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METHOD OF FORMING A TOBACCO PRODUCT OF INCREASED WET STRENGTH

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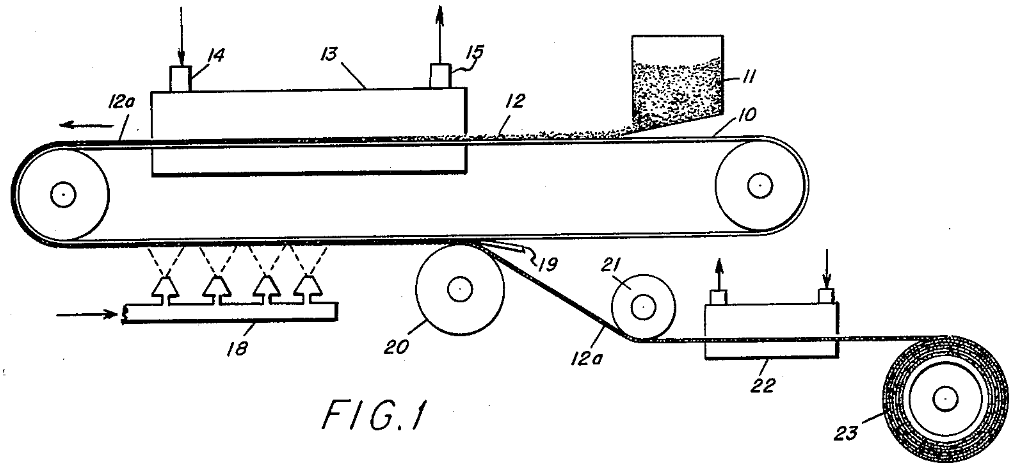

