

Aug. 5, 1958

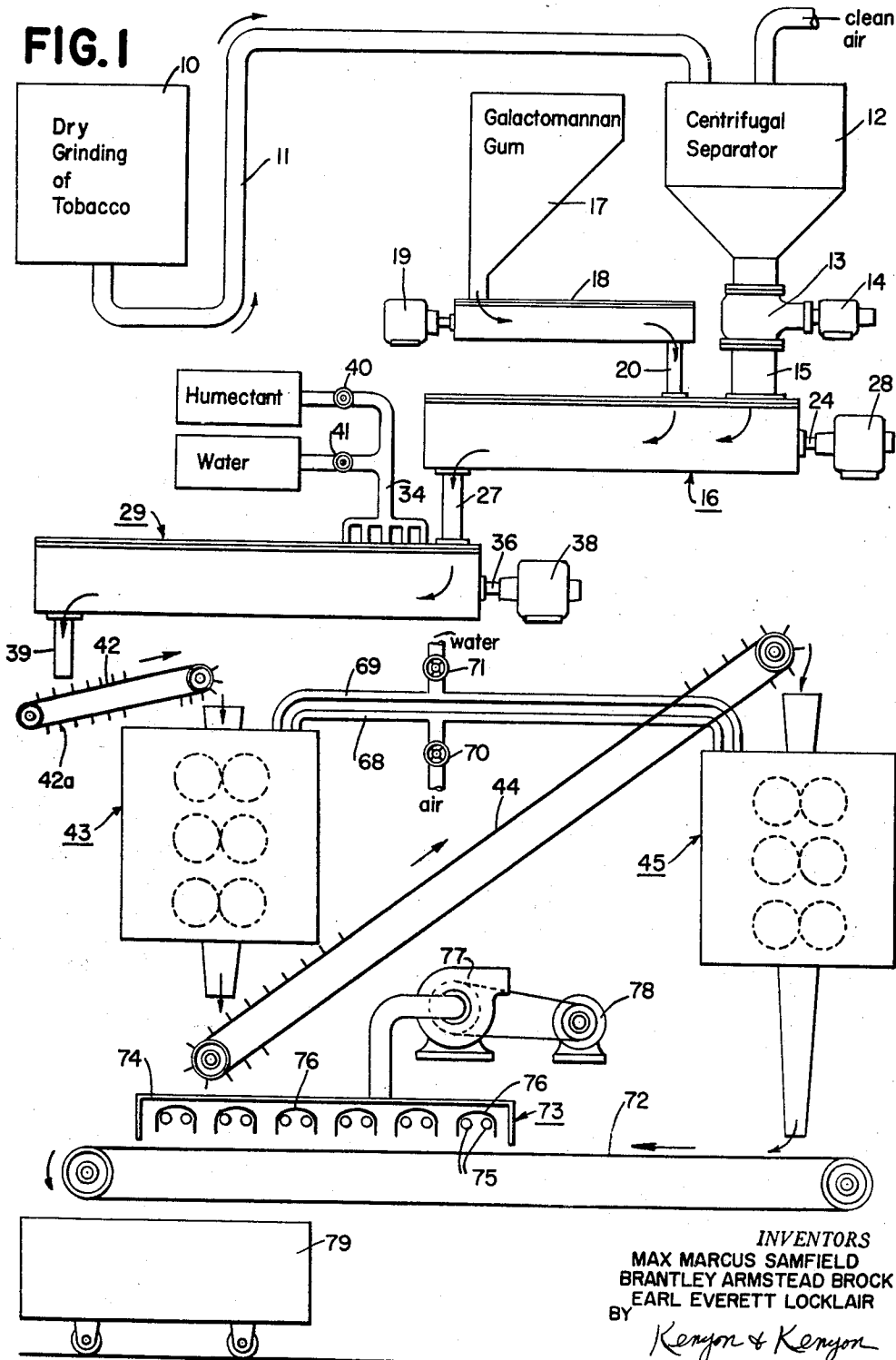
M. M. SAMFIELD ET AL
PROCESS OF CONVERTING FRAGMENTED TOBACCO
INTO COHERENT SHEETS

