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Bolton, III

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[54] **PROCESS FOR PRODUCING KRAFT PAPER LAMINATE OF TOP STOCK AND BASE STOCK LAYERS**

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[52] **U.S. Cl.** **162/55,** 162/130, 162/188

[51] **Int. Cl.** **D21h 5/00,** D21h 1/02

[58] **Field of Search** 162/130, 129, 188, 55, 132, 162/13

[56] **References Cited**

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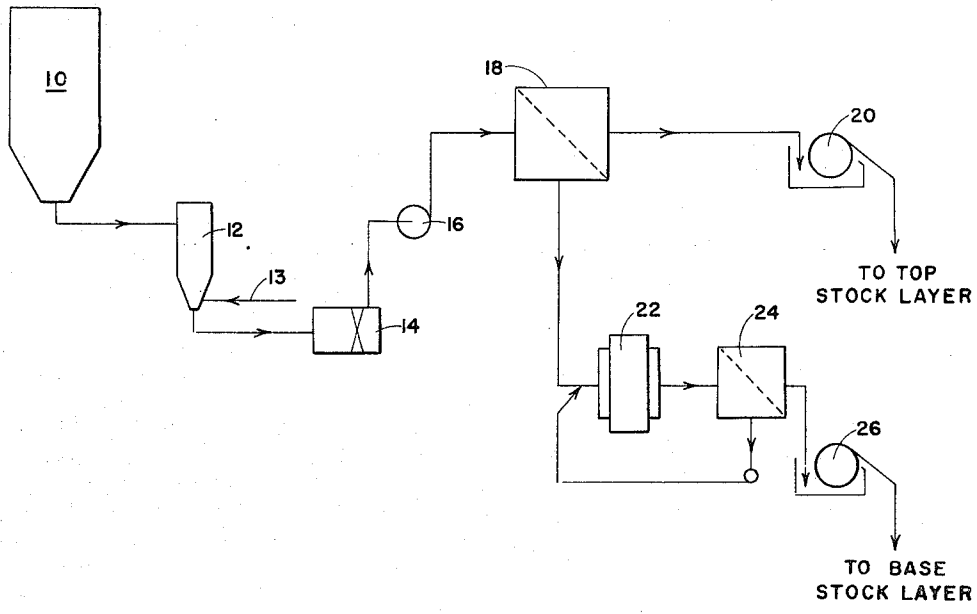
Primary Examiner—S. Leon Bashore
Assistant Examiner—M. Steven Alvo

[57] **ABSTRACT**

A process is disclosed for producing kraft paper laminate of top stock and base stock layers from kraft fiber slurry digested to high yield, wherein the digested slurry is subjected to fine screening to separate from about 10% to about 30 percent of its fiber, substantially all of the separated fibers being suitable for top stock, and forming the top stock and bottom stock layers of the laminate respectively from the so separated fibers and the remaining fibers of the slurry.

