598,260

UNITED STATES PATENT OFFICE.

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PULP BOARD AND METHOD OF MAKING SAME.

No Drawing. Application filed May 10, 1920. Serial No. 380,109.

My invention relates to an improved pulp board and to the method of making the same.

Pulp board is usually made by running paper pulp, wood pulp, or the like, with or without the admixture of a binder such as mineral pitch, asphalt, or like substances (if solid, then preferably reduced to a comminuted state), into a mold and, by means of pressure, removing the majority of the water (see, for instance, patent to Daniel M. Sutherland and myself, No. 971,936, dated October 4, 1910, and patent to myself, No. 1,272,566, dated July 16, 1918), and subsequently drying out the remainder of the water by the application of heat, preferably in a suitably constructed drier. The board, after substantially all the water has been removed, is in what might be termed a spongy condition (in my claims I term it "sponge board") and is then subjected to combined heat and pressure to form a compacted board.

So far as I am aware, it has been the practice heretofore to dry the pulp board as thoroughly as possible, in fact to a "bone dry" condition, in order to permit the fiber to be penetrated as thoroughly as possible by the binder or other added ingredient and to avoid, as far as possible, the formation of steam in the interior of the board during the step of compacting with combined heat and pressure.

I have found that the tensile strength and toughness of the compacted board can be very materially increased, in fact in many instances as much as sixty-six per cent (66%), and even higher, by providing for the presence of an appreciable percentage of moisture in the board when it is being compressed from the spongy condition to a compacted condition. I have found that the best results can be obtained by providing an amount of moisture which is about equal to the amount which would be absorbed by the completely dried, spongy board if allowed to stand exposed to ordinary atmosphere, such amount, in practice, having been found, in the case of paper pulp and of wood pulp, to constitute about five per cent (5%), by weight, of the fiber content of the board. This amount of moisture may be provided, for instance, either by stopping the drying of the board when the water content has been sufficiently reduced, or by exposing the completely dried board, while in a spongy condition, to the action of steam, or, for a sufficient length of time, to the moisture of ordinary atmosphere. The suitable amount for any particular pulp mixture can readily be determined by making a completely dried, spongy board of such mixture in the manner above described, and then exposing such board to ordinary atmosphere for a suitable length of time. For the sake of convenience, I have designated this amount in my claims as "the normal moisture of the fiber content", and this expression should be understood in the sense above indicated.

The board, while in the spongy condition and containing the desired percentage of water (and, preferably, after having been seasoned for a few days), is then permanently compacted by being subjected to combined heat and pressure, preferably by pressing the same between the two plates of a hot press of any suitable construction for such length of time, at such degree of heat, and under such amount of pressure as may be necessary, such length of time, degree of heat, and amount of pressure varying according to the kind and quantity of material used and the nature of the finished board it is desired to produce. In order to prevent sticking of the board to the plates of the press, particularly when a fusible binder is employed, it is advisable to provide the surface of the board with a coating of wax or a suitable vegetable oil, and such coating may be applied before the board is exposed to steam or the moisture of the atmosphere as it will not interfere with the absorption of moisture. The heat of the press will in most cases (if not in all cases) have to be greater than 212° F., thus raising the temperature of the water within the board to above boiling point. It will therefore be necessary in such cases, in order to avoid the formation of steam within, and consequent injury to the board, to reduce the temperature of the press to below the boiling point of water before releasing the pressure upon the compacted board; in fact, the press should be kept cool for a length of time sufficient to permit the board itself to cool to below 212° F. This cooling can be performed in any suitable manner; for instance, by flooding the steam chambers of the press-platens with cold water.

While I have found that the indicated

content of water in the uncompacted board has given the best results, approximately as good results can be obtained by using a slightly different proportion of water. For some purposes a higher water content than that indicated may be desirable; for instance, when the compacted board is afterward to be bent to shape. Care, however, must be taken not to add too much water as to do so would cause the board to have a tendency to split while pressure is being applied and to shrink after being compacted. The exact percentage of water content can therefore be varied without departing from my invention, the variations being regarded by me as equivalents of the content referred to in my claims.

My invention is not limited to the use of any particular fiber, or binder, but may be employed in connection with any suitable fiber, such as wood pulp, paper pulp, or rag pulp, and with any suitable binder, such as sulphur, shellac, mineral pitch, asphaltum, gilsonite, elaterite, china wood oil, and resinous matters generally. Nor is my invention limited to any particular proportions of fiber and binder, although it may be found that when the proportion of binder is very high and the proportion of fiber is very low, the increase in tensile strength obtained by my invention is relatively unimportant. My invention is applicable also to the manufacture of board having coloring matter embodied therein, either throughout the board or on the surface, or both, or to board having a pattern or design molded on its surface, or to any pulp articles of suitable shape or configuration.

I claim:

1. The method of making pulp board which comprises shaping a mixture of pulp and a binder into the form of a board, providing for the presence, within the board, of an amount of water approximately equal to and not substantially more than the normal moisture of the fiber content, and then compacting the sponge board thus formed in the presence of heat and cooling the board to a temperature of less than 212°F. before releasing the pressure, substantially as and for the purpose described.

2. The method of making pulp board which comprises running pulp, mixed with a binder, into a mold, compressing the pulp into the form of a board, removing the water from the pulp, exposing the pulp to moisture until it has absorbed an amount of water approximately equal to and not substantially more than the normal moisture of the fiber content, subjecting the board to combined heat and pressure, and then cooling the board to a temperature less than 212° F. before releasing the pressure, substantially as and for the purpose described.

3. The method of making pulp board which comprises shaping pulp into the form of a board, providing for the presence, within the board, of an amount of water approximately equal to the normal moisture of the fiber content, and then compacting the sponge board thus formed in the presence of heat and cooling the board to a temperature of less than 212° F. before releasing the pressure, substantially as and for the purpose described.

4. As an article of manufacture pulp board produced by compacting at a temperature higher than 212° F. dried sponge board containing an amount of water approximately equal to the normal moisture of the fiber content and cooling the board to a temperature of less than 212° F. before releasing the pressure.

5. As an article of manufacture pulp board produced by compacting at a temperature higher than 212° F. dried sponge board containing a binder and an amount of water approximately equal to the normal moisture of the fiber content and cooling the board to a temperature of less than 212° F. before releasing the pressure.

In witness whereof I have hereunto set my hand.

DANIEL M. SUTHERLAND JR.