2,845,933

Original Filed May 28, 1954

3 Sheets-Sheet 1

FIG. 1



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3 Sheets-Sheet 2

FIG. 2

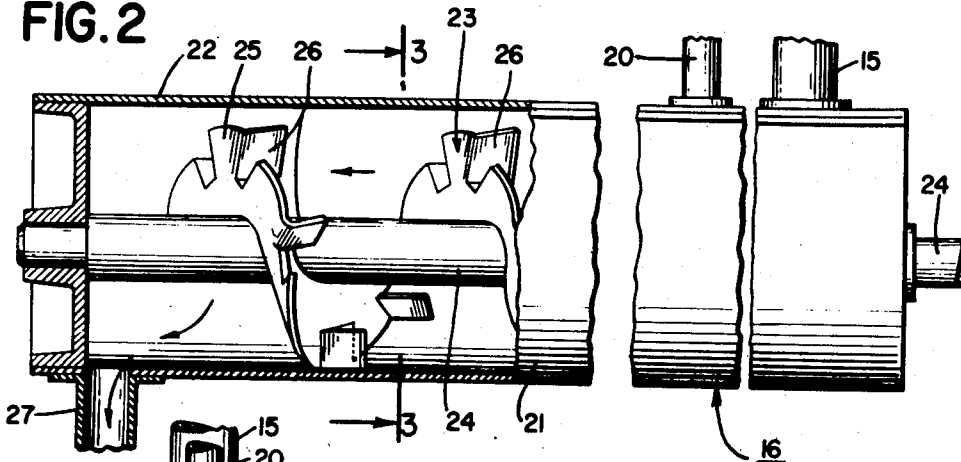


FIG. 3

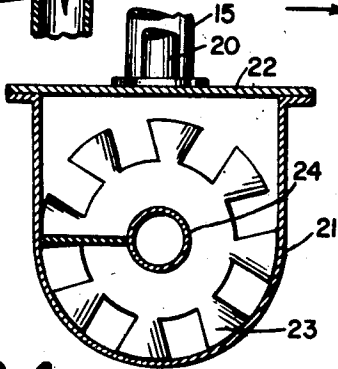


FIG. 4

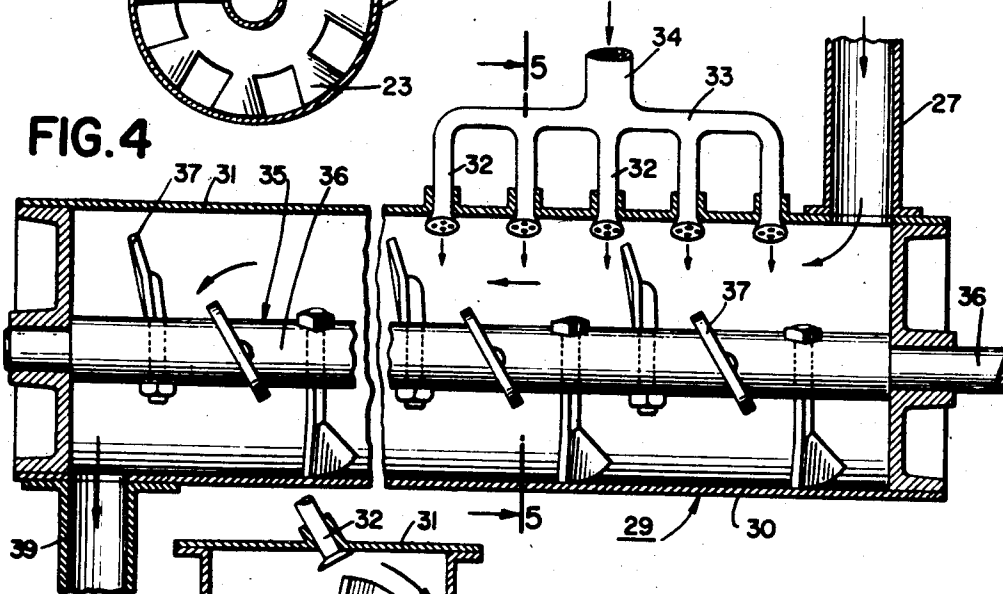
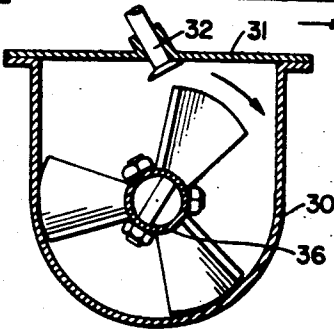


