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WATER REPELLENT PAPER AND SHEATHING BOARD

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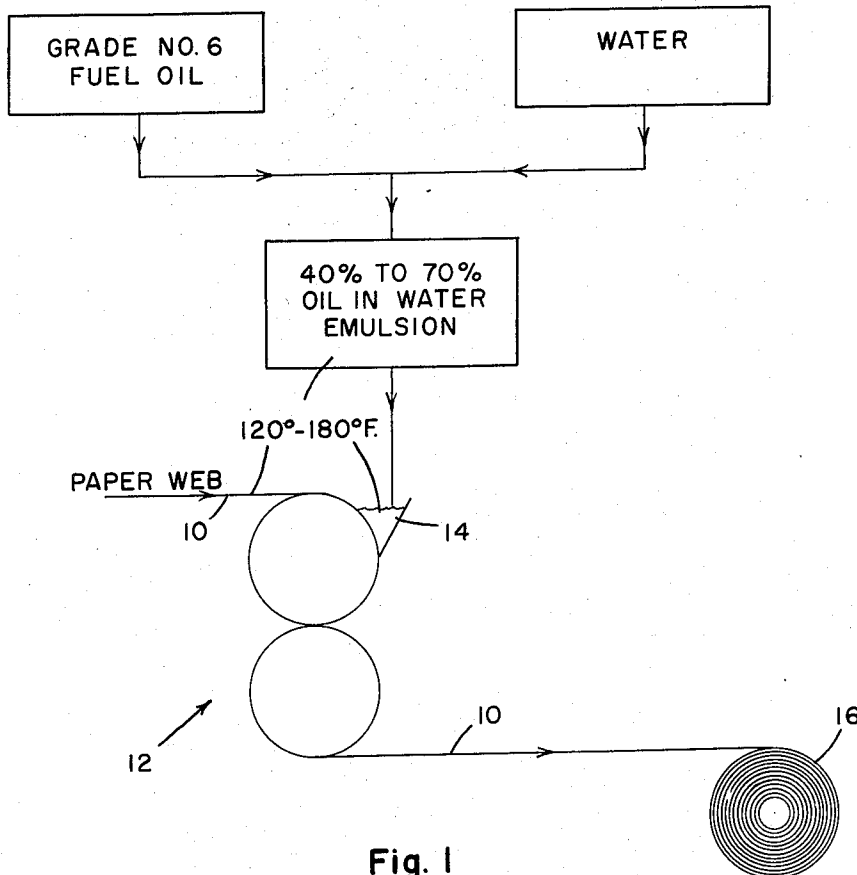


Fig. 1

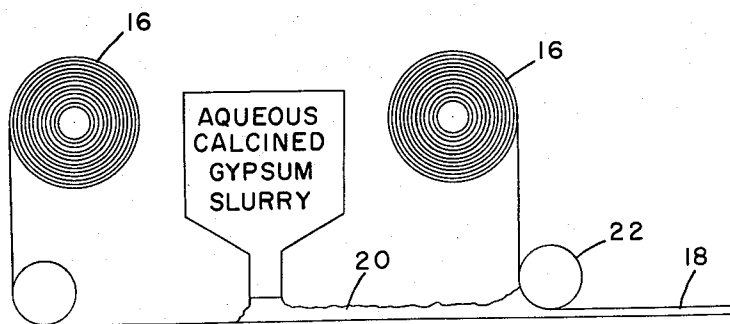


Fig. 2

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WATER REPELLENT PAPER AND SHEATHING BOARD

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8 Claims. (Cl. 117—60)

This invention relates to an improved water-repellent-surfaced paper and, more particularly, to a gypsum-sheathing-board paper cover-sheet which is relatively porous, has a high degree of water repellency on the top-surface of the paper, and a relatively higher water absorptivity on the bottom-surface.

Gypsum sheathing board is manufactured by disposing an aqueous slurry of plaster between two cover-sheets while such components are continuously progressing along a conveyor of considerable length. The cover sheets are of a relatively heavy paper, in the order of .020" thick, weighing from 60 to 80 pounds per thousand square feet.