FIG. 1

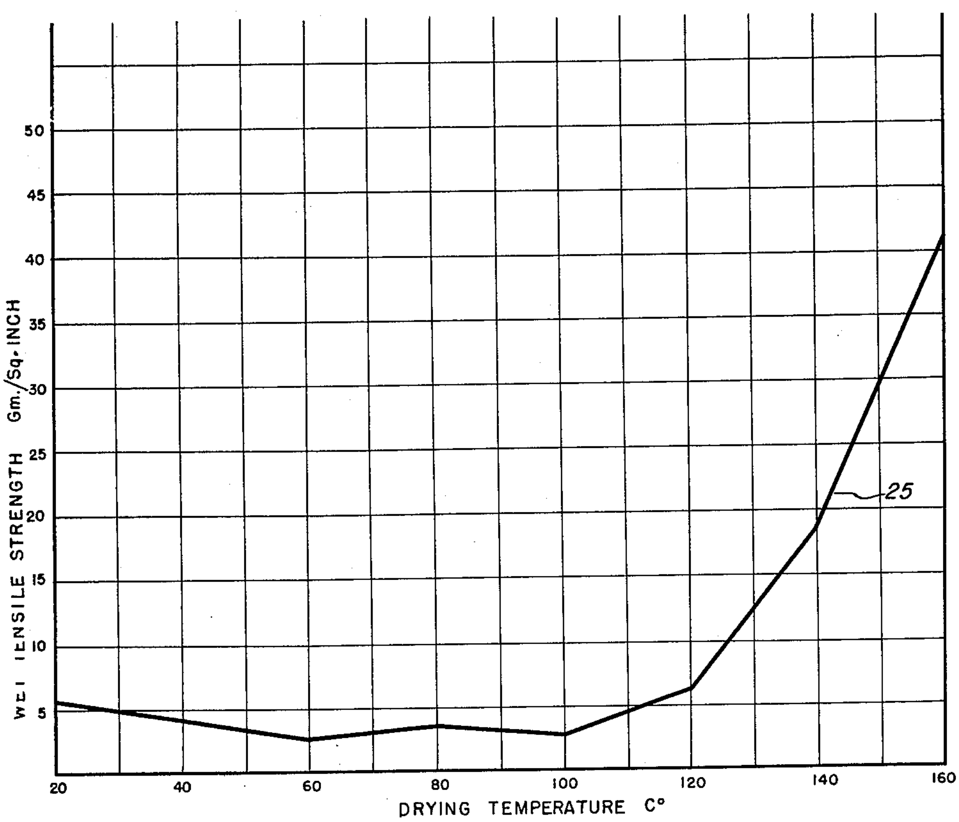

FIG. 2

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METHOD OF FORMING A TOBACCO PRODUCT OF INCREASED WET STRENGTH

Allan B. Clarke, Midlothian, Va., assignor to Philip Morris Incorporated, New York, N.Y., a corporation of Virginia

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4 Claims. (Cl. 131—140)

This application is a continuation-in-part of application Serial No. 839,658, which was filed on September 14, 1959, now abandoned.

The present invention is concerned with a method of making a reconstituted tobacco product. The method consists of a series of operations and specified conditions whereby common tobacco by-products such as stems and tobacco fines are formed into a sheet capable of being utilized in the normal manner of leaf tobacco as a smoking product. The sheet material produced may be cut or shredded similarly to the leaf parts and utilized for smoking either by itself or mixed with shredded leaf parts.

It has heretofore been proposed to grind up tobacco materials forming a wet slurry thereof, casting the slurry in the form of a film on a flat surface and drying the cast film. However, difficulties have been encountered in handling the film because of its physical weakness. Particularly the film lacked wet strength, which is a handicap because of the tendency of such films when cast and dried upon a flat surface to adhere to the surface requiring remoistening of the film to free it from the surface. Also the films had a tendency to soften and disintegrate when wetted. For example spraying the shredded product with a liquid such as flavoring materials tended to reduce the shreds into a soft mass and destroy their crispness and resiliency. Also there was the liability of particles becoming soft and disintegrating when contacted by saliva in the smoking of a cigarette embodying the product. One remedy for the difficulties was to add adhesive material to the slurry which gave added strength including wet strength to the product.

The present invention is based on the discovery that the strength and particularly the wet strength of the reconstituted tobacco product may be very materially increased by employing in the initial drying stage, after the free water has been removed, selected controlled temperature conditions within a critical range. The invention accordingly comprises the various steps and conditions which will be exemplified in the method hereinafter disclosed and the scope of the invention will be indicated in the claims.

In the accompanying drawings:

FIG. 1 comprises a diagrammatic illustration of one form of apparatus for forming the film including the drying thereof within the temperature range to be described; and,

FIG. 2 is a plotted graph of tensile strengths of the sheet material dried at various temperatures.

The initial step preliminary to the film forming operations comprises the preparation of the tobacco slurry. The starting materials may comprise any part of the tobacco plant, that is unaged or aged leaf, stem or stalk portions or mixtures thereof, but the present method has particularly practical application in making use of tobacco parts which are commonly waste or at least not utilizable in the normal manner of the leaf portions. The starting material accordingly may comprise stem parts or tobacco leaf fines, or, as will now be described as a representative example, a mixture of stems and tobacco fines.

The method of preparing such a tobacco slurry preferably involves an initial separate treatment of the components. The stems are preferably cooked and beaten or refined. The treatment in general may be similar to the pulp treatment in paper making. The leaf fines are preferably ground to further reduce the particle size such as to pass through an 80 mesh screen. The two component products are then mixed together in a large excess of liquid and further ground or beaten if necessary to arrive at the desired state. Water will, in general, be the liquid which is employed, but other liquids capable of subsequent removal by evaporation may be employed.