FIG. 5



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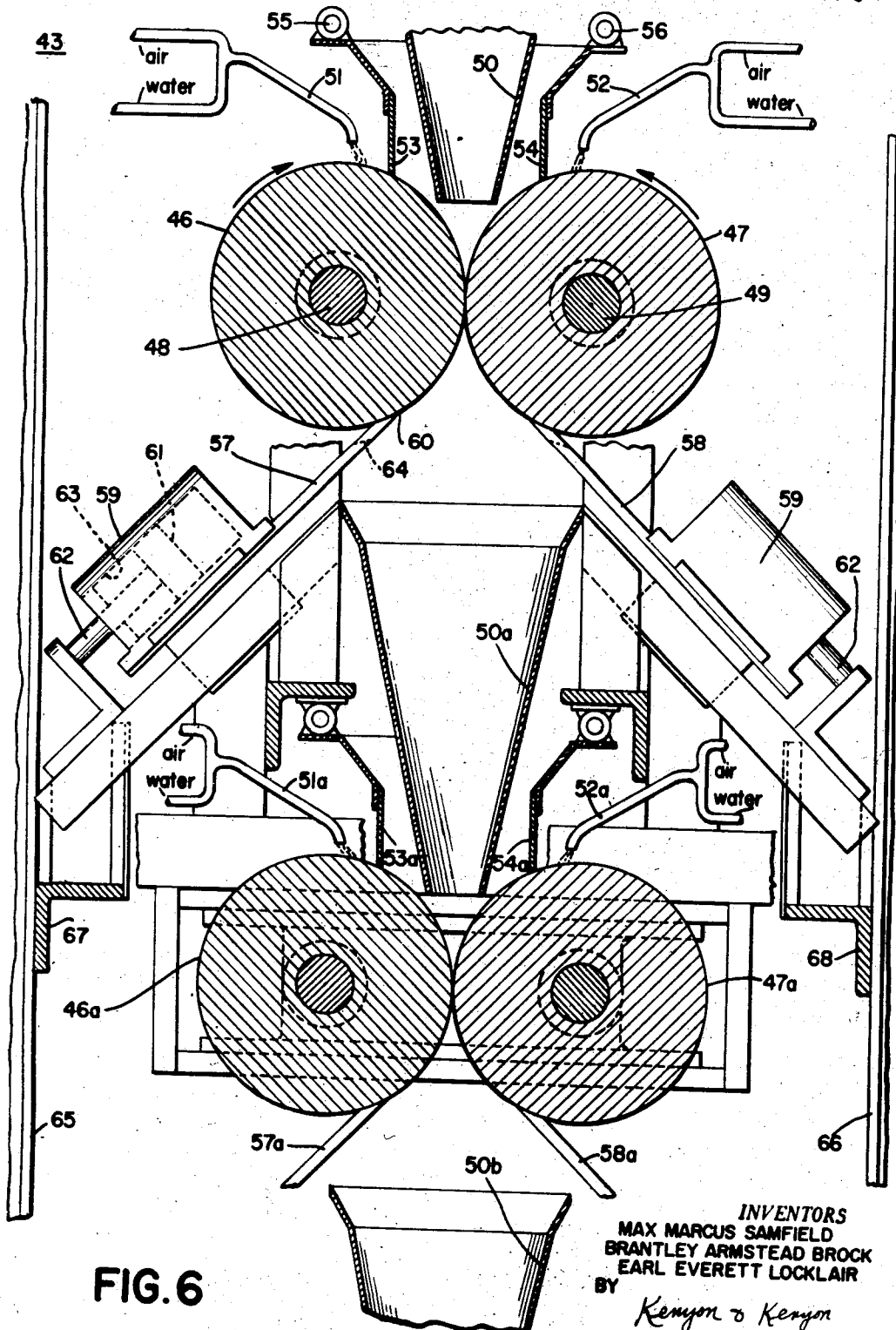