8 Claims, 4 Drawing Figures



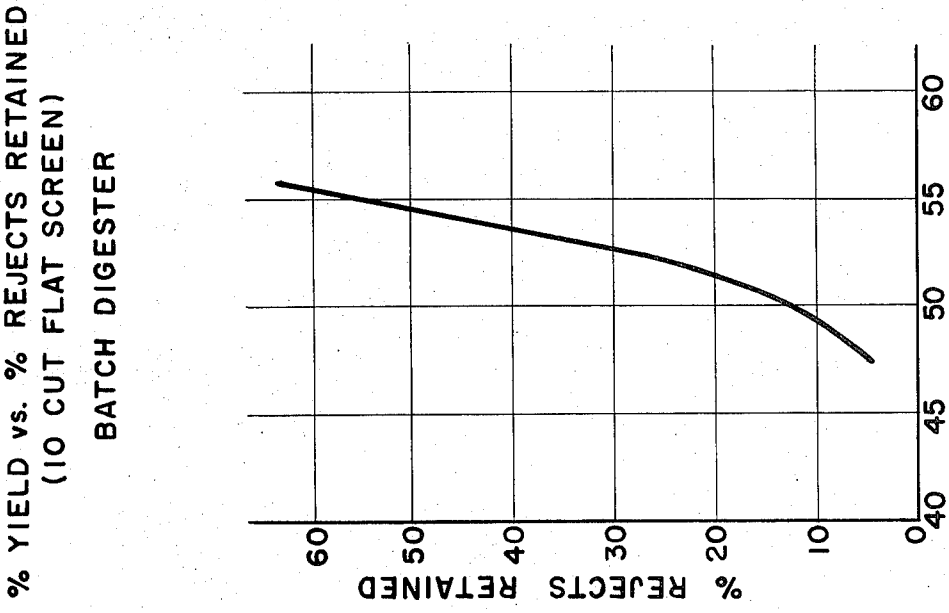

% YIELD vs. % REJECTS RETAINED
(10 CUT FLAT SCREEN)
BATCH DIGESTER
% REJECTS RETAINED
60
50
40
30
20
10
0
% YIELD
40
45
50
55
60

FIG. 1B

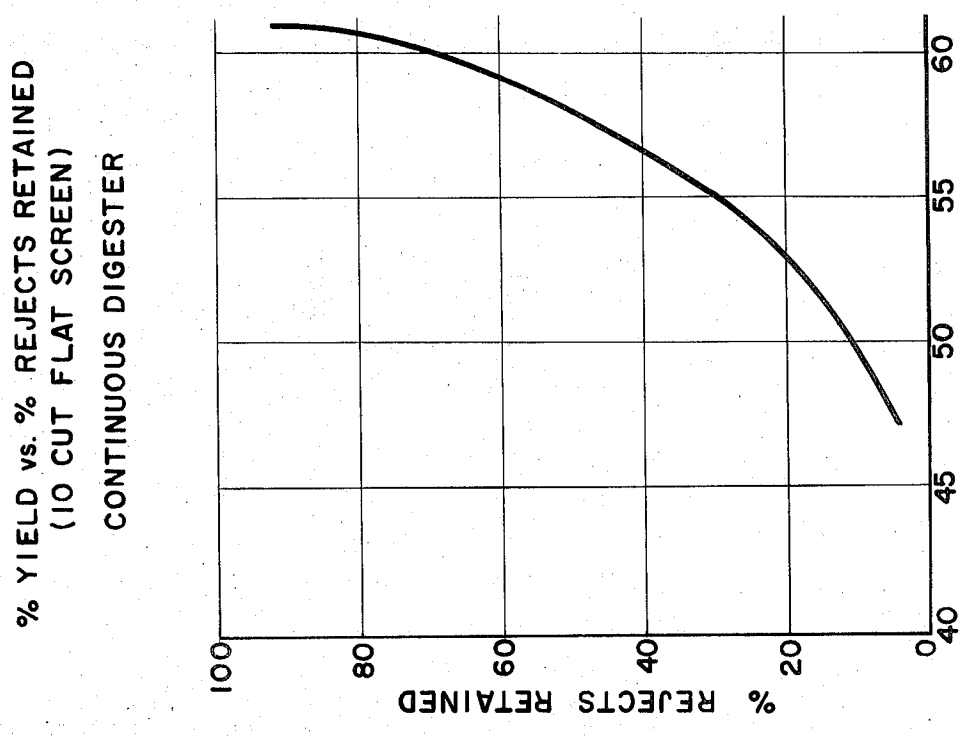

% YIELD vs. % REJECTS RETAINED
(10 CUT FLAT SCREEN)
CONTINUOUS DIGESTER
% REJECTS RETAINED
100
80
60
40
20
0
% YIELD
40
45
50
55
60

