

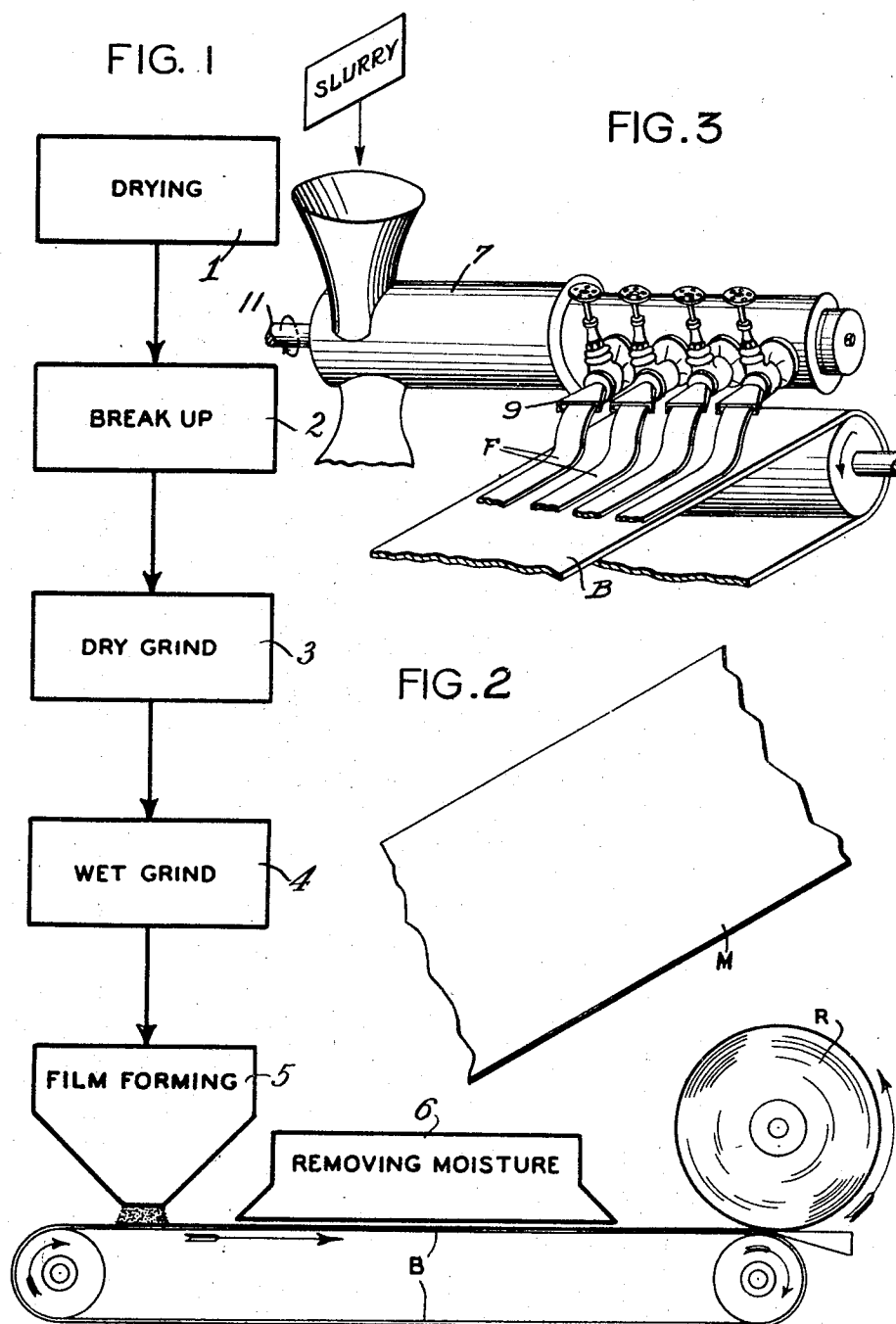
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TOBACCO SHEETS AND FILAMENTS AND METHODS OF MAKING THEM

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TOBACCO SHEETS AND FILAMENTS AND
METHODS OF MAKING THEM

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This invention relates to sheet material and more particularly to sheet material and the method of forming tough sheets, webs or films from vegetable matter, such as tobacco.

