Dec. 23, 1952 C. R. MacDONALD 2,622,491

PROCESS OF MAKING MULTIPLY WATERPROOFED SHEETS

Filed Oct. 4, 1948

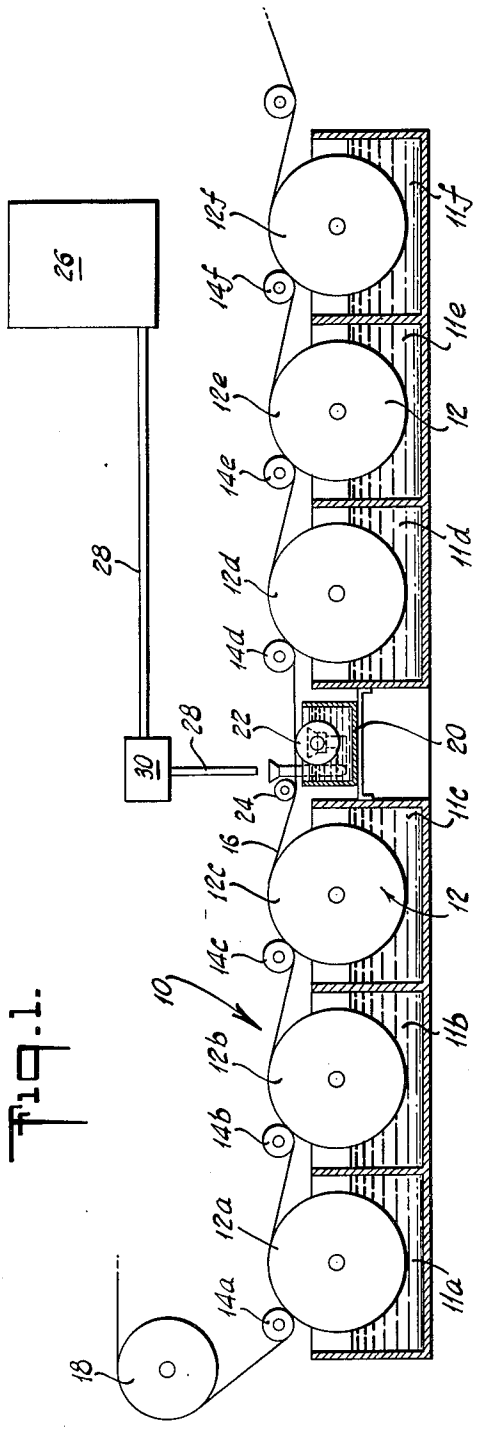


Fig. 1.

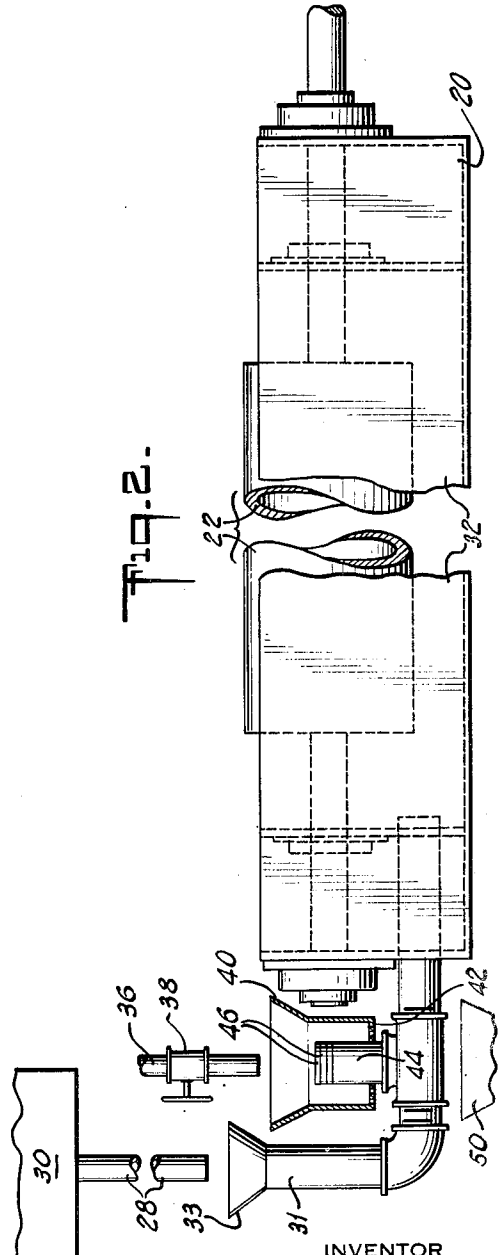


Fig. 2.