FIG. 1A

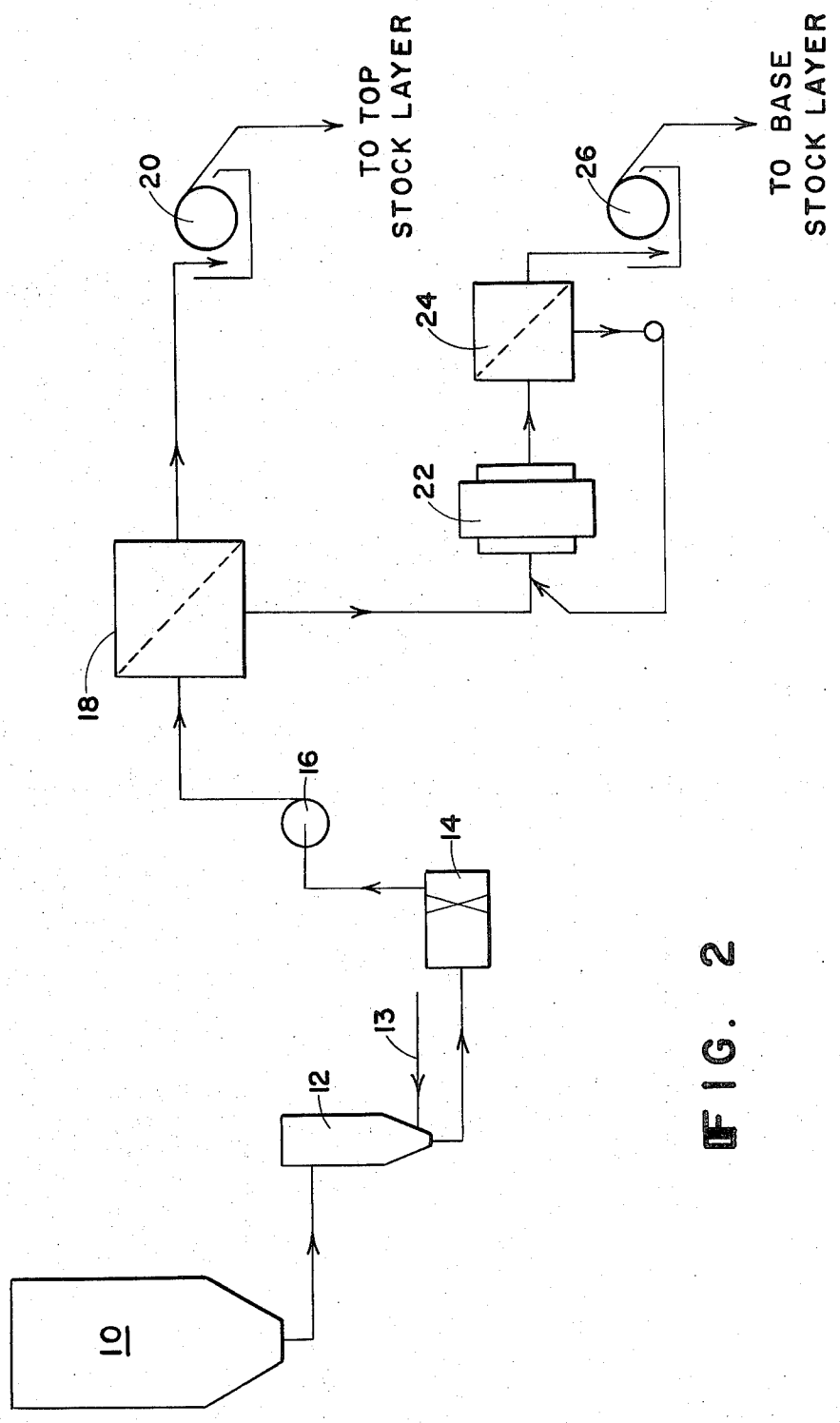

TO TOP
STOCK LAYER
TO BASE
STOCK LAYER
10
12
13
14
16
18
20
22
24
26

FIG. 2

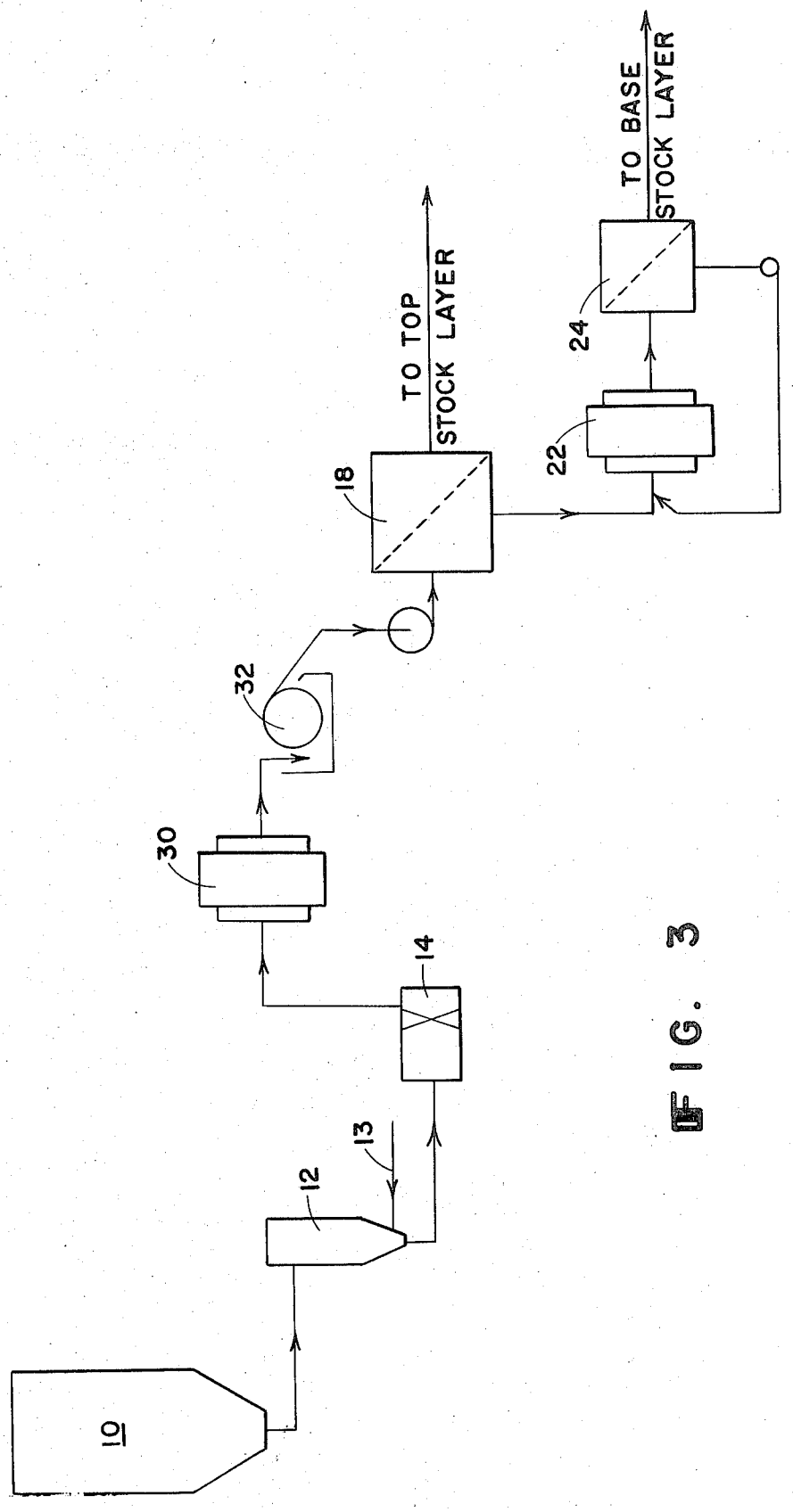


FIG. 3

PROCESS FOR PRODUCING KRAFT PAPER LAMINATE OF TOP STOCK AND BASE STOCK LAYERS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a process for producing a kraft paper laminate of top and base stock layers from high yield kraft slurry.

2. Description of the Prior Art

Although it has other uses, kraft paper laminate of the type concerned is used primarily in the production of box board, in which a corrugated paper liner is adhesively secured between two sheets of the kraft paper. So prevalent is this use that paper machines for forming the two superposed layers of the paper laminate have come to be known as "liner-board machines."

The top and base stock layers, and the kraft fibers that go into them, have markedly different characteristics. The top stock layer, usually the only side exposed, is relatively thin and needs high quality fibers which are short and flexible for strength, smoothness, and brightness. The thicker base layer can tolerate some fibers of lower quality such as long fiber "shives."

The kraft fiber slurry used for each layer is produced from the wood in digesters, which may be of the continuous or batch types, wherein the wood chips are subjected to chemical action in the presence of heat and pressure. The "yield" of a digester is expressed as the percentage of oven dry (O.D.) wood in the slurry leaving the digester to the O.D. wood fed to the digester. Yield varies inversely with the length and severity of the digestion treatment; whereas, the quality of the slurry varies directly therewith. The quality of the slurry varies inversely with the percentage of "rejects" which it contains, this percentage being commonly accepted as the proportion that will not pass a "10 cut flat screen" (slots about 0.01 inch wide by 1 ½ inch long). Except at low yields, continuous digesters produce less rejects and hence better quality stock at a given yield than do batch digesters.