In the formation of paper and similar sheet material, which has paper characteristics, it is customary to reduce the stock to pulp by the use of chemicals according to ordinary paper making technique so that the fibers of the stock will be separated from their binding material without being shortened and can interlock to provide the mat in the finally resulting product. Processes for forming tobacco paper in this manner are known but none have proved satisfactory due to the fact that in making such paper, stems or fibers must be added and in reducing the tobacco stock in forming tobacco pulp, the process employed destroys most of the essential and valuable characteristics of tobacco, such as color, taste and aroma, so that the resulting product has little value as a material for smoking.

According to our invention we make possible the formation of tobacco sheet material in which all of the desirable features and natural characteristics of tobacco are retained, insofar as aroma, taste and color are concerned, and form a part of the resulting product, while at the same time our sheet material has adequate strength for processing and can be handled as if it were natural leaf tobacco.

Our invention, therefore, consists in a novel sheet tobacco material and the provision of a method for producing such material by converting tobacco into sheet form and retaining all desirable characteristics of tobacco while eliminating disadvantages which generally are present in tobacco paper formed by recognized paper making methods.

Our invention also consists in a non-fibrous tobacco sheet material and the method of forming the same wherein tobacco is reduced to substantial colloidal size and then formed into thin sheets or webs.

It is a further object of our invention to form tobacco sheets, webs or films having physical sheet forming characteristics different from the original material, which are readily adaptable for use in the formation of cigars, cigarettes or other tobacco products.

A further object of our invention is to produce non-fibrous shredded or filament tobacco film material which corresponds generally to tobacco used in cigarette making, or smoking tobacco.

Our invention also is characterized by the provision of tobacco film having substantially the

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strength of tobacco leaves, yet substantially uniform in density and thickness while at the same time it retains the natural color, taste and odor of leaf tobacco.

It is also an object of our invention to produce tobacco sheet material having the desired tensile strength and handling quality without use of other than the purely physical division of tobacco into fine particles in a fluid liquid vehicle, such as water, so that the natural flavor, color and odor of tobacco will remain substantially unchanged in the finished product.

It is a further object of our invention to produce tobacco films, webs or filaments and provide a method for forming the same and add binders or fillers, either film forming or non-film forming in order to increase the strength of the resulting product while at the same time the natural flavor, odor and color of tobacco remain substantially unchanged.

It is an added object of our invention to produce a film forming tobacco slurry containing colloiddally dispersible tobacco particles as well as fibrous tobacco particles and form therefrom tobacco films, webs and filaments.

It is an added object of our invention to produce tobacco sheet material from tobacco, which is either disintegrated or finely divided and otherwise not in suitable form for forming tobacco articles.

Other objects of our invention will be set forth in the following description and drawings which illustrate preferred embodiments thereof, it being understood that the above statement of the objects of our invention is intended generally to explain the same without limiting it in any manner.

In the accompanying drawings which form a part of this specification, and in which like characters of reference indicate the same or like parts:

Figure 1 shows a schematic and diagrammatic illustration of a preferred method of carrying out our invention;

Figure 2 shows a sheet of the tobacco material or film; and

Figure 3 is a diagrammatic illustration showing the formation of filaments.

The tobacco utilized may be of any suitable type, such for instance as whole leaves or portions thereof, stems or mixtures of each. It is also within the scope of our invention to use waste tobacco, such as clippings, dust, chips, etc., resulting from the manufacture of cigars, cigarettes and other tobacco products. Tobacco se-

lected is preferably dried in order to drive off moisture retained therein, and then broken up into small pieces in any desirable manner. It is desirable that moisture content be reduced below five per cent since more rapid complete grinding results than when moisture content exceeds five per cent.

Referring to the drawings which show a schematic and diagrammatic illustration of the steps covering one manner of performing our invention, 1 designates a tobacco drying device of any well-known or conventional design into which a selected charge of tobacco is placed and dried until the desired moisture content is obtained.

