

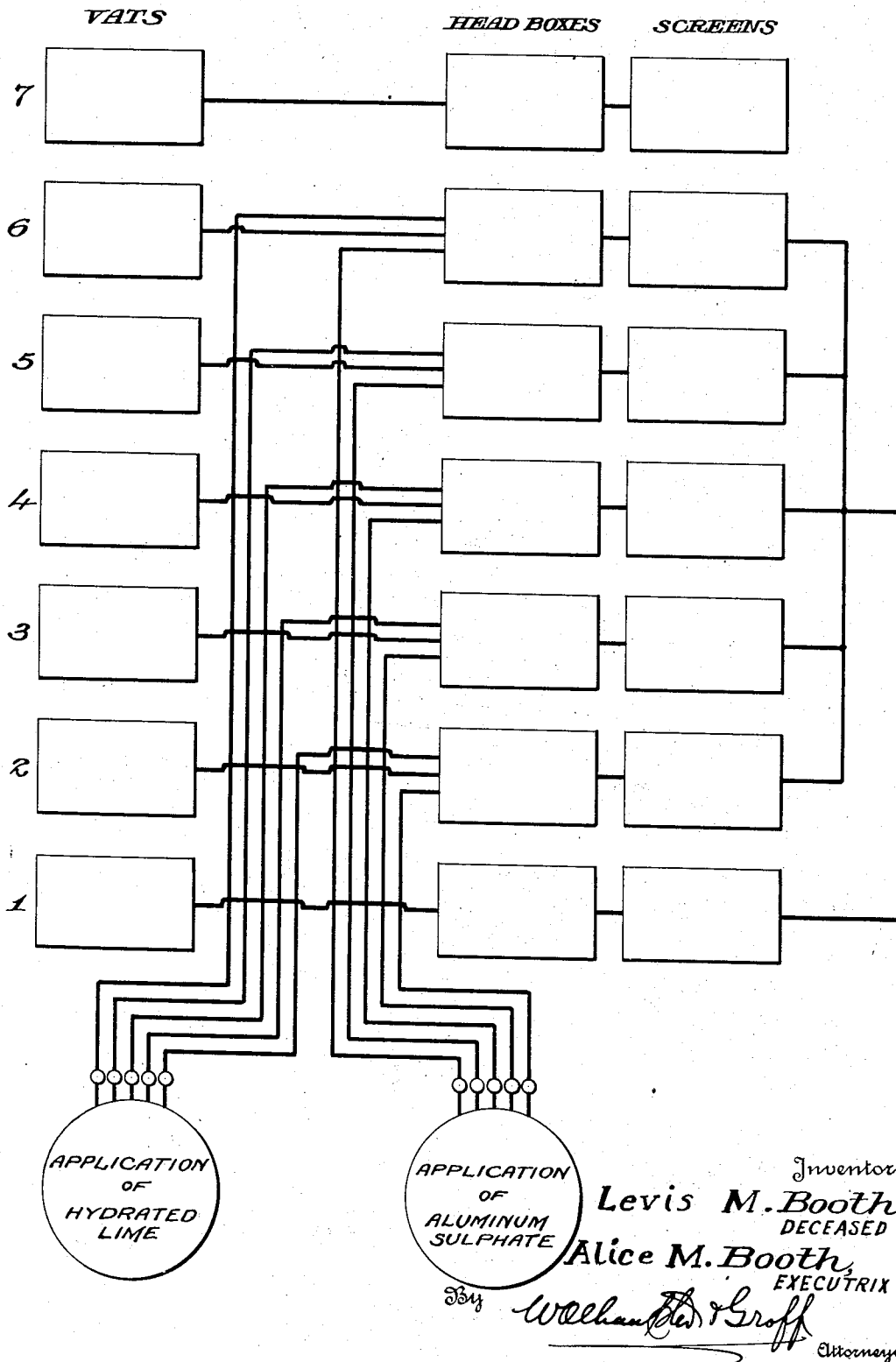
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PROCESS OF MANUFACTURING PAPER AND BOARD

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PROCESS OF MANUFACTURING PAPER
AND BOARD

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14 Claims. (Cl. 92—21)

This invention relates to a process of manufacturing multi-ply paper board and is a continuation in part of application, Serial No. 62,435, filed February 5, 1936.

A principal object of the invention is to insure improved formation and to reduce the cost of mechanical treatment of the fibrous material which is used. In that connection the invention contemplates the use of water soluble inorganic chemicals which react to form a precipitate in the stock stream of the desired ply or plies to retard or restrain the rate of water drainage therefrom. Thus, by the method disclosed herein it is possible to control the rate of water drainage from the several plies to avoid channeling caused by water flowing through the outer plies of the board without the necessity of preliminarily subjecting the stock to time and power consuming operations heretofore employed and which increase production costs.