In general, what is presently regarded as high yield digestion has a yield of 54 percent or higher while lower yields may be classed as "medium" if about 50 percent or above or "low" if lower.

The mills have strong incentives to digest to high yields. One of these is savings in wood cost, since an increase of yield of only a few per cent can save a mill as much as a million dollars or more annually in wood cost. Also, high yield digestion requires less chemicals and digester capacity, again saving substantial cost, with a corollary advantage that the lower amount of chemical can be more completely removed from mill waste water, with consequent benefit to the ecology. Less waste fiber in high yield kraft saves money and again improves purification of mill waste water and stack gases, benefiting the ecology. On the other hand, the quality of the slurry measured by its reject content decreases markedly and disproportionately with increased yield, particularly at or approaching high yields.

The rejects portion of the digested slurry is suitable with ordinary refining for use as the base stock layer of the kraft paper laminate, but is not suitable for the top stock layer. In consequence it has been a prevalent practice to digest separately the wood needed for the top stock layer and that required for the base stock layer. The wood for the top stock is digested to low or medium yield and is suitable for use in the top layer using low horsepower prerefining for knot breaking, ordinary screening and washing, and low horsepower refining for freeness control. The base layer stock is digested to high yield and, similarly treated but with additional refining in a regular higher horsepower base stock refiner, is used as the base stock. The main disadvantage of this practice is its high capital cost, requiring two sets of digesters, blow tanks, prerefiners, screens and washers, as well as the regular refiner for the base stock. In addition, the savings and other advantages from high yield digestion are only partially realized.

More recently a process has come into use in which all the wood for both layers is digested together to high yield. In this process the total slurry is subjected to special refining in what may be called an "ultrarefiner" which applies sufficient attrition forces to reduce the shive count to a maximum acceptable for top stock, the refined product being separately fed to form both the top stock layer and the base stock layer on the liner-board machine. This process has the advantages of high yield digestion but ultrarefiners are expensive equipment costly to operate, and the product is a compromise, in that the top stock layer is not as good as is desirable and the base stock layer is better than is necessary.

In another compromise process known to applicant, the mill is batch digesting all the wood for both layers in a single digestion system to a medium yield of about 52 percent. The digested slurry is subjected to screening (0.070 inch diameter holes) to provide a 50 percent accept fraction which is washed and about 40 percent of it used directly to form the top stock layer. The 50 percent reject fraction is subjected to refining in ordinary base stock refiners, washed and, with the about 60 percent remainder of the accept fraction added to it, is used to form the base stock layer. This process is less costly to install and operate than the process involving ultrarefiners since it uses less costly, ordinary refiners on only half the stock. However, the process has the drawbacks of only partially realizing the advantages of high yield versus low yield digestion, and the product is a compromise in that the screening accepts portion contains some fibers undesirable for the top stock layer.

SUMMARY OF THE INVENTION

An object of this invention is to provide a process of making a kraft paper laminate of top and base stock layers from a single slurry which has been digested to a high yield, which process does not involve the high capital and operation cost of the process utilizing ultrarefiners and yet obtains fully the advantages of high yield digestion.

Another object is to provide such a process wherein the fiber of the top stock layer is essentially only fiber having the desired characteristics, and provides a top stock layer of a quality at least as good as that produced by the separate digestion systems process and better than is obtained in the other two processes mentioned above.

It was conceived that if there were a way of cleanly segregating from high yield kraft slurry enough of the "good" (non-reject) fiber portion to form the top stock layer, such segregated portion could be used with little

or no refining of it as the furnish for that layer, and this would enable the remainder of the fiber content of the slurry to be used with only ordinary refining to form the base layer. At first it was believed that fine screening to effect such a segregation would not be possible because the high reject concentration at high consistency (4 percent or more) would blind the screen. However, it has been discovered that the desired result can be obtained by very fine screening (holes about 0.06 inch diameter or less or slots about 0.02 inch wide or less), provided the slurry as it passes over the screen is subjected to pulses of very high frequency and intensity. The bumped rotor of the screening machine disclosed in U.S. Pat. No. 3,363,759, operated at high speed, has been found capable of supplying the requisite pulsation.