Following the drying operation the dried tobacco, if necessary, is broken up in a suitable conventional shredding or breaking up device 2 and is then placed in a grinding mechanism 3, such as a ball mill, preferably charged with pebbles of suitable size, colloid mill or other suitable device, where it is ground until it is pulverized or reduced to fine powder. If desired, the tobacco can be preground to small size in one mill and then pulverized in another mill. If a ball mill is used, the amount of time required to grind the tobacco to size will vary according to the quantity of tobacco being ground, the size of the ball mill, and the balls used therein, and the speed at which the ball mill is operated. For optimum results, the charge should not exceed the volume of the voids. A mill completely filled with pebbles is static and no grinding occurs. The state of the dry tobacco at the time the grinding starts, that is its size, also has something to do with the amount of time necessary to reduce it to the required fineness. Obviously, if the tobacco being comminuted is in the form of broken up leaves, or a mixture of leaves and stems, more time will be needed to reduce the tobacco to the desired powder state, than if waste tobacco powder or small chips or clippings were to be reduced further materially in size.

If a colloid mill is used, the reduction of tobacco to desired fineness can be effected in an extremely short time, since the capacity of colloid mills is high although the ultimate colloidal dispersion sought may be small unless the powder is treated in the manner described hereinbelow.

It has been found that if a 1 1/4 gallon ball mill is used in which the ball or stone size is 1/2 inch, 200 grams or 1/16 of a pound of tobacco, as mentioned above, can be reduced to desired powder fineness in six hours, if the ball mill is rotated at 45 to 50 rotations per minute. This grind is obtained when the moisture content of the tobacco is below 5 per cent. If the tobacco moisture content is greater than 5 per cent, a longer period of time would be required to reduce it to the desired powder state.

The pulverized or finely ground tobacco is then introduced into a second grinding device, if desired, or left in the first mill and mixed with a suitable quantity of fluid in order to prepare it for a wet or final grinding. Any fluid, such as water or ethyl alcohol, preferably neutral in nature, with which a colloidal dispersion will take place can be used. It is important that a fluid be chosen which will have little or no deleterious effects upon the tobacco or otherwise change its normal characteristics insofar as taste, odor and color are concerned since they are carried over into our final product and retained therein. Water forms a very satisfactory medium and is usually used in an amount suitable to form a fluid mix-

ture. A ratio of 1:8 by weight may be used, although other suitable proportions will give the same or satisfactory results.

As in the case of dry grinding, the period of grind is dependent to the same extent upon the quantity of material being ground, as represented by the mixture of fluid and pulverized tobacco, the capacity of the ball mill, if a ball mill is selected as the grinding mechanism, the size of balls and speed of operation of the mill. We have found that a ball mill is a satisfactory device to use in carrying out this step of our process, and that with a 1 1/4 gallon mill containing 800 cubic centimeters of water and 100 grams of tobacco constituting the wet grind mixture, the time required to reduce the charge of powdered tobacco to colloiddally dispersible particles or to sheet or film forming size and state ranges between one and ten hours, and that on an average six hours suffice, although by physical examination the difference in the general appearance of films made from a slurry formed by grinding between the periods noted is not great. If anything, the material ground for the longer period of time results in a denser sheet.

The size of the ball mill employed may vary in accordance with the commercial requirements and the amount of film material to be produced at one time. Recent literature (see briefs of papers presented at the Atlantic City meeting, fall, 1941, Division of Paint, Varnish and Plastics Chemistry, published by the American Chemical Society, relating to ball mill grinding) indicate that a ball mill larger than 1 1/4 gallon mill described above may be used, and if the conditions surrounding the charging such as size of ball and ratio of the ball and total charge to mill volume, and speed of rotation be kept such that the ball motion is the same (slipping, cascading, cataracting), then for all practical purposes about the same result will be obtained regardless of the size of mill utilized.

A satisfactory colloidal dispersion or slurry can also be formed without dry grinding tobacco to a fine powder although the product is not as uniform as when the two steps above described are employed. If this method be resorted to, water or other suitable fluid is added to a quantity of dry tobacco and the mixture placed in a ball mill 4 for grinding. We have found that when this mixture is ground for a period of about eight hours good results are obtained. This is greater than the minimum time necessary for complete dry grinding but less than the total time usually consumed in both dry and wet grinding. The resulting product is not so uniform, however, due to the veins of leaves and parts of stems which resist grinding, especially when they contain any moisture in excess of five per cent and hence it is possible that the resulting product may contain minute fibrous particles which are recognizable as such and add to the strength of the film.

