RECONSTITUTED TOBACCO MANUFACTURE

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14 Claims

ABSTRACT OF THE DISCLOSURE

An improved reconstituted tobacco sheet is formed by refining a slurry of tobacco stock material and water until the pulp reaches a critical value of pulp fineness of between 100 and 900 milliters value (inverted) on the Schopper-Rieger scale and then casting and drying the resultant slurry to sheet form. The reconstituted sheet formed by this technique manifests tensile strength greater than most prior art sheets and appears to be less porous and less mottled and generally exhibits lower orientation factors (longitudinal breaking strength divided by transverse breaking strength).

This application is a continuation-in-part of our prior application Ser. No. 355,954, filed Mar. 30, 1964, now abandoned.

This invention relates to the manufacture of reconstituted tobacco products. More particularly, the invention concerns the preparation and use of refined tobacco stock material such as stems, stalks, and veins.

It is known to make tobacco products from dry ground tobacco and various fiber materials including wood pulp. The pulp fibers provide coherence and strength.

It is desirable to some smokers that the highest possible proportion of tobacco material be used in homogenized and reconstituted tobacco products. To this end it has also been proposed that tobacco stem, stalk or other fibrous material be used in place of wood or sulfite pulp fiber and that the fiber (hereinafter sometimes referred to as stem) be treated variously in water.

It is an object of the present invention to provide a method of making tobacco products comprising or including refined tobacco stems.

It is also an object of the present invention to provide a method of making tobacco products from tobacco dust and stems by refining the stem fibers.

It is a further object of the present invention to provide a method of making tobacco products from non-tobacco materials in admixture with refined tobacco stems.

It is also an object of this invention to provide novel tobacco products, such as sheets and shreds, which are composed entirely of refined tobacco stems, or of a combination of refined tobacco stems with tobacco dust and/or non-tobacco materials.

According to the invention, suitably refined tobacco stems are mixed with a quantity of water suitable for shaping and the dispersion is shaped and dried. Other ingredients, such as adhesives, mold inhibitors, dyes, water resistance agents, ash additives, burn modifiers, flavors and humectants, as well as ground tobacco leaf or stem portions may be combined with the refined tobacco stems.

The dry grinding of tobacco to sizes between about forty and three hundred twenty-five mesh is done by the usual hammer mill or the like.

The tobacco stems may be steeped in water and cooked under pressure prior to refining, but the cooking and pretreatment may be omitted to obtain products of varying character.

The critical feature of the invention is the extent to which the stems, stalks or other tobacco stock material are treated in a refiner. They are refined until the fineness value in a "Schopper-Rieger" system has reached at least a minimum value and increases with further refinement. The fineness value after inversion may be between about 100 and 400 milliters and even up to 960 mlll, depending upon the properties desired.

The stem pulp may be combined with tobacco dust in water, treated in a vacuum, and formed into a shaped article of manufacture, such as a sheet or bend. After the product is dried, the dust may range from about twenty to about eighty percent of the solids, but about fifty percent is a good value for cigar binder. The products may be used in pipes, cigars or cigarettes as fillers and in cigars as binder or wrapper. Various shaped structures can be made by spraying, molding or casting. Reverse roll coating may be used to form sheets.

The following example, Example I, is illustrative of a preferred mode of practicing this invention and contains the general refining procedure used to produce the stem pulp used to prepare the examples set forth hereinafter. The only difference in the later examples is the pulp preparation prior to refining (i.e., cooking versus no cooking) and the final fineness value of the stems, which may be varied within the limits claimed in the invention to meet the physical requirements of the desired product.

Example I

Tobacco leaves are dry ground in a hammer mill to pass more than 98% of the material through a screen having openings of seven thousands of an inch (80 mesh U.S. Standard sieve) and 25% of the material is retained on a screen having openings of three and one-half thousandths of an inch (170 mesh U.S. Standard sieve).