It is important for the preparation of a satisfactory film, that the proportion of tobacco solids to liquid be in the range of from about 3 to about 8% by weight, with about 5% being preferred. The tobacco solids content may be about equal parts cooked pulp and raw ground fines. Desirably the slurry is so prepared, and particularly the treatment of the stems is carried on under controlled conditions, such as to result in a substantial proportion of tobacco ground to a gelatinous state and similarly a substantial proportion remaining as discrete fibers. For example the stem may be beaten to the condition such that one-third to one-half of the stem product may be recognizable under high magnification as definite discrete fibers. The slurry may, of course, contain also various additives such as glycerine or other humectants, non-volatile flavorings and other materials common to smoking tobacco mixtures. As a whole, however, the solid constituents are predominantly and essentially tobacco.

FIG. 1 shows diagramamtically an apparatus and method for converting the slurry into a dried film. It includes primarily a movable flat casting surface upon which the slurry is deposited and advanced through the drying zone. The coating surface as shown in FIG. 1 comprises a continuous metal band 10 preferably of stainless steel. The slurry may be deposited thereon by any standard means indicated in FIG. 1 as a supply box 11 having an adjustable slit opening for delivering a film of slurry 12 onto the belt surface. The thickness of the layer will depend upon circumstances but as a representative example with a slurry containing about 5% solids the initial film, as regulated by the speed of the belt and size of slit opening, can be in the range of .050 to .125 inch. The film proceeds on the band 10 to the drying zone indicated in FIG. 1 as a forced draft oven 13 with a hot air intake 14 and exhaust 15. Conditions are selected such that the film 12*a*, as it emerges from the drying oven, is substantially free of water. However, in order to provide the outstanding results obtainable by means of the present invention, the way in which this result is accomplished involves two essential steps. In the first step, the film is heated to a temperature sufficiently high to drive off all the free water present in the film. The term "free water," as employed herein, means all water present in the film which can be removed by bringing the water to a temperature which corresponds to the boiling point of water. Thus, under atmospheric conditions, the film will be subjected to a temperature of about 100° C., whereby the free water is evaporated from the film. The second step, involves heating the thus-treated film until the film itself reaches a temperature which is at least 120° C. and which is below 160° C. Preferably the film is heated until it reaches a temperature of 140° C.± 10° C.

The first step can be conducted in an oven at a temperature of from about 100° C. to 200° C. or even higher so long as the temperature of the film is no higher than 100° C. The duration of this step will depend on the thickness of the film, the moisture content of the film and other conditions of the film but will generally be between about 5 minutes and 2 hours. The end of this first step or heating period can be determined by measuring the temperature of the film during heating. For any temperature within the range of 100 to 200° C. to which the atmosphere in the oven is heated, the film will reach a temperature plateau, which is always considerably below 100° C. After this plateau has been reached, when the temperature of the film begins to rise, and particularly when the temperature of the film reaches 100° C., the free water can be considered to be driven off and the first step can be considered completed.

The second step is then conducted by heating the film in an atmosphere maintained at a temperature of from about 120° C. up to 160° C. for a period of time until the temperature of the film is at least 120° C. but below 160° C. This can be done most readily in an oven but can also be done employing hot drying rolls or other suitable means. This time can readily be determined by measuring the temperature of the film by conventional means and will generally be a time of about 30 minutes. The two drying steps may be conducted in two separate ovens maintained at different temperatures or the film can be passed through a single oven having a temperature gradient. Preferably, however, both steps are conducted in a single oven, such as oven 13, which is maintained at a temperature of from 120° C. up to 160° C. In this manner, there is a smooth transition from step 1 to step 2 and there is a minimum amount of equipment required for the two operations.

It is of course necessary to remove and collect the dried film from the belt 10 and preferably in the form of a continuous sheet for convenient handling and storage. It is a characteristic, however, of dried films of the type and composition involved that, despite the highly polished surface of the stainless steel belt 10, the film adheres firmly to the belt and can be readily separated only by remoistening to a substantial degree. Accordingly, the film is sprayed with a liquid, which is preferably water, in its return run as indicated at 18. The wetting liquid may include if desired various additives such as flavorings or dyes. The degree of wetting will vary in different cases but in general it is necessary to apply liquid to the extent of a moisture content in the range of about 20% to 40% in order to be able to free the film readily from the surface of the traveling belt. In previous operations of such character it has been found that the film, when remoistened to the degree necessary, commonly has inadequate strength for the manipulations in removing it from the carrier band and feeding it to a takeup roll, and it is due to the critical drying operations of the present invention that the operation, is accomplished without difficulty. The film proceeds from the spraying apparatus 18 forwardly to where a doctor blade 19 serves to separate the film from the band 10. Suitable rolls 20 and 21 serve to support and direct the removed film 12a in its advance. Preferably, the removed film is redried to a desired extent and accordingly is directed through a drying oven 22 where the moisture content is reduced to about 12% to 15% and is then wound on a collecting roll 23.