FIG. 6

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PROCESS OF CONVERTING FRAGMENTED TOBACCO INTO COHERENT SHEETS

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Original application May 28, 1954, Serial No. 433,062, now Patent No. 2,708,175, dated May 10, 1955. Divided and this application November 4, 1954, Serial No. 477,522

21 Claims. (Cl. 131—140)

This invention relates to a process for the recovery of fragmented tobacco in the form of coherent sheets suitable for blending with leaf tobacco in the manufacture of cigarettes, cigars and other forms of smoking tobacco. This application is a division of our application Serial No. 433,062, filed May 28, 1954, now matured as U. S. Patent No. 2,708,175, issued May 10, 1955 for "Composition of Matter Consisting Chiefly of Fragmented Tobacco and Galactomannan Plant Gum."

Between the time leaf tobacco is received for conversion into smoking products, and the completion of the process in which it is stemmed, dried, cased, cut and blended into a form suitable for manufacture of cigarettes and the like, a considerable amount of fragmented tobacco or so-called tobacco fines are produced. Tobacco in this form is at present either used in the manufacture of low-priced unprofitable products, or sold at a low price for conversion into fertilizer or tobacco by-products. Actually these tobacco fines are high quality material of composition suitable for use in cigarettes, cigars and other tobacco products if they could first be physically reconstituted into sheet form and thus made available for blending with leaf tobacco.

The problem of preventing loss in tobacco values through fragmentation of leaf tobacco is an old one in the cigarette and cigar-making business. Many proposals have been advanced for the reconstitution of tobacco in coherent sheet form. Early proposals were to pulp the fragmented tobacco in a water slurry and form it into sheets by methods resembling those used in the manufacture of paper. Later proposals were to grind the tobacco in water to form a colloidal suspension of exceedingly fine particles of tobacco in an aqueous matrix which is then extruded and dried in sheet form. Each of these procedures has been found to affect unfavorably the smokability and flavor of the tobacco, probably because soluble flavoring elements are either leached out or hydrolyzed. More recently another process has been proposed, in which dry-ground tobacco is mixed with three to four or more times its own weight of an aqueous solution of one of the water soluble forms of cellulose derivative or of an alginic or pectinic acid polysaccharide, the mixture being formed into sheets and dried to expel most of the water. But this last-named process has found only a limited use in the manufacture of low-priced tobacco products, because the nature of the binder and the need to use large amounts of water have caused a serious alteration in the smoking taste of the product.

According to one form of the present invention certain of the following steps are carried out: dry-ground tobacco and a quantity of mucilaginous plant gum, each in the form of a dry finely-divided powder, are mixed and then worked together without wetting until the two powders are dispersed in each other with substantial uniformity; a limited and relatively small amount of water, with added humectant or plasticizer if desired, is added

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to the mixed powders while the latter are being tumbled or agitated together in such manner that local concentration of water in excessive amounts is prevented, as for instance by use of a finely divided mist or spray; the dampened mixture of powders is subjected to working under mechanical shearing action while in moist condition, for example by passage between one or more pairs of closely-spaced steel rollers revolving at different peripheral speeds; moisture is sprayed on one or both such rollers while the mixture passes between them; and the worked mixture is formed into thin damp sheets on a support, which may be movable, and are subjected to heat whereby most of the water is evaporated off in a few seconds, thus producing flexible sheets having about the tensile strength of leaf tobacco and blendable with leaf tobacco into a smoking product whose taste, flavor and aroma are indistinguishable from an all-leaf mixture of the same initial blend.