A pulp is prepared from tobacco stems in water. Pennsylvania cigar filler tobacco stems are suitable. About one pound of stems per gallon of water is charged into an agitated pressure vessel. The mixture is heated with agitation in an open vessel by sparging steam into the vessel, for about ten minutes, to a temperature of about 200° F. The vessel is sealed. Heating is continued for five to ten minutes until the temperature reaches 255° F. (40 pounds per square inch gauge). This temperature is maintained for about two hours. The mixture is cooled to about 170° F. Cooling takes about one half hour. The material is next circulated through a paper pulp type disc refiner which beats the individual fibers into fibrils mechanically. The rate of passage of the pulp through the refiner is such that over a period of four hours the material would pass through the refiner about one hundred times. The material passes through the refiner device until a critical value of pulp "fineness" is reached. The preparation of the pulp is then complete.

As soon as refining begins, measurements at least every half hour are taken of the progress of fineness. A fifty gram sample containing two grams of insoluble tobacco addition of water. This is charged into the reservoir of an material is taken. The volume is brought to one liter by instrument known as a "Schopper-Rieger" fineness tester, a device commonly used in the paper industry.

The one liter of liquid passes gravimetrically through a screen having area and openings of standard size. The
liquid collects below the screen in a sump and is allowed to escape from the sump through an orifice at a fixed rate. An overflow duct is provided at a level a little higher than the orifice and the liquid which overflows is collected. Liquid overflows because the orifice does not allow liquid to escape as quickly as does the screen on which pulp is retained. The volume of overflow liquid is an indication of the rate at which liquid and stem pulp are separated on the screen and the volumetric value is called “freeness.”

As refining continues the successive measurements of freeness reach a minimum volumetric value. At or after this value is reached the pulp is ready to be combined with dust. After the minimum value is reached the volumetric values increase and a freeness inversion point is exceeded. The critical value of this invention is the use of pulp which is refined to a degree which at least reaches and passes the point of freeness inversion. In this example an inverted freeness of 250 milliers was reached and refining stopped.

The pulp is mixed with the dust previously made by dry grinding tobacco leaves, in a ratio of about one part dry dust to one part stems on a dry basis by weight, and water is also added so that the mixture comprises about four parts of dried or negative stem pulp and ninety-two parts water. The mixture is stirred under vacuum for about an hour to remove air and other gases.

Less than 5% of the mixture of pulp and dust on a dry basis are retained on the 100 mesh screen of a Clark Classifier. This device is noted in U.S. Patent 3,115,882 for use in tobacco manufacture.

Finally, the mixture is promptly spread uniformly on a film forming surface, such as a stainless steel belt. The material is dried to a moisture content of about three percent, remoistened to about twenty percent moisture, removed from the forming surface and cut to useful shapes and sizes. The application of the material to the film forming surface may be by projection (brush spatter or spray) or by knife casting, in which case the application pressure must be controlled to achieve optimum quality of product.

Although there is also an inversion point on the “Canadian” freeness scale, this occurs at a much lower level of refining than on the “Schoapper-Rieger” scale and is not a useful indication of when stem pulp is ready for use in tobacco sheet manufacture according to this invention.

For example, it is well known that the effective upper limit of freeness on the “Canadian” Standard (a value of about minus 850 CSF) corresponds approximately to only the inversion point on the Schoapper-Rieger scale. It follows that inversion on the Canadian Standard scale occurs at a considerably lower level of refining than does inversion on the Schoapper-Rieger scale. Accordingly, the negative valuation on the Schoapper-Rieger scale is considerably different from negative readings on the Canadian Freeness scale in both quality and quantity.

We have found that fiber, whether tobacco or other cellulose fibers, refined to measure on the Canadian freeness scale, no matter what the value and whether positive or inverted, is generally coarser, longer and different in physical characteristics and quality than fiber refined to a degree measurable only on the inverted or negative portion of the Schoapper-Rieger scale. In fact, fibers falling into the negative portion of the S-R scale, are to an unexpected degree finer, less coarse and of a different quality than any refined to any measurable value on the CSF scale.