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Patented Dec. 23, 1952

2,622,491

UNITED STATES PATENT OFFICE

2,622,491

PROCESS OF MAKING MULTIPLY WATERPROOFED SHEETS

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Application October 4, 1948, Serial No. 52,708

1 Claim. (Cl. 92—40)

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This invention relates to a process for making paper and is more particularly concerned with an improved process for making a multi-ply sheet in which a layer of waterproofing material is interposed between certain plies.

It is well known to form a multi-ply sheet of paper on a paper making machine of the cylinder type and to apply a relatively thin layer of an aqueous emulsion of asphalt between certain of the plies simultaneously with the formation thereof. An emulsion applicator roll is, for example, placed between two of the cylinder moulds of the paper machine and this applicator roll applies a thin layer of the emulsion to the underside of the newly-formed ply from the preceding cylinder mould as it advances to receive a paper ply from the next succeeding mould. The layer of asphalt emulsion is thus sandwiched between two plies of the paper sheet, generally the two center plies of the sheet. Since the sheets are commonly composed of six or more plies, the water in the emulsion must generally, therefore, drain through three plies of paper in order to escape from the sheet. The emulsions most effectively employed for this purpose contain colloidal mineral matter, such as clay, as the emulsifying agent, and have, therefore, a rather gelatinous consistency. This gelatinous structure tends to restrain the free drainage of the water with the result that the speed of the paper making machine must be carefully controlled in order to permit adequate opportunity for drainage of water through the plies. Further, as a result of the gelatinous nature of the emulsion, separation of the plies of the sheet during formation sometimes occurs.

It is an object of this invention to provide a process for making waterproofed multi-ply sheets of the character indicated, whereby the asphalt emulsion employed permits rapid drainage of water and the paper making machine may be run at greater speeds than has heretofore been possible.

It is a further object of the invention to reduce the tendency of waterproofed multi-ply sheets to delaminate. Other objects and features of the invention will appear hereinafter.

The above-mentioned and other objects are realized, according to the invention, by subjecting the asphalt emulsion to be employed in the preparation of a waterproofed multi-ply paper sheet to controlled flocculation by careful adjustment of pH substantially immediately prior to application between the newly-formed plies of the sheet. I have found that when the pH of

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the asphalt emulsion is adjusted to between 3.5 and 5, as by the addition of controlled quantities of alum or other acidic salt or acid, the gelatinous consistency of the emulsion is overcome, without, however, affecting the efficacy of the emulsion or its ease of application. When the thus-treated emulsion is applied between the plies of the sheet on the paper making machine, the water in the emulsion drains freely and the machine may be satisfactorily operated at high rates of speed. The plies of the resulting sheet are firmly bonded by the asphalt layer and any tendency to delaminate is eliminated.

While I have mentioned alum as the pH adjusting agent which is preferably employed, other acidic salts such as sodium acid phosphate or the like, and acids, such as sulfuric acid, may be used.

The emulsions which are treated and employed according to the invention are those resulting from the emulsification of asphalt in water, using as emulsifying agents mineral colloids, such as finely-divided clays, and the like paste-forming mineral powders. An emulsion of the character indicated may be made, for example, by dispersing asphalt of 140 to 180° F. M. P. in water with the aid of an argillaceous emulsifying agent, such as Kentucky ball clay. The dispersion or emulsification of the asphalt may be suitably carried out by the process described in U. S. Patent No. 1,969,308 dated August 7, 1934.

A fuller understanding of the invention will be had by reference to the drawings in which:

Fig. 1 is a diagrammatic view of a cylinder type machine for the manufacture of multi-ply paper sheets, showing the use of the emulsion applicator roll.

Fig. 2 is a view partly in section and partly in elevation showing in more detail the applicator roll and the means for supplying asphalt emulsion thereto.