In the preferred process according to the invention, the wood is digested only sufficiently to provide a high yield kraft fiber slurry of at least 54 percent yield, and preferably higher particularly where the digesters are continuous. The slurry, either as "hot stock" (prewashing) or "brown stock" (postwashing) is subjected to screening in a screening machine between a cylindrical screen and a coaxially mounted cylindrical rotor, preferably the screen having apertures in the diameter range 0.030 inch to 0.055 inch and an open area in the range about 15 to 30 percent of the total screening area of the screen, or slots having a width between about 0.01 and about 0.02 spaced between 5 and 12 per inch, the rotor being in accordance with U.S. Pat. No. 3,363,759, rotated at high speed (e.g. about 5,000 to 7,500 feet per minute), the machine being operated to reject about 80 percent of the slurry content. In this preferred process the about 20 percent fraction passing the screen as accepts, which consists almost entirely of the "good" top stock quality fiber, is used either without refining or with a small amount of refining for freeness control to form the top-stock layer of the laminate made on the linerboard machine, being first washed if the slurry was screened as hot stock. The about 80 percent portion rejected by the screen is used to form the base layer of the laminate, being first subjected to regular base stock refining and, if the slurry was screened as hot stock, being also washed.

The refining cost is reduced if the reject portion only is refined after screening. On the other hand, since this procedure requires separate washers for the accept and reject portions from the screen, it may be more desirable to refine the slurry in a pulp refiner so that it can be washed in entirety in one system of washers before it is screened.

The preferred process just described has been found to produce an accept fraction, having less than 1 percent of the reject content of the slurry and provides a better quality top stock layer of the laminate than the process using an ultrarefiner as described above, having better brightness and strength with less of the undesirable shives. The top stock layer so produced is similarly better than that obtained with the 50—50 screening process and at least as good as the product of the process separately digesting the stock for each layer, while the base stock layer is as good as is required. The superior quality of the top stock layer is due in part to the fact that the screen accepts fraction of the high yield kraft is of better quality than stock produced from medium or low yield kraft. The equipment cost and its operating cost in the process of this invention are substantially less than in the process utilizing ultrarefining, which is the only prior process known to applicant in which all the stock for both layers is digested to high yield, with all the advantages this entails.

The screening machine used in the preferred process as described is capable not only of effecting the desired clean separation of the "good" top stock fiber but also of separating most of it even where its amount is low such as 30 percent or less, a surprising result when it is considered that it is mixed with such a large amount of reject material. Apparently, the high frequency and intensity of the pulsation produced by the rotor keeps the slurry content in a constant state of agitation such that virtually all of the fiber in the slurry has access to the open area of the screen.

The about 20–80 percent separation at the screen is preferred for several reasons. One is that these are about the right proportions to provide top and base layers of requisite thickness. A more important reason is that the machine operates very effectively in separating in these proportions. Separation at a higher ratio of accepts to rejects is likely to produce accepts with more undesirable fiber content and provides more fiber than is needed for the top stock, with about 30 percent the upper limit for providing accepts of requisite quality. Separation at a lower ratio is possible but if less than about 10 percent probably will not provide sufficient fiber for the top stock layer and will necessitate another screening of the rejected portion to make up the deficiency.

Smaller apertures or narrower slots in the screen than the minimums of the preferred ranges are likely to reject too much of the desired fiber or to blind; whereas, larger holes or wider slots than the maximums of the preferred ranges are likely to yield accepts of lower quality, with about 0.06 diameter holes and 0.02 wide slots being the maximums for providing an accepts fraction of requisite quality.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIGS. 1A and 1B are typical curves showing increase in percent rejects with increased yield for respectively continuous digestion and batch digestion of wood to kraft fiber.

FIG. 2 is a flow sheet illustrating a practice of the process of the invention; and

FIG. 3 is a modification of the flow sheet of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. 1 the two curves show the percent of rejects in continuous and batch digested kraft respectively on the vertical scale at the left for yields from low to high on the horizontal scale at the bottom. It will be noted that for yields of 50 percent or lower both curves show reject percentages below 20 percent. Above 50 percent yield the batch digestion curve climbs steeply, increasing from less than 40 percent rejects at a yield of 53 percent to more than 60 percent rejects at a yield of 56 percent. At a yield of 55 percent the continuous digestion curve shows a reject content of only 30 percent but an increase of continuous digestion yield from 55 to 60 percent increases the reject content to about 70 percent.