We have found that, by continuing refining beyond the S-R inversion point, we unexpectedly obtain a finished tobacco product such as sheet, which is stronger, has greater tensile strength and is less porous and mottled (thick and thin areas related to poor casting of the stem pulp slurry) than products made by old methods. In addition, such products generally exhibit lower orientation factors (longitudinal breaking strength divided by the transverse breaking strength). Above all, the appearance of sheet or other product is enhanced to an unexpected degree, in that, such product is more uniform in color, feel, look and aroma.

We have found that the upper value of inverted SR (negative value) which would tend to negate the effective results noted above, and, as will be seen from the following examples, we have produced successful sheet from pulp refined to an inverted Schoapper-Rieger of 960 ml., which is the effective upper limit of the Schoapper-Rieger scale.

At this Schoapper-Rieger degree of refinement, tobacco products acquire an unexpected degree of silken smoothness which is decidedly desirable in products such as cigar wrapper. Furthermore, the additional product strength resulting from such exceptional refining is useful for products such as cigar wrapper which are generally made thinner (to aid workability on cigar machines) and would normally be decidedly weaker as a result.

It is noted that this invention is, of course, more suitable to the technique of drying sheet or other product on a smooth porous drying surface. A large body of the prior art employs standard paper making or Fourdriner type casting and screen-drying apparatus. Because of the high degree of refining, the pulp made under the present invention is of such fineness and in an advanced state of hydrolization, that it is clear that the techniques used with such prior art machines would not be applicable due to the tendency of the present pulp to pass through such screens. Further, prior art concerned with such screen-drying apparatus would not suggest that such fine pulp could be employed.

The following are specific examples of sheet made in accordance with the present invention and by the method previously outlined in Example 1, with modifications as noted. It should be recalled that the invention here relates to refinement and that the use of specific types of tobacco the use of tobacco dust or non-tobacco ingredients in admixture with various proportions of refined stems and the specific drying apparatus is for the purpose of illustration only of the various procedures which may be employed within the scope of this invention.

In the following examples, we have also set forth the respective values of the sheet products for tensile factor, porosity and average orientation. The advantages in appearance are not possible to demonstrate by value in this description but are demonstrable in fact.

Example 2

In run #S-8711, a mixture of 6.0% solids in water of Maryland crushed #4 stems, unswetced and uncooked was allowed to soak in water for one-half hour and then was refined in accordance with the procedure outlined in Example 1 for 160 minutes until a freeness on the SR scale of —190 was reached. The resultant pulp was mixed in a ratio 80%/20% with tobacco dust and cast into sheet as explained. The resultant sheet had a porosity (sec./300 cc.) of 110, a tensile factor of 133 and an average orientation factor of 1.18.

In summary

<table>
<thead>
<tr>
<th>Run No.</th>
<th>S-8711</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refining time, mins.</td>
<td>160</td>
</tr>
<tr>
<td>Freeness SR</td>
<td>—190</td>
</tr>
<tr>
<td>Porosity, sec./300 cc.</td>
<td>110</td>
</tr>
<tr>
<td>Average tensile factor</td>
<td>133</td>
</tr>
<tr>
<td>Average orientation factor</td>
<td>1.18</td>
</tr>
</tbody>
</table>

Since sheet varies somewhat in thickness or sheet weight (grams/ft²) conditions, and sheet tensile strength varies proportionally to sheet weight, we find it best to compare the sheet tensile strength on a unit sheet weight basis (i.e., per gram of sheet weight) rather than compare raw sheet tensile strength data. Tensile factors, as shown herein, represent the sheet tensile strengths (grams breaking strength) divided by the sheet weights (gram/ft²).
### Example III

The exact same procedure, as set forth in Example II was followed, except as to time of refining and freeness value. In summary, the results are as follows:

<table>
<thead>
<tr>
<th>Run No.</th>
<th>Refining time, mins</th>
<th>Freeness, SR</th>
<th>Porosity, sec./300 cc</th>
<th>Average tensile factor</th>
<th>Average orientation factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S-8710</td>
<td>200</td>
<td>-220</td>
<td>185</td>
<td>1.80</td>
</tr>
</tbody>
</table>

### Example IV

The exact same procedure, as set forth in Example II was followed, except as to time of refining and freeness value. In summary, the results are as follows:

<table>
<thead>
<tr>
<th>Run No.</th>
<th>Refining time, mins</th>
<th>Freeness, SR</th>
<th>Porosity, sec./300 cc</th>
<th>Average tensile factor</th>
<th>Average orientation factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S-8709</td>
<td>260</td>
<td>-340</td>
<td>205</td>
<td>1.03</td>
</tr>
</tbody>
</table>

### Example V

The refining procedure was again that of Example II, except for refining time and freeness values.