The apparatus and steps described may be varied considerably within the principles of the present invention. If desired the film may be initially deposited upon a Fourdrinier type conveyor and a large portion of the liquid removed directly, and other manipulations employed generally similar to those used in paper making.

A large number of tests for wet tensile strength have been made on the film dried at various temperatures and FIG. 2 is a curve based on values thus derived.

The samples for such tests were prepared as follows:

A slurry of tobacco parts was made. First a quantity of shredded tobacco stems was cooked with water in a pressure cooker at 15 lbs. pressure (approximately 240° F.) for one hour. This was refined in a beater to a freeness on the Schopper-Riegler scale of about 140, the mass therefore comprising a mixture of gelatinous material and discrete fibers each in at least a large percentage. There was then added a quantity of tobacco leaf fines and a small amount of glycerine. A slurry was prepared from the above materials and added water by mixing the constituents for thirty minutes in a Waring Blendor. The slurry consisted of approximately 5% solid tobacco materials and 95% water. The solid tobacco material consisted approximately of: tobacco stems 50%, tobacco leaf fines 46% and glycerine 4%.

A series of dried samples of tobacco sheet were made from the above described slurry. In each case a layer of the slurry about .075 of an inch in thickness was flowed onto a glass plate and then dried in a forced draft oven held at a predetermined temperature. The drying time varied from about 16 hours at the 20° C. temperature to about 1 hour at the 160° C. temperature. Several dried samples were prepared at each selected temperature and wet tensile strength determinations were made on five samples for each of the selected temperatures. The wet tensile strength values recorded in the below Table A comprise the average of the five samples at the respective temperatures indicated.

The wet tensile strength was determined as follows:

The tobacco sheet was cut into strips 1 inch wide by 5 inches long. Each strip was placed between clamps on a standard Scott tester with the clamps adjusted to 1 inch apart. A transverse band across the strip between the clamps was then wetted by applying three spaced drops of distilled water from an eye dropper, followed by a 1 minute idle time period. This served to form a wet band about 3 mm. wide across the strip. At the end of the time period the tester was energized and the elongation and breakage were recorded on the graph paper attached to the tester. As stated above the value in the second column of Table A below is the average of five samples at the respective drying temperature.

Table A

Drying temperature, °C.:	Wet tensile strength, gms. per in. width
20	5.7
40	4.4
60	2.8
80	3.6
100	2.9
120	6.4
140	18.7
160	41.1

The values were employed as points in plotting the curve 25 of FIG. 2. The samples tested for wet tensile strength were prepared by soaking sections of the film in water for about one minute whereby they acquire a water content of about 50% to 80%. It will be noted that at 120° C. the wet strength increases rapidly upwardly through 160° C. However, sheets dried at above 160° C. were quite noticeably scorched, with a corresponding manifestation of brittleness and some distintegration. For a good product, therefore, 160° C. is indicated as the upper limit. Additional subsequent tests produced values which fell on or very close to the original curve 25.

Similar samples were also tested for dry tensile strength and it appeared that all samples tested possessed at least a moderately satisfactory dry tensile strength. However, it was found that those samples dried in accordance with the present invention had superior dry tensile strength in the range of considerably above 400 grams per square inch. The samples referred to as tested for dry tensile strength were first conditioned in an atmosphere of 65% relative humidity whereby the samples acquired a moisture content in the range of 10% to 14%, which is substantially standard for smoking tobacco products.