It will be seen therefore that at the same high yields batch digested slurry contains more rejects than does the continuous digested slurry and higher yields are obtainable with continuous digestion which will provide sufficient "good" fiber to form the top stock layer.

FIG. 2 illustrates a practice of the process of the invention with hot stock screening of the slurry to separate the top stock. From digester 10 (continuous or batch) where it is digested to a high yield, the kraft fiber goes to blow tank 12. At the exit of tank 12, dilution liquid is added through line 13 to form a slurry of about 4 percent consistency which passes through prerefiner 14 from which it is pumped by pump 16 to screening machine 18. Screening machine 18 is constructed and operated as above described to separate an accepted fraction, preferably of about 20 percent of the slurry content, which contains substantially only fibers of the "good" (non-reject) portion of the slurry fed thereto. This accepted fraction goes to washer 20 from which it is fed to be ultimately formed into the top stock layer on the linerboard machine. The slurry portion rejected by the screen of machine 18 goes to regular base stock refiner 22, thence to coarse screen 24 (e.g. 0.078 to 0.094 holes) from which the reject fraction is returned to the inlet of refiner 22, while the accepted fraction goes from screen 24 via washer 26 to be ultimately formed into the base stock layer of the paper laminate.

It will be understood that machines indicated singly in the drawings may be in multiple. If screening machines 18 are used in multiple, they are arranged in parallel, except as noted below. Refiner 22 may be capable of operation as an ultrarefiner but if so, will usually be operated at lower horsepower than is required for ultrarefining.

The flow sheet of FIG. 3 differs from that of FIG. 2 in that screening machine 18 operates on brown stock, there being interposed between prerefiner 14 and machine 18 pulp refiner 30 and washer 32, the latter making unnecessary washers 20 and 26 of FIG. 2.

In the process as illustrated in the flow sheet of either FIGS. 2 or 3, if screening machine 18 is operated to accept more fiber than is needed for the top stock layer, the excess thereof may be added to the rejected portion of slurry, preferably after it has been refined. In either flow sheet, if the screening machine 18 does not accept a sufficient quantity of fibers to form the top stock layer, the deficiency may be made up, for example, by providing a second screening machine 18 of like construction and operation to the first one and feeding thereto some or all of the stock accepted by screen 24, to provide an accept fraction containing acceptable fiber lost in the portion rejected by the first machine 18, and additional such fiber produced in the refining. The fraction accepted by the screen of this second machine may then be added to the fraction accepted by the screen of the first machine to form the top stock layer, while the slurry portion rejected by the screen of the second machine is used to form the base layer.

I claim:

1. A process for producing a kraft paper laminate of top stock and base stock layers from kraft fiber slurry which has been digested to a yield of at least 54 percent, which comprises the steps of:

subjecting said digested slurry to fine screening to separate said slurry into a first fraction passing through said screen and a second fraction not passing through said screen, said first fraction containing between about 10 and about 30 percent of the total fiber content of the slurry which consists substantially only of the shorter fiber having characteristics suitable for top stock, said second fraction containing the remaining, mainly longer fibers of said slurry;

utilizing fiber of said first fraction in forming the top stock layer of said paper; and

utilizing fiber of said second fraction in forming the base stock layer of said paper.

2. A process according to claim 1 wherein said first fraction contains about 20 percent of the total fiber content of said slurry and is utilized in substantial entirety to form said top stock layer.

3. A process according to claim 1 wherein the fiber of said first fraction is washed, and the fiber of said second fraction is refined and washed, prior to said forming steps.

4. A process according to claim 1 wherein all the fiber of said digested slurry is washed and refined prior to said screening step.

5. A process according to claim 1 wherein said slurry is subjected to said screening in a screening zone defined between a co-axial screen and rotor both of substantially circular cross-section, the rotor providing pulses of high frequency and intensity in said zone to prevent plugging of said screen.

6. A process according to claim 1 wherein said first fraction contains only fiber which will pass through screening apertures of a diameter not exceeding about 0.06 inch.

7. A process according to claim 6 wherein said first fraction contains only fiber which will pass through screening apertures of a diameter of 0.55 inch.

8. A process according to claim 1 wherein said first fraction contains only fiber which will pass through screening slots of a width not exceeding about 0.02 inch.

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