For comparison, we set forth the following example of sheets made with freeness values falling in the positive side of the SR scale, i.e., prior to inversion. The same basic procedure and material as set forth in Example II was followed in each of the following examples, except for the degree to which the stems were refined. It is noted that the following examples have values which would fall in the negative range of the Canadian freeness scale, although on the Schopper-Riegler scale they are positive values. The examples are given in summary form.

<table>
<thead>
<tr>
<th>Run No.</th>
<th>Refining time, mins</th>
<th>Freeness, SR</th>
<th>Porosity, sec./300 cc</th>
<th>Average tensile factor</th>
<th>Average orientation factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S-8712</td>
<td>400</td>
<td>-960</td>
<td>240</td>
<td>0.97</td>
</tr>
</tbody>
</table>

### Example VI

It will thus be observed that each of the sheets made with freenesses falling in the positive range of the SR scale (and consequently in the entire CSF scale) has significantly greater porosity, lower tensiles and generally higher orientation factor than their negative SR counterparts in runs S-8709, S-8710 and S-8711. It can also be demonstrated that such positive SR sheets had poorer appearance and feel.

We have thus demonstrated that the objects and advantages set forth hereinafore are obtained by the present invention and while the preferred forms have been described, it is obvious that various modifications are available. For example, the product can be made in shaped molded or other form rather than sheet. Additionally, it is obvious that sheet can be made from refined stems alone, without the incorporation of ground tobacco leaf or stem dust in the slurry prior to shaping. For certain applications, this is preferred. Products made without the incorporation of ground dust are stronger than those containing tobacco dust, since the refined stem pulp is the major factor in the sheet strength.

### Example VII

Refining procedure was the same as set forth in Example II, except for refining time and freeness values.

### Example VIII

The refining procedure was again that of Example II, except for refining time and freeness values.

### Example IX

The same basic procedure and material as set forth in Example II was followed in each of the following examples, except for the degree to which the stems were refined. It is noted that the following examples have values which would fall in the negative range of the SR scale, although on the Schopper-Riegler scale they are positive values. The examples are given in summary form.

<table>
<thead>
<tr>
<th>Run No.</th>
<th>Refining time, mins</th>
<th>Freeness, SR</th>
<th>Porosity, sec./300 cc</th>
<th>Average tensile factor</th>
<th>Average orientation factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S-8714</td>
<td>20</td>
<td>+350</td>
<td>50</td>
<td>1.16</td>
</tr>
</tbody>
</table>

### Example X

The exact same procedure as set forth in Example IV was followed, except that the sheet was cast directly from the refined stem pulp, without the incorporation of 20% tobacco dust in the slurry. The resultant sheet properties were generally comparable to those listed in Example IV for Run S-8709, except for the Average Tensile Factor, which was found to be 240 instead of 185, an increase of 30%.

Various types of tobacco may be employed as suits taste, availability and customer requirements and desires. It is not necessary that the tobacco be in stem form since other suitable stock material such as veins, stalk, and fine leaf pieces may also be used. An example involving the use of refined tobacco stalks in place of tobacco stems is as follows:

### Example XI

The exact same procedure as set forth in Example VI was followed, except that the material refined to an inverted SR freeness of -960 cc. was Connecticut Broadleaf Stalks chopped to ¼-inch lengths in place of the Maryland crushed stems used in Example VI. Additionally, the resultant pulp was cast into sheet form and dried without the prior incorporation of ground tobacco dust. The properties were as follows:

<table>
<thead>
<tr>
<th>Refining time, mins</th>
<th>Freeness, SR</th>
<th>Porosity, sec./300 cc</th>
<th>Average tensile factor</th>
<th>Average orientation factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>420</td>
<td>-960</td>
<td>nil</td>
<td>76</td>
<td>0.99</td>
</tr>
</tbody>
</table>

The product is decidedly weaker than that obtained in Example VI, but is nevertheless usable for certain tobacco applications. Additional strength, if required, can be obtained through preparation of thicker sheets.