We have also found that a good sheet may be obtained by wet grinding whole tobacco leaves for one or more hours and then filtering the grind through a coarse filter. When such a grind has been prepared and filtered, the unground portions, consisting principally of stems and veins, are removed and the filtrate consisting of the better portions of the leaves can then be wet ground in a ball mill as above described for a suitable time. This forms a good slurry which can be extruded, spread out or centrifugally applied to suitable sheet forming surfaces or formed into filaments. The proportions of tobacco and water used in the above case runs substantially

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the same as when a charge of powdered tobacco and water are introduced into a ball mill.

We have found that dry grinding tobacco to a fine powder and then mixing with a fluid medium, such as water, without the above grinding or colloid mill action makes possible the formation of an intimate mixture, but when this mixture is applied in a thin layer to a sheet or web forming surface and allowed to dry, the resulting product is a porous sheet of material of low strength not suitable for processing or forming into smoking or other tobacco articles.

However, when the same powder is ground in water or other fluid medium, in the manner described, a colloidal dispersion or slurry is formed and substantially all of the particles are colloidal dispersible. In this colloidal state the particles of tobacco or colloids evidence other characteristics than in the case of the powder obtained merely by dry grinding to a fine powder, and when the colloidal dispersion or slurry is applied to a sheet or web forming surface, such as a smooth flat surface, endless belt or plate conveyor, or is centrifugally applied upon the interior of a rotating cylinder, there is such an attraction between the several particles forming the slurry, probably due to the immense surface attraction existing therebetween, that when the excess moisture in the spread-out dispersion or slurry is allowed to evaporate, either naturally or by artificial means, a thin dense sheet material or film will form by the agglutination of the particles in the dispersion, which can be removed as sheets or stripped off in webs or filaments and wound on a reel or otherwise handled, depending upon the purpose for which the material is to be used.

As shown in Figure 1, the colloidal dispersion or slurry which has been ground for the proper period is applied in some suitable manner in thin layers to form sheets or in a continuous layer to form webs. We have shown an endless traveling flat plate or belt B upon which the slurry is sprayed by a suitable device 5 in order to form an endless web which is stripped off and wound upon a reel R. It has been found that any surface to which our colloidal dispersion of tobacco is applied must not react noticeably with the tobacco or the constituents of the dispersion or else the resulting sheet material will contain spots or marks or general discolorations which greatly decreases its appearance. However, sheets can be formed upon iron or steel plates, as will be obvious despite the above disadvantages. For best results and perfect sheets and webs unmarked by blotches, chromium plated belts, or flat endless bands or equivalent flat endless bands are preferred. In forming sheets, plates made from similar materials or ferrotype plates can be used, such as commonly used in photographic work.

The substantially impermeable type of surface provided by the belts and plates described is preferred because when dispersions are spread thereupon the natural soluble constituents of the tobacco and/or vegetable dispersions are retained and not filtered out through or by the film forming surface.

The conversion of the colloidal dispersion or tobacco slurry into sheets or webs may be effected in many other ways, such for instance, as by pouring the slurry over the film forming surface, by spraying with a spray gun, or using suitable extruding mechanism or even by applying the slurry upon the inside surface of a rotating cyl-

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inder by centrifugal action set up by the rotation of the cylinder. Usually it is best to dry the layers of applied colloidal dispersion in a somewhat humid atmosphere due to the fact that the resulting product is somewhat more flexible than when it is dried quickly in a very dry atmosphere. However, if the latter method is used, upon placing the sheet material in humidifiers, any desired degree of flexibility can be obtained. The resulting product is both dense and tough and has suitable strength, flexibility and other desirable characteristics of natural tobacco leaf. If it is desired, the colloidal slurry may be formed into filaments or endless ribbons of any width and thickness depending upon the use to which it is to be put. Films formed in this manner by spraying, etc., can be utilized in cigarette making and either constitute the whole rod or be employed as a blending medium, or they can also be used in pipe smoking tobacco or any other related use.