The water-affecting characteristics desired in the cover-sheets for gypsum sheathing board are known to be of an unusual character, difficult to attain in a practical and commercially acceptable manner. To obtain the essential bond between the gypsum plaster and paper cover-sheets, the paper bottom-surface should have substantial water absorptivity, relative to the water repellent top surface, whereby the plaster slurry is absorbed into the paper bottom surface to form a continuous bond and keying of the subsequently hardened or set gypsum thereto. It will also be apparent that for commercially practical drying of the set gypsum core, a substantial porosity of the cover-sheets is essential for removal therethrough of the water or water vapor to be driven off in drying the core.

Thus, attempts to provide, in combination with these paper cover-sheet bottom-surface characteristics, further characteristics of a highly weather resistant or water repellent top-surface are obviously seriously restricted. The top-surface must be maintained sufficiently porous to permit the above discussed gypsum core drying at a practical rate. Means are thus desired for treating generally the individual fibers or fiber groups with a highly non-continuous, water repellent top-surface coating.

A considerable advantage is obtained if this coating can be applied during paper manufacture, avoiding serious technical handicaps which arise in attempting to coat paper at a board forming machine or the marked economic disadvantages in coating the board subsequent to gypsum board manufacture. Coating one surface of paper for water repellency during the paper manufacture, to provide a finished paper free of such coating on its opposite surface, requires a water repellent coating which, while highly attracted and adhered to the top-surface, does, not penetrate through the paper destroying the necessary water absorptivity of the opposite surface, and further does not transfer to the bottom surface of the adjacent convolution when rolled into the finished paper roll.

The requirements sought in a coating material and method are thus not only difficult to attain insofar as the combination of vapor-permeability and water-repellency, but even more difficult because of the essential application characteristics.

It is an object of the present invention to provide a

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water repellent coating and method of application which fulfills the above requirements and is further susceptible of highly practical and economical application to one surface of a paper web during manufacture.

Further objects are to produce a satisfactory water repellent coating which will not penetrate completely through heavy paper and will not affect water absorptivity characteristics of the surface of the paper that is to be bonded to the gypsum core and which will not adversely affect the vapor permeability, or other characteristics of the paper vital for the manufacture of gypsum sheathing board.

Another object is to eliminate the necessity of aging of the paper before it can be satisfactorily used in gypsum board manufacture.

It is a further object to provide a novel coating which is comprised of low-cost and readily available materials. Briefly, the invention contemplates the emulsification in water of bunker C, grade No. 6 fuel oils which are of certain limited physical characteristics and in certain emulsification proportions, and, further, the application of such emulsions to one surface of a paper web at specified conditions and rates of application.

These and other objects of the invention will be more readily apparent when considered in relation to the preferred embodiment as set forth in the specification and shown in the drawings in which:

Fig. 1 is a schematic diagram of the method of making vapor-permeable gypsum sheathing cover paper, in accordance with the invention.

Fig. 2 is a schematic diagram of the process of making water-repellent gypsum, sheathing board with the cover paper of Fig. 1, in accordance with the invention.

In accordance with the invention, an oil-in-water emulsion is prepared with grade No. 6 fuel oils, also known as bunker C oil, using suitable emulsifying equipment and suitable emulsifying agents, which are in common practice in the art of emulsification, and preferably maintaining temperatures during emulsification of from 120° F. to 180° F. The emulsions include from 40% to 70% of the specified fuel oil, by volume, in water, and are preferably of an oil-to-water ratio of approximately 60 to 40. A volatile emulsifying agent additive is especially advantageous in that after application of the emulsion, to the paper the inactive water and emulsifying agent ingredients can be most rapidly evaporated off. For example, 1% of each of morpholine and oleic acid has been found to provide the desired quality of emulsifying agent in accordance with the invention.