This invention, of course, relates to the utility of novelly-refined tobacco pulp, combinations of such pulp with tobacco dust, as described previously, or with a variety of non-tobacco ingredients to produce tobacco products with particular physical, chemical, taste or aroma properties are frequently employed. Such non-tobacco ingredients may be combined with the tobacco pulp of this invention include natural and synthetic adhesives, insolubilizing or crosslinking agents, humectants or plasticizers, inorganic ash additives and whiteners, fungicides, non-tobacco fibers and inorganic and organic combustion modifiers. An example illustrating the use of non-tobacco additives in combination with the refined tobacco pulp of this invention is as follows:

### Example XII

To 6.0 parts (dry basis) of refined Maryland stems prepared exactly as described in Example VI is added (all
on a dry basis) 0.85 part guar gum, 0.15 part ethylhydroxyethyl cellulose gum, 0.5 part propylene glycol (humectant), 0.2 part glyoxal (insolubilizing agent), 0.2 part diatomaceous earth (ash additive for coherence), 0.02 part titanium dioxide (ash whiteners) and 0.01 part capstan (fungicide) and the resultant dispersion adjusted with water to 3.5% total solids. The resulting dispersion of tobacco stem pulp and non-tobacco ingredients is combined with a 17% total solids dispersion of 9.0 parts (dry basis) Wisconsin leaf dust (99.5% minus 80 mesh; 80% minus 200 mesh) to produce a uniform dispersion with a total solids of 6%. The dispersion is cast on a moving perforated stainless steel belt, dried, remoistened and doctoring from the belt.

The resultant product is non-porous and did not disintegrate in water due to the effects of the insolubilizing agent. It possessed additional strength due to the non-tobacco adhesive employed, additional resistance to drying out due to the humectant employed, additional resistance to mold growth due to the fungicide incorporated, and additional coherence and whiteness in the ash after combustion due to the inorganic ash additive and whiteners employed.

What is claimed is:
1. In the method of making reconstituted tobacco products comprising the steps of creating a slurry of tobacco stock material in water, shaping said slurry to sheet form and then drying the step of refining said slurry of tobacco stock material prior to the shaping thereof for a period of time until the freeness value in a Schopper-Riegler scale system passes the minimum value and increases beyond a negative 100 milliters value-wise on said scale upon further refinement.

2. The method according to claim 1 wherein the refinement is continued to a freeness value between 100 and 450 negative Schopper-Riegler.

3. The method according to claim 1 wherein the refinement is continued to a freeness value between 100 and 450 negative Schopper-Riegler.

4. The method according to claim 1 wherein the refinement is continued to a freeness value approximating 900 milliters negative Schopper-Riegler.

5. The method according to claim 1 wherein the refined tobacco pulp is combined with dry ground tobacco particles prior to shaping.

6. The method of claim 5 wherein said dry ground tobacco particles are ground to a particle size between 40 and 325 mesh.

7. The method according to claim 1 wherein said tobacco stock material comprises tobacco stems.

8. The method according to claim 1 wherein said tobacco stock material comprises tobacco stalks.


10. A tobacco product made by the method of claim 5.


13. The method according to claim 1 wherein the refined pulp is combined with non-tobacco additives prior to shaping.

14. A method for making reconstituted tobacco sheet material which comprises dry grinding tobacco to a particle size between 40–325 mesh, preparing a pulp by refining tobacco stock material with water for a period of time until the freeness in a Schopper-Riegler scale system passes a minimum value and increased value-wise on the said scale upon further-refinement, stopping said refinement when the value on said scale approximates 250 ml. combining said pulp and dry ground particles in water, and finally shaping the slurry into a sheet.