As shown in the drawings, moisture may be removed from the web or film by any known moisture extracting device, such as 6, after which the material is treated in any suitable manner such as being wound upon a reel R. The moisture removed may be accelerated, if desired, in order to speed up the process. When the slurry is applied to an endless band, such as B, the latter may be heated to drive off moisture or a vacuum pump may be used in connection with the traveling sheet forming surface. Low suction is very helpful in removing moisture from the surface of the film. A similar moisture removal can also be effected whenever sheets are formed by centrifugally applying the slurry to the inner wall of a rotating cylinder. For instance, the cylinder may be heated or a suction pump can be placed to coat with the inner wall and effect the desired results.

Figure 3 shows diagrammatically a suitable method of forming filaments F. Tobacco slurry made in accordance with the methods described hereinabove is forced from a container 7 by a screw mechanism (not shown) driven by shaft 11 through suitable nozzles 9. The filament forming mechanism can be of the same conventional construction and operation as that shown in Day patent, No. 452,466. Nozzles 9, which can be of any desired cross section capable of forming filaments F of the desired width and thickness, deposit filaments F on belt B in the same conventional manner as that shown in Izard Patent No. 2,198,621. A device such as shown at 6 in Figure 1 can be used for removing the desired amount of moisture from filaments F on belt B.

If desired, a peptizing agent may be added to the mixture of natural fluid and powdered tobacco being wet ground since a peptizing agent assists somewhat in the dispersion and gelation of the colloidal particles. If a peptizing agent is used, it will be added in relatively small quantities, say $\frac{1}{2}$ to 1 per cent by weight and may consist of a gluconic acid, tannic acid, dilute sodium hydroxide, or any other suitable material.

Usually it is desirable that the slurry have a pH ranging between 4-7 in order to form good films or sheets. In some cases, however, it has been found that some tobaccos in a slurry having a pH of 7 do not make a good film and hence it is advisable to add a small quantity of acid, either organic, such as citric acid, or inorganic such as hydrochloric acid, in order to decrease the pH to say 4. So also if the slurry has a pH above 7

(neutral) and is alkaline, it is best to add acid and decrease the pH in order to get the best results. Films made from slurries having an alkaline reaction are not as strong as those made from slurries having a pH ranging between 4-7.

The film or sheet material produced in the manner above described, in the main may be characterized as dense, uniform and non-fibrous. In some cases it may be desirable to form a film in which fibers are present. This can be effected by forming a colloidal dispersion of colloidal tobacco particles in which small fibers of tobacco are suspended, which fibers will be present in the finished film and add to its strength. It has been found that if tobacco containing in excess of 10 per cent moisture is dry ground, the cellular material constituting the major leaf portions will be readily ground to a fine or pulverized state but that the stem portions and large veins are not usually affected similarly. They are, however, broken up and reduced to a fine fibrous state so that if a fluid mixture of these materials, as set forth above, be placed in a ball mill and ground for the required time, a colloidal dispersion containing small fibers will be formed and can be made into the desired film, filaments or ribbons.

While in most instance the film produced from our colloidal slurry, described above, is extremely satisfactory, in some cases it may be desirable to utilize binders or fillers and add them to the colloidal slurry in order to increase the strength of the resulting film products. These materials may be of two general types. The first includes materials which in themselves have film forming properties and when added to the slurry increases the strength of film produced. Suitable materials are methyl ether of cellulose sold under the trade-mark of "Methocel," or ethyl ether of cellulose known as "Ethocel," or gelatine or polyvinyl alcohol. These materials have no objectionable effect upon the finished product insofar as handling and use in tobacco products is concerned.

The other class of binders and fillers, which may be used, may be characterized as non-film forming in themselves. Examples of these are glycerine, diethylene glycol and sorbitol. As in the case of film forming material binders and fillers, just discussed, these binders and fillers also have the tendency to retard the evaporation of water from the sheet or film formed from our colloidal slurry of tobacco particles. Usually these materials may be added in a proportion up to 5 per cent by weight of dry tobacco; 1 to 3 per cent has given desirable results.