In the drawing, the figure is a diagrammatic view illustrating where the chemicals may be introduced.

In the manufacture of paper board it is customary to form the stock in a number of separate webs as, for example, on individual cylinder molds. The several webs are combined and comprise the paper board. In the manufacture of multi-ply paper board as many as eight cylinder molds are in commercial use. By way of illustration, consider a seven mold machine making a double lined board. The stock which is to comprise one liner is formed on mold No. 1. This is couched off by a felt and carried to the couching point of the No. 2 mold. The first ply of filler stock is formed on the No. 2 mold. At this couching point the stock from the No. 2 mold is added. Similar successive additional plies of filler stock are added at the couching points of molds Nos. 3, 4, 5 and 6, respectively. The other liner ply is added at the couching point of mold No. 7. The consolidated wet web is next subjected to the action of various water removal equipment such as extractor rolls, suction couch rolls, press rolls and finally to the dryers and calenders.

The liner stock for molds Nos. 1 and 7 may be of the same or different character. In the latter instance separate beating and jordaning equipment are used. Ordinarily the filler stock which is formed on molds Nos. 2, 3, 4, 5 and 6 is prepared by beating and jordaning in equipment which is common to all of the filler stock.

With a view to facilitating the drainage of the water from the wet web which has left the

couches it has heretofore been customary to mechanically prepare the stock forming the liner plies in such a manner that the water pressed from the stock forming the filler plies will readily pass through the liner plies. Depending upon whether water tends to flow from wet stock freely or slowly, the stock is said to be "free" or "slow." Pulp which is free may be made less free by various power consuming operations, such as beating, jordaning or other mechanical treatment. Various gradations of freeness or slowness are thus obtained with less or more, respectively, of mechanical treatment depending on requirements.

The filler stock has been mechanically prepared so that it is slower than the liner stock in order to facilitate drainage through the liner. Customarily all of the filler stock is treated uniformly so that that which is formed on molds Nos. 2 and 6 is no freer than that which is formed on mold No. 4 comprising the center ply.

According to the present invention it has been found that, by the addition of appropriate material, of which at least a portion is applied after the water suspension of stock has been divided for delivery to the several molds, it is possible to control the rate of drainage from the several plies and from the consolidated wet web in a more logical manner and which assures desirable results which have hitherto been unobtainable except with additional cost for mechanical equipment and cost for operation of such additional equipment.

In practice, it has been found desirable to apply two or more chemical reagents, for example, water soluble inorganic chemicals, which mutually react to form an insoluble precipitate to cause slower water drainage. One chemical may be added at or before the division of the stock referred to above, or after the division of the water suspension of stock to be delivered to the several molds has been effected. The other chemical used should be applied after the stock has been divided into the separate streams. In certain instances it is desirable to provide diverse treatments for the several plies of stock.

The fundamental procedure is to enhance the slowing action of the stock which is to comprise the inner portion of the board, for example that which is formed on mold No. 4. Less of or different chemical treatment should be applied to the water suspension of stock going to the molds Nos. 3 and 5 and still less or different or none whatsoever to molds Nos. 2 and 6.

The process is equally applicable for the man-

ufacture of any product wherein stock is prepared as a water suspension by a common process, but is later formed separately. Similar graduated treatment to meet the appropriate requirements may be provided.

As one example of the present invention it has been found that sulphate of aluminum and hydrated lime are efficient and cheap chemicals which may be used for this purpose. In actual practice two continuous dry feeders have been used, one for sulphate of aluminum and one for lime. It is preferred to divide the sulphate of aluminum applied to the water suspension of the stock being delivered to the separate molds. A typical division is cited as follows (parts by weight):

To mold number	Percentage
1.	0.0
2.	10.0
3.	22.5
4.	35.0
5.	22.5
6.	10.0
7.	0.0
	100.0

Simultaneously, or subsequently, there is applied hydrated lime which has been appropriately proportioned to the several streams of stock in order to produce a gelatinous precipitate including aluminum hydroxide and calcium sulphate which has the desired slowing influence, and, at the same time, to so treat the water carrying the stock that good formation on the several molds will be attained.

Above there is described specifically only one example of the use of my invention. However, under certain circumstances it may be found advantageous to substitute other chemicals of a similar class to produce equivalent results.

In place of aluminum sulphate other metallic salts may be used such as the chlorides or sulphates of iron, or magnesium, producing precipitates which include for instance respectively iron hydroxide and magnesium hydroxide. The process may also be carried on by the substitution of alkalis or the other alkaline earths in place of the hydrated lime specified above, or, under certain specific conditions sodium aluminate can be used.