The preferred mucilaginous plant gum is that which consists essentially of galactomannan. As commercially available, such gums consist of 80% to 90% galactomannan, 10% to 15% water, and the balance ash and protein. They are commonly sold in the form of a dry powder. Galactomannan is a high molecular-weight branched polysaccharide substance composed almost wholly of the sugars D-galactose and D-mannose. It is substantially free of uronic acids or uronides. Depending on the particular plant source from which it is derived, it consists predominantly or mainly of D-mannose in proportions running from about 60% to about 86% of the polysaccharide. "Guar gum" which is obtained from guar seed endosperm and consists principally of galactomannan is the preferred binder material for use according to this invention. "Locust bean gum" which is obtained from the seed of the carob tree and also consists principally of galactomannan may also be used. Such gums, consisting principally of galactomannan, when burned in small amounts with tobacco, produce no detectable change in the taste, flavor or aroma of the tobacco smoke.

The composition of matter according to this invention consists essentially of a major proportion of fragmented tobacco and a minor proportion of galactomannan plant gum, plus added moisture either water alone or water and a suitable humectant, this composition being preferably in the form of a coherent sheet having a flexibility, thickness and tensile strength approximating that of natural tobacco leaf.

The mixing of galactomannan gum with tobacco is carried out while each is in the form of a finely-divided dry powder, and preferably a somewhat extended and intimate mixing is employed to bring about a substantially uniform dispersion of each powder in the other. The desirable relative proportions of each are mentioned below.

Moistening of the mixed dry powders is preferably carried out by some means which tumbles or agitates the mixture of powders and introduces the water, or water plus humectant or plasticizer, into the mixture in a manner which avoids local concentrations of moisture. Since it is often desirable to incorporate a small amount of glycerine, or other humectant, in the finished sheet material, this substance being miscible with water is most conveniently introduced when the water is introduced. Hence the mixed dry powders are, according to the preferred form of this invention, moistened with a liquid which is itself a mixture of water and glycerine.

The working of the dampened mixed powders may be carried out in any suitable apparatus which is adapted to apply a shearing action while the mixture is in moist condition. Such shearing action or its equivalent ap-

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pears necessary to the subsequent formation of coherent sheets. When adequately worked the material acquires excellent sheeting properties. A sufficient amount of working is given to the material when it has been passed between, for example, six pairs of rollers each pair defining a space between them of about 0.004 inch, with the periphery of one roller in each pair travelling at a higher linear rate of speed than that of the other roller at the point of closest approach between them. In this way a wiping action is produced, the sheet tending to stick to the faster moving roll from which it is taken off by a doctor blade. In this wiping action tobacco particles and plant gum particles, each slightly moistened, are rubbed together and it is believed that relatively sticky mucilaginous matter in microscopic amounts is thereby spread over the surfaces of the tobacco particles. The sheared material may drop by gravity from one such roller-pair to another, arranged in a vertical flight and finally deposited upon a support such as a moving belt or screen in the form of a continuous coherent damp sheet or a series of such sheets of small size.

Since the use of some lubricant is often found to be necessary on the rollers, and water or glycerine or a mixture thereof will serve the purpose, it is within the scope of this invention to introduce part at least of the desired moistening liquid—whether water or humectant or both—into the tobacco-galactomannan mixture during the shearing operation itself. This may be done by continually moistening the rollers as they turn, and of the total moisture intended to be introduced into the tobacco-galactomannan mixture a considerable part may be introduced during shearing rather than during the mixing stage.

The sheet, without being disturbed in its position on the belt or screen, may then be passed through a dryer, preferably an overhead infra-red electric resistance heater, where a major part of the contained moisture is evaporated within a few seconds, leaving the sheet with a moisture content roughly approximating that contained in the leaf tobacco with which the sheet material is thereupon to be blended. Upon emerging from the dryer the sheet material may, for example, be about 0.014 inch in thickness, and will be found to have a color approximating that of the tobacco used and a tensile strength roughly equal to that of leaf tobacco. If desired, such sheet material may be broken up in suitable equipment before passing to the blending machine.