While the preferred embodiment of the invention has been shown and described, it is to be understood that the invention is not confined to the specific method steps and the details of the construction of the apparatus for carrying out the method herein set forth, by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art, without departing from the spirit of the invention, or exceeding the scope of the appended claims.

What is claimed is:

1. The method of forming tobacco sheet material which comprises reducing a quantity of dry tobacco to a fine powder, further reducing said powder in an aqueous medium containing a peptizing agent to form a liquid colloidal tobacco suspensoid wherein the natural constituents and properties of said tobacco are retained therein, applying said suspensoid in a thin layer to a

relatively smooth surface, and removing moisture from said layer to form sheet material therefrom.

2. The method of forming non-fibrous aromatic vegetable sheet material which comprises breaking up a quantity of dry fibrous aromatic vegetable material, dry grinding said material for a time sufficient to reduce it to a fine powder, adding an aqueous medium to said fine powder, wet grinding said powder in said aqueous medium for a time sufficient to reduce a substantial part of the particles to colloidal size and produce a colloidal aromatic material dispersion containing natural properties characteristic of said material including color, taste and aroma, applying said dispersion to an impermeable surface in a relatively thin layer, removing moisture from said layer, and retaining and maintaining in said layer substantially all of the original soluble and insoluble constituents of said original vegetable material and characteristic properties of said material including color, taste and aroma substantially unchanged.

3. The method of manufacturing tobacco sheet material from natural tobacco which comprises, subjecting a quantity of tobacco to moisture removal to reduce the amount of moisture therein to below five per cent, grinding said dried tobacco for a period of time sufficient to remove fibrous characteristics therefrom and reduce said tobacco to finely powdered form, mixing said powdered tobacco with water, wet grinding said mixture for a period of time sufficient to reduce substantially all of the powdered tobacco to colloidal dispersible particles and produce a colloidal dispersion, applying said dispersion to an impermeable film forming surface, and removing moisture therefrom to form a thin self-supporting colloidal tobacco film.

4. The method of forming natural fibrous aromatic vegetable material into a non-fibrous flexible film retaining the natural color, taste and aroma characteristics of the original fibrous aromatic vegetable material which comprises, grinding a quantity of broken-up aromatic vegetable material for a period sufficient to reduce said natural fibrous material to small size, water wetting and then wet grinding a quantity of said ground material for a period sufficient to reduce substantially all of said ground material to colloidal dispersible particles and form a colloidal dispersion, casting said dispersion upon a relatively smooth surface to form said film, removing excess moisture content from said film and retaining and maintaining therein substantially all soluble and insoluble constituents and characteristic properties of said original vegetable material including color, taste and aroma.

5. The method of making tobacco films which comprises adding an aqueous medium to and then wet grinding a quantity of tobacco leaves containing stems and veins for a sufficient time to remove the stems and veins from the leafy tobacco material, separating said stems and veins from the mixture containing said leafy material, further grinding the liquid residue containing the leafy tobacco portions for a period sufficient to form a fluid tobacco dispersion wherein substantially all of said leafy tobacco material is in the form of colloidal dispersible particles, said dispersion containing said tobacco substantially unmodified as to color, taste and aroma, then forming said dispersion into self-supporting, continuous, coherent sheet material, and removing moisture from said material and retaining and

maintaining the soluble and insoluble original constituents and properties of said tobacco including color, taste and aroma substantially unchanged.

6. The method of forming flexible sheet material from tobacco which comprises converting a quantity of unmodified tobacco into a colloidal dispersion in water, said dispersion containing all of the original soluble and insoluble constituents of the tobacco, including normal characteristics of color, taste and aroma, forming said dispersion into a relatively thin layer, and drying said layer by evaporating said excess moisture content therefrom to produce self-supporting sheet material, said material retaining substantially all of the original soluble and insoluble constituents of said tobacco as well as retaining desirable characteristics of color, taste and aroma.