In connection with the foregoing, it is of course understood that it is necessary to select metallic salts and alkalies or alkaline earths, according to their capacity to mutually react and produce a precipitate of a gelatinous characteristic which is insoluble. No one in practising the invention would select compounds which did not react to form a precipitate even though it was classifiable in a particular group. In other words, in choosing a substitute for aluminum sulphate or the acid ingredient to react with an alkaline ingredient, it is necessary to use mutually reactive substances which will form an insoluble precipitate. Calcium chloride, an acid substance, when added to calcium hydroxide, an alkaline substance, will not be satisfactory, whereas, calcium chloride reacting with sodium aluminate will form an insoluble precipitate. Calcium sulphate and sodium aluminate also form an insoluble precipitate.

As a further illustration of the invention, it should be pointed out that such combinations of reagents may be used that will be of specific advantage in the type of paperboard being manufactured. For example, the combination of

aluminum sulphate and sodium aluminate may be used where a light colored board is sought. In the manufacture of test liner, ferric chloride or ferric sulphate may be used in combination with hydrated lime where the color of the resulting board is not a factor.

Without departing from the spirit of this invention the chemicals may be applied at any appropriate stage of the process of paper making. In forming paperboard by the improved method more economical drying is also effected and there is an absence of checking or curling in the finished product.

What is claimed is:

1. The method of making paperboard containing at least three inner plies on a multi-cylinder machine, which consists in adding to various streams of the same stock which are to comprise the inner plies of the board different amounts of sulphate of aluminum and hydrated lime to cause the formation of different amounts of an insoluble reaction product in the individual streams of said stock, forming the several plies from said individual streams of stock, with the stocks containing the greater amount of insoluble reaction product forming the inner portion of the board, and thereafter consolidating the plies into a single sheet of board.

2. The method of making paper board containing at least three inner filler plies on a multi-cylinder machine utilizing one given main filler stock stream, to eliminate the tendency to channelling caused by drainage of water from the inner filler plies to the outer plies, which comprises, dividing said main filler stock stream into a plurality of divisional filler ply streams, adding to said divisional streams respectively different quantities of a first reagent selected from the group consisting of hydrated lime and sodium aluminate, adding to said divisional streams respectively substantially reacting quantities of a second reagent selected from the group consisting of aluminum sulphate and the sulphates and chlorides of iron and magnesium, forming a central filler ply from a said divisional filler stock stream having a relatively high content of said reagents, and forming filler plies outside the central filler ply from respective divisional stock streams whose content of said reagents decreases with the number of plies a given intermediate ply outside said central ply is spaced from the central filler ply, and then consolidating said plies into a single sheet of board with said central filler ply in the center thereof and said outer filler plies arranged outwardly therefrom.

3. The method of making paper board containing at least three inner filler plies on a multi-cylinder machine utilizing one given main filler stock stream, to eliminate the tendency to channelling caused by drainage of water from the inner filler plies to the outer plies, which comprises, dividing said main filler stock stream into a plurality of divisional filler ply streams, adding to said divisional streams respectively different quantities of a first reagent which is hydrated lime, adding to said divisional streams respectively substantially reacting quantities of a second reagent which is sulphate of aluminum, forming a central filler ply from a said divisional filler stock stream having a relatively high content of said reagents, and forming filler plies outside the central filler ply from respective divisional stock streams whose content of said reagents decreases with the number of plies a given intermediate ply outside said central ply is spaced from the central

filler ply, and then consolidating said plies into a single sheet of board with said central filler ply in the center thereof and said outer filler plies arranged outwardly therefrom.

4. The method of making paper board containing at least three inner filler plies on a multi-cylinder machine utilizing one given main filler stock stream, to eliminate the tendency to channelling caused by drainage of water from the inner filler plies to the outer plies, which comprises, dividing said main filler stock stream into a plurality of divisional filler ply streams, adding to said divisional streams respectively different quantities of a first reagent which is hydrated lime, adding to said divisional streams respectively substantially reacting quantities of a second reagent which is selected from the group consisting of the chlorides and sulphates of iron, forming a central filler ply from a said divisional filler stock stream having a relatively high content of said reagents, and forming filler plies outside the central filler ply from respective divisional stock streams whose content of said reagents decreases with the number of plies a given intermediate ply outside said central ply is spaced from the central filler ply, and then consolidating said plies into a single sheet of board with said central filler ply in the center thereof and said outer filler plies arranged outwardly therefrom.