The proportions by weight of galactomannan gum and water in the dampened and worked material before drying may vary considerably. In the damp mix, galactomannan gum may run from a minimum of about 0.75% to a maximum of about 10%, the water from about 12% to about 60%, with up to about 10% of the water being replaced by a like weight of glycerine or other humectant if desired, and the balance essentially tobacco. A damp mixture which has been found satisfactory consisted of 2.9% of guar gum, 48.3% water and humectant including the natural water-content of the tobacco, and 48.8% tobacco taken on a bone-dry basis.

The finished composition of matter consists essentially of a minor proportion, about 1% to 20% by weight, of galactomannan gum, preferably guar gum but including also locust bean gum, an amount of moisture roughly equal to the amount of moisture commonly present in natural tobacco leaves as prepared for blending, that is, approximately 9% to 13% by weight of the total composition, and the balance a major proportion of dry-ground tobacco with the individual fragments thereof in finely-divided form and bound together in coherent preferably sheet-like form having a tensile strength roughly equal to that of natural leaf tobacco as prepared for blending. Optionally the composition may include a humectant such as glycerine. The foregoing composition will, when formed in a sheet about 0.014 inch thick, which is about the thickness of natural leaf tobacco,

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have a flexibility and tensile strength approximately equal to that of such leaf tobacco. A finished sheet ready for blending and having excellent handling and smoking qualities, produced by the process above described, consists of 4.6% guar gum, 11.5% water, 5.6% glycerine, and 78.3% tobacco taken on a bone-dry basis.

Referring to the annexed drawings:

Figure 1 is a diagrammatic representation of an apparatus suitable for carrying out the process.

Figure 2 is a vertical longitudinal section through mixer 16.

Figure 3 is a vertical section in the plane 3, 3 of Figure 2.

Figure 4 is a vertical longitudinal section through moistener 29.

Figure 5 is a vertical section in the plane 5, 5 of Figure 4.

Figure 6 is a vertical section through the central axis of roller mill 43 in a plane at right angles to the axes of the rollers and showing two pairs thereof.

These drawings show, for purposes of illustration and not to limit the invention, one sequence of process steps and one form of apparatus by which the invention may be carried out.

Referring to Figure 1, fragmented tobacco is fed to hammermill 10 in which it is dry-ground to particles of desired size. Finely-ground tobacco delivered by hammermill 10 is propelled in an air stream by a blower (not shown) through conduit 11 to centrifugal separator 12 where a substantially complete recovery of tobacco particles is effected. From separator 12 tobacco in the form of a finely-divided dry powder is delivered through proportioning valve 13, controlled by motor 14, through pipe 15 to mixer 16.

Galactomannan gum is fed from hopper 17 to proportioning feeder 18 containing a screw feed device (not shown) rotated by motor 19. Galactomannan gum is delivered from feeder 18 to mixer 16 through pipe 20. Motors 14 and 19 are electrically interrelated, by means not shown, to assure the delivery of constant proportions of tobacco and galactomannan gum to mixer 16.

Mixer 16 (see also Figures 2 and 3) consists of an elongated trough 21 having a cover 22. Axially disposed within trough 21 is a cut-and-folded flight conveyor screw 23 consisting of a central shaft 24 to which is secured a helical flight 25 whose periphery is cut at intervals to form segments 26 folded in a direction generally parallel to the axis of the screw. The construction is such as to secure intimate mixing of powdery material which is also propelled length-wise through trough 21. The folded segments of the flight act as lifting vanes to produce a cascading effect and this promotes agitation and better mixing. In this way, galactomannan gum entering through pipe 20, and finely-divided tobacco entering through pipe 15, each in the form of a dry powder, are intimately mixed and transported to the end of trough 21 where the mixture is delivered through pipe 27 to the moistener 29 described below. Secured to shaft 24 is a motor 28 by which the screw is rotated and mixing effected.