7. The method of forming flexible sheet material from tobacco which comprises reducing a quantity of natural unmodified tobacco in a wet state to a substantially colloidal dispersion in water, said dispersion containing substantially all of the original soluble and insoluble constituents, and characteristic properties of the tobacco including color, taste and aroma, then forming said dispersion into a thin layer upon a relatively smooth surface, drying said layer in a controlled atmosphere to form self-supporting sheet material, retaining in said material substantially all of the original soluble and insoluble constituents and characteristic properties of said tobacco including color, taste and aroma, and removing said layer of dried self-supporting tobacco sheet material from said surface.

8. The method of forming flexible sheet material from tobacco, which comprises reducing a selected quantity of tobacco to fine particle size while maintaining the natural characteristics and properties of said tobacco including color, taste and aroma unchanged, associating said fine tobacco particles with an aqueous fluid and forming the mixture into a colloidal dispersion, spreading said colloidal dispersion on a relatively smooth surface to form a thin layer of self-supporting tobacco sheet material, and removing moisture from said layer and retaining and maintaining the soluble and insoluble original constituents and properties of said tobacco substantially unchanged.

9. The method of forming a flexible tobacco film which comprises drying a quantity of tobacco to eliminate substantially all moisture therefrom, pulverizing said tobacco to form a dry fine powder, adding an aqueous medium to said powder, grinding said mixture of powder and aqueous medium for a period sufficient to convert it to a colloidal dispersion wherein substantially all tobacco particles are colloiddally dispersible, retaining in said dispersion substantially all desirable soluble and insoluble constituents of said tobacco which contribute to the characteristic properties of color, taste and aroma, applying said dispersion in thin layer form upon a relatively smooth surface, drying said material on said surface to reduce the moisture content of said layer while maintaining the quantity of soluble and insoluble constituents of said tobacco in said layer substantially unchanged, and then stripping said layer from said surface in the form of self-supporting sheet material having substantially the same taste, color and aroma characteristics and properties of natural tobacco.

10. The method of forming flexible tobacco filament material which includes reducing a quan-

tity of selected tobacco to a fine powder, further reducing said powder in an aqueous fluid to a dispersion containing colloidal tobacco particles, retaining in said dispersion substantially all of the soluble and insoluble constituents of said tobacco, forming said dispersion into relatively thin and narrow filaments, and drying said filaments by removing moisture therefrom while maintaining said soluble and insoluble constituents in said filaments being treated substantially unchanged, said filaments being self-supporting and retaining the characteristic properties of taste, color and aroma of the original tobacco.

11. The method of forming tobacco sheet material which comprises grinding a mixture of selected tobacco leaves and stems so as to eliminate substantially all fibrous characteristics, and reducing a large portion of the material being ground to colloiddally dispersible particles, forming a colloidal dispersion of said ground material in water, said dispersion retaining the desirable characteristic properties of the original tobacco including color and aroma, transforming said dispersion on an impermeable surface into a thin self-supporting film containing said particles, preventing the substantial removal of soluble and insoluble constituents of the original tobacco during the formation of said film, removing moisture from said film and maintaining and retaining in said film substantially all natural characteristics and properties of said tobacco including color, taste and aroma.

12. The method of forming tobacco sheet material which comprises reducing a quantity of tobacco in a wet state to substantially a colloidal dispersion in an aqueous medium containing fibrous tobacco particles, and substantially all soluble and insoluble constituents of said tobacco, converting said dispersion into a thin layer on a dense supporting surface, removing moisture from said layer to produce a self-supporting sheet, and retaining and maintaining in said sheet substantially all soluble and insoluble original constituents and properties of said tobacco including color, taste and aroma substantially unchanged.

13. Tobacco film or sheet material comprising a flexible matrix of agglutinated colloidal tobacco particles containing substantially all of the original chemical constituents and properties of tobacco including characteristic color, taste and aroma, said constituents being in their original chemical form substantially unmodified by reaction with any alkali or acid reagents, and said constituents including sugar, starch, organic acids, nicotine and those mineral salts common to the original tobacco from which said film or sheet material is formed, said soluble and insoluble constituents being present in said tobacco sheet or film material in substantially the proportions and form in which they were present in said original tobacco, substantially unmodified by adding constituents foreign to said original tobacco.

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