5. The method of making paper board containing at least three inner filler plies on a multi-cylinder machine utilizing one given main filler stock stream, to eliminate the tendency to channelling caused by drainage of water from the inner filler plies to the outer plies, which comprises, dividing said main filler stock stream into a plurality of divisional filler ply streams, adding to said divisional streams respectively different quantities of a first reagent which is sodium aluminate, adding to said divisional streams respectively substantially reacting quantities of a second reagent which is sulphate of aluminum, forming a central filler ply from a said divisional filler stock stream having a relatively high content of said reagents, and forming filler plies outside the central filler ply from respective divisional stock streams whose content of said reagents decreases with the number of plies a given intermediate ply outside said central ply is spaced from the central filler ply, and then consolidating said plies into a single sheet of board with said central filler ply in the center thereof and said outer filler plies arranged outwardly therefrom.

6. The method of making paper board containing at least three inner filler plies on a multi-cylinder machine utilizing one given main filler stock stream, to eliminate the tendency to channelling caused by drainage of water from the inner filler plies to the outer plies, which comprises forming outer liner plies from a stock stream, dividing said main filler stock stream into a plurality of divisional filler ply streams, adding to said divisional streams respectively different quantities of a first reagent selected from the group consisting of hydrated lime and sodium aluminate, adding to said divisional streams respectively substantially reacting quantities of a second reagent selected from the group consisting of aluminum sulphate and the sulphates and chlorides of iron and magnesium, forming a central filler ply from a said divisional filler stock stream having a relatively high content of said reagents, and forming filler plies intermediate the central filler ply and the outer liner plies from respective divisional stock streams whose

content of said reagents decreases with the number of plies a given intermediate ply outside said central ply is spaced from the central filler ply, and then consolidating said plies into a single sheet of board with said central filler ply in the center thereof and said outer liner plies on the outside thereof.

7. The method of making paper board containing at least three inner filler plies on a multi-cylinder machine utilizing one given main filler stock stream, to eliminate the tendency to channelling caused by drainage of water from the inner filler plies to the outer plies, which comprises forming outer liner plies from a stock stream, dividing said main filler stock stream into a plurality of divisional filler ply streams, adding to said divisional streams respectively different quantities of a first reagent which is hydrated lime, adding to said divisional streams respectively substantially reacting quantities of a second reagent which is sulphate of aluminum, forming a central filler ply from a said divisional filler stock stream having a relatively high content of said reagents, and forming filler plies intermediate the central filler ply and the outer liner plies from respective divisional stock streams whose content of said reagents decreases with the number of plies a given intermediate ply outside said central ply is spaced from the central filler ply, and then consolidating said plies into a single sheet of board with said central filler ply in the center thereof and said outer liner plies on the outside thereof.

8. The method of making paper board containing at least three inner filler plies on a multi-cylinder machine utilizing one given main filler stock stream, to eliminate the tendency to channelling caused by drainage of water from the inner filler plies to the outer plies, which comprises forming outer liner plies from a stock stream, dividing said main filler stock stream into a plurality of divisional filler ply streams, adding to said divisional streams respectively different quantities of a first reagent which is hydrated lime, adding to said divisional streams respectively substantially reacting quantities of a second reagent which is selected from the group consisting of the chlorides and sulphates of iron, forming a central filler ply from a said divisional filler stock stream having a relatively high content of said reagents, and forming filler plies intermediate the central filler ply and the outer liner plies from respective divisional stock streams whose content of said reagents decreases with the number of plies a given intermediate ply outside said central ply is spaced from the central filler ply, and then consolidating said plies into a single sheet of board with said central filler ply in the center thereof and said outer liner plies on the outside thereof.

9. The method of making paper board containing at least three inner filler plies on a multi-cylinder machine utilizing one given main filler stock stream, to eliminate the tendency to channelling caused by drainage of water from the inner filler plies to the outer plies, which comprises forming outer liner plies from a stock stream, dividing said main filler stock stream into a plurality of divisional filler ply streams, adding to said divisional streams respectively different quantities of a first reagent which is sodium aluminate, adding to said divisional streams respectively substantially reacting quantities of a second reagent which is sulphate of aluminum, forming a central filler ply from a said divisional

filler stock stream having a relatively high content of said reagents, and forming filler plies intermediate the central filler ply and the outer liner plies from respective divisional stock streams whose content of said reagents decreases with the number of plies a given intermediate ply outside said central ply is spaced from the central filler ply, and then consolidating said plies into a single sheet of board with said central filler ply in the center thereof and said outer liner plies on the outside thereof.