Referring to the drawings the numeral **10** designates generally a paper machine of the cylinder type adapted for the manufacture of waterproofed multi-ply paper sheets. The machine **10** comprises vats **11***a*, **11***b*, **11***c*, **11***d*, **11***e*, and **11***f* in which are mounted cylinder moulds **12***a*, **12***b*, **12***c*, **12***d*, **12***e*, and **12***f*, respectively. Above the cylinder moulds are the usual couch rolls **14***a*, **14***b*, **14***c*, **14***d*, **14***e*, and **14***f*, blanket **16**, and drum roll **18**. Interposed between the cylinder moulds **12***c* and **12***d* is an emulsion applicator roll unit comprising a trough **20** in which is mounted a screen-covered applicator roll **22**. A tension roll **24** is provided to press the blanket **16** against

the surface of applicator roll 22. Asphalt emulsion is maintained in a tank 26 and supplied through pipe line 28 to the applicator roll unit. A metering device 30 which may suitably be a weir box, is interposed in pipe line 28 to regulate the flow of emulsion. Referring particularly to Fig. 2, pipe line 28 discharges into a supply line 31, having a funnel-shaped mouth 33, leading into the applicator roll chamber 32 of trough 20. A water inlet 36 controlled by a valve 38 discharges into a level control box 40, having a perforated bottom 42. Extending upwardly into box 40 is a pipe 44 which is connected with line 30 and supports rings 46. A drain 50 is positioned below box 40.

The asphalt emulsion is maintained in tank 26 and continuously supplied through pipe line 28 to the chamber 32, a film of the emulsion is picked up on the surface of roll 22 and applied to the paper web adhering to blanket 16 as it passes over roll 22. The metering device 30 maintains a uniform flow of emulsion regulated in accordance with the speed of the machine. The level of the emulsion in chamber 32 and proper dilution of the emulsion is attained by means of level control box 40. The height of pipe 44 is adjustable by means of the removable rings 46 and may be adjusted to conform to the desired level in chamber 32. Dilution water from pipe 36 continuously discharges into box 40, and through pipe 44 and 31 into chamber 32. Excess water drains through the perforated bottom of box 40 and is led off through drain 50.

The adjustment of the pH of the emulsion in accordance with my invention is effected substantially immediately prior to application by the applicator roll 22, e. g., in tank 26 or in chamber 32, or in weir box 30. If the pH adjustment takes place in the tank 26 it is generally necessary to agitate the treated emulsion in order to prevent settling. Agitation may be effected by any suitable means (not shown) such as a current of air, a mechanical agitator or the like. It is preferable, therefore, to adjust the pH of the emulsion after it has been introduced into chamber 32. The pH adjusting agent, if acidic salt is used, may be added as a solid, but preferably is added as an aqueous solution, care being taken not to incorporate more water than necessary into the emulsion. In practice, for example, 100 parts of an aqueous emulsion of an asphalt having a melting point of about 165° F. and a penetration (77° F.) of 10 to 15, prepared by the use of clay as the emulsifying agent and having a pH of about 6 to 7, are treated by the addition of sufficient aluminum sulphate, added as an aqueous solution, to lower the pH of the emulsion to within the range of 3.5 to 5. The amount of pH adjusting agent required for any particular emulsion is readily determined by gradually adding the agent to a small quantity of the emulsion until the desired pH is reached.

When the film of the emulsion treated in accordance with my invention is applied to the lower surface of the paper ply formed on cylinder mould 12*d* and carried into contact with applicator roll 22 on blanket 16, and the film then enclosed within the paper sheet by the application of plies formed on cylinder moulds 12*c*, 12*b*, and 12*a* successively, the water in the emulsion film drains freely through the later-formed plies and a sheet of desired maximum moisture content is rapidly attained. In practice, for example, use of an emulsion treated in accordance with the invention and having an adjusted pH between 3.5 and 5 has permitted machine speeds up to 25% greater than were commonly attainable with emulsions formerly used. Thus, the paper making capacity of the machine may be raised to approximate more nearly the drying capacity of the machine. Further, multi-ply sheets formed with an asphalt waterproofing layer deposited from an emulsion having an adjusted pH in accordance with my invention have a greatly reduced tendency to delaminate during formation in comparison with previously known multi-ply waterproofed sheets.

It will be obvious to those skilled in the art that various changes and modifications may be made in the above described process without departing from the spirit and scope of my invention as defined in the appended claim, and it is intended, therefore, that the matter contained in the foregoing description and in the drawing shall be interpreted as illustrative and not in a limiting sense.

I claim:

A method of making waterproofed multi-ply paper which consists of treating an aqueous emulsion of asphalt containing a mineral colloid as an emulsifying agent with an acidic salt to adjust the pH of said emulsion within the range of 3.5–5, forming on a paper machine a plurality of fibrous plies coating at least one of the plies with said emulsion and applying other plies thereto to form waterproofed paper.

CHESTER R. MACDONALD.

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