Grade No. 6 fuel oil is a residual, thick, black oil, defined in A.S.T.M. Tentative Specifications for Fuel Oils, D396-48T, as an oil for use in burners equipped with preheaters permitting a high viscosity fuel, and is qualified therein by the following data:

Minimum flash point	-----° F.	150
Maximum water and sediment, by volume	percent	2.00
Saybolt viscosity, Furol @ 122° F.	sec	45 to 300
Kinematic viscosity @ 122° F., in centistokes		92 to 638

Of particular importance in the present invention is the relatively high viscosity of the grade No. 6 fuel oil. Fuel oil of viscosity between 70 and 140 seconds, Furol at 122° F., has been found most satisfactory, in accordance with the invention.

Referring to Fig. 1, in the preferred form of the invention, a 60% oil emulsion, prepared as above defined, is applied, at a temperature of from 120° F. to 180° F., to the top-surface of the relatively heavy paper web 10 at a paper machine calendar stack 12, whereat the paper is also at a temperature in the order of 180° F.,

using a conventional water box 14 at the calender stack. The paper will absorb from 2 to 7 pounds of the emulsion per thousand square feet of paper at ordinary paper machine speeds. Best results may be obtained using a paper which has been previously sized with conventional sizing agents, such as rosin size.

The emulsion of the invention is very rapidly absorbed by the fibrous material at the top-surface of the paper web due to the sufficiently low viscosity of the emulsion. It has been found, further, that an emulsion of grade No. 6 fuel oil, applied at the above calender stack temperatures, very rapidly loses its water content, leaving a highly adherent, water repellent coating disposed upon the individual fibers or fiber groups of the paper, within the very short time interval, in the order of 4 to 10 seconds, prior to its being rolled, as in roll 16. This coating is thus formed of a relatively high viscosity material, which has been well absorbed while in the emulsion state, whereby there is substantially no subsequent penetration of the fuel oil through the web to the opposite face, nor is there transfer of the fuel oil to the bottom-surface of the paper of the adjacent convolution in the ultimate paper roll, which will appreciably affect the absorption properties of the paper bottom-surface. Prior paper cover-sheets for gypsum sheathing, treated to provide a suitable water repellency on the top-surface, have been subject to excessive penetration or transfer of the water repellent coating applied, thus, the bottom-surface of such paper is detrimentally water repellent, hampering the bond between the subsequently formed gypsum core and the paper bottom-surface. Furthermore, prior coatings for water repellency have all decreased substantially the vapor permeability and hampered the drying of the subsequently formed gypsum sheathing board.

Grade No. 6 fuel oil is a petroleum product of certain above defined characteristics which have been found highly advantageous when used in accordance with the invention. The particular characteristics which define a grade No. 6 fuel oil have been found to be the particular characteristics desired to be employed in the process of the invention. It will be realized, however, that grade No. 6 fuel oil is not a single definite chemical product, but instead is a class of petroleum products from which it has been found that an improved water repellent coating may be provided in accordance with the invention. Although not all grade No. 6 fuel oils are in all ways similar one to another, to thus all provide a constant optimum resultant water repellency, all do provide a novel improved repellency, free from the disadvantages of penetration and transfer, when used in accordance with the invention.

Fig. 2 is a schematic diagram of the manufacture of gypsum sheathing board 18 from the coated paper of rolls 16, employing the usual gypsum board forming methods and equipment. A water slurry of calcined gypsum 20 is disposed between the uncoated bottom surfaces of two opposed water repellent paper cover sheets having on the outwardly disposed top surfaces thereof a vapor-permeable coating of grade No. 6 fuel oil. The untreated and non-repellent bottom surfaces of the cover sheets are relatively absorbent of the gypsum slurry, whereby, after forming, by means of a forming master roll 22, and subsequent setting and drying of the paper covered gypsum sheathing board, a highly satisfactory gypsum to paper bond is obtained, providing an improved resultant water repellent gypsum sheathing.

Having completed a detailed disclosure of the preferred embodiments of my invention so that those skilled in the art may practice the same, I contemplate that variations may be made without departing from the scope of the invention as defined in the appended claims.

I claim:

1. A method of making vapor-permeable, gypsum-sheathing cover-paper having a coated water-repellent

surface and an opposite surface substantially free of said coating, comprising the steps of forming an oil-in-water emulsion of from 40% to 70% grade No. 6 fuel oil and water, applying said emulsion to only one surface of a paper-web of about .020 inch thickness with less than complete through penetration of said paper by said emulsion, and drying said coated-paper to remove the excess water therefrom.