10. The method of making paper board containing at least three inner filler plies on a multi-cylinder machine utilizing one given main filler stock stream, to eliminate the tendency to channelling caused by drainage of water from the inner filler plies to the outer plies, which comprises, dividing said main filler stock stream into a plurality of divisional filler ply streams, adding to said divisional streams respectively different quantities of a first reagent, adding to said divisional streams respectively substantially reacting quantities of a second reagent which reacts with said first reagent in said filler stock to produce an insoluble precipitate of the group consisting of aluminum hydroxide, iron hydroxide, and magnesium hydroxide, forming a central filler ply from a said divisional filler stock stream having a relatively high content of said reagents, and forming filler plies outside the central filler ply from respective divisional stock streams whose content of said reagents decreases with the number of plies a given intermediate ply outside said central ply is spaced from the central filler ply, and then consolidating said plies into a single sheet of board with said central filler ply in the center thereof and said outer filler plies arranged outwardly therefrom.

11. The method of making paper board containing at least three inner filler plies on a multi-cylinder machine utilizing one given main filler stock stream, to eliminate the tendency to channelling caused by drainage of water from the inner filler plies to the outer plies, which comprises, dividing said main filler stock stream into a plurality of divisional filler ply streams, adding to said divisional streams respectively different quantities of a first reagent, adding to said divisional streams respectively substantially reacting quantities of a second reagent which reacts with said first reagent in said filler stock to produce an insoluble precipitate which includes aluminum hydroxide, forming a central filler ply from a said divisional filler stock stream having a relatively high content of said reagents, and forming filler plies outside the central filler ply from respective divisional stock streams whose content of said reagents decreases with the number of plies a given intermediate ply outside said central ply is spaced from the central filler ply, and then consolidating said plies into a single sheet of board with said central filler ply in the center thereof and said outer filler plies arranged outwardly therefrom.

12. The method of making paper board containing at least three inner filler plies on a multi-cylinder machine utilizing one given main filler stock stream, to eliminate the tendency to channelling caused by drainage of water from the inner filler plies to the outer plies, which comprises, dividing said main filler stock stream into a plurality of divisional filler ply streams, adding to said divisional streams respectively different quantities of a first reagent, adding to said divi-

sional streams respectively substantially reacting quantities of a second reagent which reacts with said first reagent in said filler stock to produce an insoluble precipitate which includes iron hydroxide, forming a central filler ply from a said divisional filler stock stream having a relatively high content of said reagents, and forming filler plies outside the central filler ply from respective divisional stock streams whose content of said reagents decreases with the number of plies a given intermediate ply outside said central ply is spaced from the central filler ply, and then consolidating said plies into a single sheet of board with said central filler ply in the center thereof and said outer filler plies arranged outwardly therefrom.

13. The method of making paper board containing at least three inner filler plies on a multi-cylinder machine utilizing one given main filler stock stream, to eliminate the tendency to channelling caused by drainage of water from the inner filler plies to the outer plies, which comprises, dividing said main filler stock stream into a plurality of divisional filler ply streams, adding to said divisional streams respectively different quantities of a first reagent, adding to said divisional streams respectively substantially reacting quantities of a second reagent which reacts with said first reagent in said filler stock to produce an insoluble precipitate which includes magnesium hydroxide, forming a central filler ply from a said divisional filler stock stream having a relatively high content of said reagents, and forming filler plies outside the central filler ply from respective divisional stock streams whose content of said reagents decreases with the number of plies a given intermediate ply outside said central ply is spaced from the central filler ply, and then consolidating said plies into a single sheet of board with said central filler ply in the center thereof and said outer filler plies arranged outwardly therefrom.

14. The method of making paper board containing at least three inner filler plies on a multi-cylinder machine utilizing one given main filler stock stream, to eliminate the tendency to channelling caused by drainage of water from the inner filler plies to the outer plies, which comprises, dividing said main filler stock stream into a plurality of divisional filler ply streams adding to said divisional streams respectively different quantities of a first reagent, adding to said divisional streams respectively substantially reacting quantities of a second reagent, said reagents each being selected from groups of chemicals which mutually react to form a precipitate of a gelatinous characteristic which is insoluble and which decreases the water drainage rate from said filler stock, forming a central filler ply from said divisional filler stock stream having a relatively high content of said reagents and forming filler plies outside the central filler ply from respective divisional stock streams whose content of said reagents decreases with the number of plies a given intermediate ply outside said central ply is spaced from the central filler ply, and then consolidating said plies into a single sheet of board with said central filler ply in the center thereof and said outer filler plies arranged outwardly therefrom.

Alice Lippincott Booth.

Executrix of the Estate of Levis M. Booth,
Deceased.