Moistener 29 (see also Figures 4 and 5) consists of an elongated trough 30 and a cover 31. Pipe 27 is secured at one end to cover 31 and permits delivery to the moistener of the mixture of galactomannan gum and tobacco from mixer 16. Also secured to cover 31 are a series of spray jets 32 interconnected by a header 33, fed by pipe 34. Axially disposed within trough 30 is a paddle conveyor screw 35 consisting of a shaft 36 to which are bolted a series of paddles 37, set at suitable angles to mix and propel material contained in trough 30. Secured to shaft 36 is a motor 38 which provides power to drive the moistener. Moistened material delivered at the end of trough 30 by the action of paddles 37 is delivered from the moistener through pipe 39. The arrangement is such that liquid discharged through

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spray jets 32 in the form of finely-divided liquid particles, which may be atomized with air, is introduced into the mixture of galactomannan gum and tobacco while the same is being continuously agitated or tumbled with the result that local concentrations of moisture are avoided and the total amount of moisture used may be kept at a minimum. The moisture supplied to moistener 29 may consist either of water alone or of water plus a desired humectant such as glycerine, or it may consist of a mixture of water and humectant. Preferably, the moistening liquid is introduced through pipe 34 in atomized condition in a current of air propelled at high speed by means not shown in the drawing. The relative quantities of humectant and water may be controlled by means of valves 40 and 41 which are diagrammatically shown in Figure 1. These may be proportioning valves suitably interrelated and controlled.

From the moistener 29 the moistened mixture of galactomannan gum and powdered tobacco delivered from pipe 39 is conveyed by conveyor belt 42 to a roller mill 43. Preferably, belt 42 is equipped with ridges or flanges 42a which separate the material received from pipe 39 into separate small masses, and feed these masses successively, separated by an appreciable interval of time, into roller mill 43.

Roller mill 43 comprises a plurality of pairs of powdered rollers, the rollers of each pair being arranged to form a narrow pass between them, for example, a pass of about 0.004 inch in width at the point of closest approach. A plurality of roller-pairs are provided in the mill in superposed relation with material discharged from between an upper roller-pair falling by gravity into the bite of the next lower roller-pair. It appears desirable in the practice of this invention to pass the dampened and mixed powders through several pairs of rollers, for example six such pairs in the illustration here given. If the number of passes is to be six, the six roller-pairs may be mounted in a single vertical flight in one mill. For convenience, however, it is preferred that the six pairs of rollers be equally divided between two separate mills, with provision as by conveyor belt 44 to transport material issuing from the first mill to the receiving hopper of a second roller mill 45. In the description of a roller mill which follows, one roller-pair and related parts only will be described. It will be understood that such description is equally applicable to such additional number of roller pairs as may be provided.

Referring to Figure 6, a pair of rollers 46, 47 are secured respectively upon independently power-driven shafts 48, 49 suitably journaled. Each shaft is suitably powered as, for example, from a motor (not shown), and the speed of the motors is controlled so that during normal operation the peripheral surface of one of rollers 46, 47 moves faster than the peripheral surface of the other roller at point of closest approach between them. Above the bite between rollers 46 and 47 is positioned a guide chute 50 which directs falling material into the bite of the rollers. Spray nozzles 51 and 52, connected respectively to sources of compressed air and water, direct an atomized spray of moisture at the surfaces of rollers 46, 47 during operation. Spreaders 53, 54, each loosely mounted upon its respective pivot 55, 56, rest by gravity against the surfaces of the respective rollers 46, 47 adjacent the nozzles and cause the moisture delivered through the nozzles to be evenly spread out across the surfaces of the rollers as they approach the bite between them.