2. A method of making vapor-permeable, gypsum-sheathing cover-paper having a coated water-repellent surface and an opposite surface substantially free of said coating, comprising the steps of forming an oil-in-water emulsion of from 40% to 70% grade No. 6 fuel oil and water, applying said emulsion to only one surface of a heavy paper-web at a rate of from 2 to 7 pounds of emulsion per thousand square feet of paper with less than complete through penetration of said paper by said emulsion, and drying said coated-paper to remove the excess water therefrom.

3. A method of making vapor-permeable, gypsum-sheathing cover-paper having a coated, water-repellent surface and an opposite surface substantially free of said coating, comprising the steps of forming an oil-in-water emulsion of from 40% to 70% grade No. 6 fuel oil and water, and applying said emulsion to only one surface of a heavy paper-web at an emulsion temperature of from 120° F. to 180° F. with less than complete through penetration of said paper by said emulsion.

4. A method of making vapor-permeable, gypsum-sheathing cover-paper having a coating, water-repellent surface and an opposite surface substantially free of said coating, comprising the steps of forming at 120° F. to 180° F. an oil-in-water emulsion of from 40% to 70% grade No. 6 fuel oil and water, and applying said emulsion at said temperature to only one surface of a heavy paper-web with less than complete through penetration of said paper by said emulsion, said paper-web being at a temperature of from 120° F. to 180° F.

5. A method of making vapor-permeable, gypsum-sheathing cover-paper having a coated, water-repellent surface and an opposite surface substantially free of said coating, comprising the steps of forming at 120° F. to 180° F. an oil-in-water emulsion of from 40% to 70% grade No. 6 fuel oil of 70 to 140 seconds viscosity (Furol @ 122° F.) and water, and applying said emulsion to only one surface of a heavy paper-web at a temperature of from 120° F. to 180° F. with less than complete through penetration of said paper by said emulsion.

6. The process of making water-repellent, gypsum-sheathing-board, comprising the steps of forming an oil-in-water emulsion of from 40% to 70% grade No. 6 fuel oil and water, applying said emulsion to only the top-surface of a heavy paper-web with less than complete through penetration of said paper by said emulsion, drying the said coated paper-web to remove the excess water therefrom, subsequently depositing an aqueous, calcined-gypsum slurry adjacent the bottom-surface of said paper, and forming a board therefrom, whereby said gypsum hardens and bonds to said uncoated bottom-surface to provide a strong, water-repellent board.

7. The process of making water-repellent, gypsum-sheathing-board, comprising the steps of forming an oil-in-water emulsion of from 40% to 70% grade No. 6 fuel oil and water, applying said emulsion at a temperature of from 120° F. to 180° F. to only the top-surface of a heavy paper-web which is at a temperature of from 120° F. to 180° F. with less than complete through penetration of said paper by said emulsion, drying the said coated paper-web to remove the excess water therefrom, subsequently depositing an aqueous, calcined-gypsum slurry adjacent the bottom-surface of said paper, and forming a board therefrom, whereby said gypsum hardens and bonds to said uncoated bottom-surface to provide a strong, water-repellent board.

8. The process of making water-repellent, gypsum,

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sheathing-board, comprising the steps of forming at from 120° F. to 180° F. an oil-in-water emulsion of from 40% to 70% grade No. 6 fuel oil of 70 to 140 seconds viscosity (Furol @ 122° F.) and water, applying said emulsion at a temperature of from 120° F. to 180° F. to only the top-
surface of a heavy paper-web which is at a temperature
of from 120° F. to 180° F. with less than complete
through penetration of said paper by said emulsion, dry-
ing the said coated paper-web to remove the excess water
therefrom, subsequently depositing an aqueous, calcined-
gypsum slurry adjacent the bottom-surface of said paper,

and forming a board therefrom, whereby said gypsum hardens and bonds to said uncoated bottom-surface to provide a strong, water-repellent board.

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