Distintegration in water tests were also made. One inch squares of the samples dried at each temperature were placed in beakers containing 100 ml. of water. Each beaker was given the same amount of agitation and the time recorded when the one inch squares began to disintegrate. All the samples dried at and below 100° C. disintegrated within 6 hours. The samples dried above 100° C. and up to 160° C. were still intact after 52 hours.

Similar tests in which the drying temperature was at

160° C. and higher were also carried out. Samples of similar composition and prepared similarly when dried at temperatures above 160° C. begin to show signs of scorching and at temperatures substantially above 160° C., as for example at 170° C., the scorching was distinctly apparent. Such scorching rendered the sheet very dark brown to black and made the material unattractive. In addition, such scorching altered the flavor of the tobacco. The scorched material was found to have chemical changes which had occurred during scorching. These changes included the transformation of the sugars normally present in the tobacco.

Tests, generally similar to the above tests, were also run with samples prepared and treated similarly to those listed in Table A except the proportions of the stems and leaf parts and the percentage of total solids present in the slurry differed. Sheet material of adequate wet tensile strength was obtained when the film was dried at a temperature within the range of 120° C. up to 160° C. For example, in one series of tests tobacco slurries and test strips were prepared in substantially the manner described above and the test strips were wetted as described above and subjected to tensile strengths in the Scott tester in accordance with the procedure described above the drying temperature being at 140° C. In one sample (B–1) the total solids content of the slurry was 4% and the layer thereof flowed onto the casting plate was approximately .075 of an inch thick. In another sample (B–2) the total solids content of the slurry was 7% and the layer thereof flowed onto the casting plate was approximately .100 of an inch thick. In each case the solids part was composed of the following proportions:

	Percent
Stem pulp	50
Leaf fines	46
Glycerine	4
Total	100

The tensile strength recorded in the below Table B was determined as above described, except the final value was the average of ten or more samples.

Table B

Sample	Solids Content, percent	Gms. per inch width
B–1	4	74.1
B–2	7	86.0

In another test a slurry was similarly made having 5% total solids but the solids were in the proportions:

	Percent
Stem pulp	35
Leaf fines	61
Glycerine	4
Total	100

Sheets were cast and samples C–1 and C–2 were made employing different drying temperatures. The thicknesses of the layer of the slurry as flowed onto the casting plate was approximately .100 of an inch. The wet tensile strength as determined on the Scott tester in the manner described above was as follows:

Table C

Sample	Drying Temperature, ° C.	Wet Tensile Strength, gms. per inch width
C–1	100	17.4
C–2	140	72.3

In still another series of tests a slurry having 5% total solids but the solids were in the proportions:

	Percent
Stem pulp	75
Leaf fines	21
Glycerine	4
Total	100

Sheets were cast and samples D–1 and D–2 were made employing different drying temperatures. In these tests the thickness of the layer of the slurry as flowed onto the casting plate was approximately .125 of an inch. The wet tensile strength as determined on the Scott tester in the manner described above was as follows:

Table D

Sample	Drying Temperature, ° C.	Wet Tensile Strength, gms. per inch width
D–1	100	33.6
D–2	140	81.6

As a result of various tests and experiments which were carried out on tobacco slurries made generally similar to those described above for Table A, but varying considerably therefrom in percentage of tobacco solids, it could be seen that with a solids content in the slurry below about 3%, the dried samples exhibited generally similar wet tensile strength as those of Table A but a substantial amount of the soluble solids ran out of the film prior to drying which altered undesirably the flavor of the product. On the other hand increasing the solids content of the formulation above about 8% resulted in a non-flowable mass which was difficult to cast and required casting in thicknesses of more than 0.150 of an inch and tendency of the dried sheet to crumble in normal desired handling conditions.

The product of the method of the present invention is also characterized by a reduction in the amount of alkaloids which are primarily nicotine, such reduction being evident at temperatures distinctly noticeable when the drying temperature reaches about 120° C. Also the sugar content is transformed and reduced with temperatures of 100° C. and higher and the sugar substantially disappears when the temperature reaches 120° C. The product of the present method also is more dense than when dried at lower temperatures and its burning rate is decreased.

The sheet material derived according to the present method may be cut up into sections corresponding in size to normal stemmed tobacco leaf portions and utilized similarly. The method therefore enables tobacco materials such as stems and fines to be converted into a product which may be readily manipulated and which may be shredded like ordinary tobacco leaf and utilized in a smoking product in a substantially simlar manner and having properties and characteristics generally similar to shredded tobacco leaf. The sheet material may be employed as a cigar wrapper since with the added wet strength it will not fall apart in the smoker's mouth as readily.

It should be understood that various apparatus may be employed and certain changes made in some of the associated steps comprising the complete method and that accordingly the matter contained in the foregoing description should be regarded for the most part as illustrative and not in a limiting sense.

I claim:

1. A method of forming a tobacco sheet material of increased wet strength comprising preparing a slurry of finely reduced tobacco parts in water, the said tobacco parts being present in an amount in the range of 3% to 8% with a substantial proportion reduced to a gelatinous state, casting a film of said slurry on a flat traveling supporting surface, passing the supporting surface and film

through a drying zone having an atmosphere in the temperature range of 120° C. to 160° C., heating the film in said drying zone until the temperature of the film reaches the boiling point of water, whereby the free water is removed and thereafter heating said film in said drying zone until the temperature of said film is at least 120° C. and less than 160° C., passing the supporting surface and dried film through a rewetting zone where liquid is applied to wet the film to a moisture content in the range of 20% to 40%, stripping the wetted film from the supporting surface, drying it to below substantially 35% moisture content, and collecting the product.

2. A method of forming a tobacco sheet material of increased wet strength comprising preparing a slurry of finely reduced tobacco parts in water, the said tobacco parts being present in an amount in the range of 3% to 8% with a substantial proportion reduced to a gelatinous state, casting a film of said slurry on a flat traveling supporting surface, passing the supporting surface and film through a drying zone having an atmosphere in the temperature range of 130° C. to 150° C., heating the film in said drying zone until the temperature of the film reaches the boiling point of water, whereby the free water is removed and thereafter heating said film in said drying zone until the temperature of said film is at least 130° C. and less than 150° C., passing the supporting surface and dried film through a rewetting zone where liquid is applied to wet the film to a moisture content in the range of 20% to 40%, stripping the wetted film from the supporting surface, drying it to below substantially 35% moisture content, and collecting the product.

3. A method of forming a tobacco sheet material comprising preparing a slurry of tobacco parts in a finely reduced state and containing a substantial proportion of gelatinized tobacco parts in water, with the tobacco parts being present in an amount of from about 3% to about 8% by weight of the total slurry composition, casting said slurry into a film, heating said film at a temperature of

at least the boiling point of water and continuing said heating until the temperature of the film has reached the boiling point of water to remove all of the free water present therein and thereafter heating the film in an atmosphere which is maintained at a temperature of at least 120° C. until the temperature of the film is at least 120° C. and less than 160° C.

4. A method of forming a tobacco sheet material comprising preparing a slurry of tobacco parts in a finely reduced state and containing a substantial proportion of gelatinized tobacco parts in water, with the tobacco parts being present in an amount of from about 3% to about 8% by weight of the total slurry composition, casting said slurry into a film, heating said film at a temperature of at least the boiling point of water and continuing said heating until the temperature of the film has reached the boiling point of water to remove all of the free water present therein and thereafter heating the film in an atmosphere which is maintained at a temperature of at least 130° C. until the temperature of the film is at least 130° C. and less than 150° C.

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ABRAHAM G. STONE, *Primary Examiner.*

F. RAY CHAPPELL, SAMUEL KOREN, *Examiners.*