Below rollers 46, 47 are doctor blades 57, 58 in contact with each of the rollers respectively, at a point below the bite. Each doctor blade is retractable for purposes of cleaning. The mechanism for this purpose consists, for example, of movable cylinder 59 to which doctor blade 57 is secured, both being adapted to move together in guides (not shown) so that the sharpened

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edge 60 of the blade is movable in a straight line towards and from the surface of the roller. In the form of apparatus shown, a piston head 61 secured on the end of fixed rod 62 engages the cylindrical walls 63 of a chamber within cylinder 59. By admission of compressed air from a source thereof (not shown) against either face of piston head 61, the cylinder 59 and doctor blade 57 may be advanced to a position in which edge 60 of the blade is in contact with the surface of roller 46, or is retracted to the position indicated at 64. Since the arrangement of all doctor blades in the mill is the same, the same description will apply to each. The compressed air connections should preferably be such that all doctor blades retract at the same time when the machine is shut down for cleaning.

Moistened material which has passed between the bite of rollers 46, 47 falls by gravity, aided by doctor blades 57, 58, into chute 50a whereby it is guided into the bite between the next pair of rollers 46a, 47a which are likewise provided with spray nozzles 51a, 52a, spreaders 53a, 54a, and doctor blades 57a and 58a. These rollers, powered, moistened and actuated in the same manner as rollers 46, 47, in turn deliver material from between their bite into guide chute 50b of the next succeeding pair of rollers.

A suitable supporting frame including posts 65 and 66 provides support for frame members 67, 68 and other frame members not shown, which in turn support the bearings, driving motors, moistening apparatus, doctor blade retractors and other parts of the mill.

Air and water may be fed to the mill (see Fig. 1) through pipes or headers 68, 69, to which the admission respectively of air and water may be controlled by valves 70, 71.

After the damp mixture has passed through the last roller-pair of the mill or mills provided, the same is deposited, preferably by gravity, on the horizontal surface of a moving belt 72 which may, for example, be a fine mesh chain. If the material was initially introduced into the uppermost roller-pair in the form of small batches with an appreciable interval of time between the feed of each batch, and the time interval between batches is long enough, the material issuing from between the final pair of rollers will fall on belt 72 in the form of separate small sheets of damp material. Such sheets are carried along by belt 72, separate from another, to pass under the heater 73.

Preferably heater 73 utilizes infra-red heat. It comprises a hood 74 and a series of infra-red resistance heater elements 75, 75, preferably arranged in pairs under reflectors 76. A fan powered by motor 78 is arranged to draw air out of hood 74. Sheet material on belt 72, after passing beneath heater 73, is then ready for blending use in the further stages of the manufacture of tobacco products, and may for example be discharged into cart 79. At this stage the sheets discharged from belt 72 are of a size suitable for handling in tobacco blending operations and have a thickness and tensile strength approximately equal to that of natural tobacco leaves.

The following example illustrates in detail a specific process embodying the invention:

Tobacco was ground in hammermill 10 until from about 20% to 35% would pass through a 140-mesh screen and from about 0.5% to 10% would remain on a 30-mesh screen, with the ratio of coarse to fine particles being random within these limits.

The guar gum, the galactomannan used in this example, was of about the same degree of fineness as the ground tobacco.

The roller mills 43 and 45 contained six roller-pairs, the spacing at each bite being 0.004 inch. Each roller was 8½ inches in diameter. One roller in each pair was rotated at 60 R. P. M., the other at 45 R. P. M. This meant a peripheral velocity at the bite between

them of about 130 and about 95 feet per minute respectively.

About 780 lbs. per hour of fragmented tobacco containing about 8% moisture fed through pipe 15 to mixer 16; about 46 lbs. per hour of guar gum (consisting of 78.5% guar galactomannan, 12% moisture, 4.5% ash and 5% protein) fed through pipe 20 to mixer 16; a mixture consisting of about 68 gallons (568 lbs.) per hour of water and 5 gallons (50 lbs.) per hour of glycerine fed through pipe 34 to moistener 29; and about 17 gallons (142 lbs.) per hour of additional water supplied through nozzles 51, 52 to all of rollers 46, 47, 46a, etc. will produce a total of about 1586 lbs. per hour of damp mixture delivered by roller mill 45 to screen 72. Screen 72 travelling at 132 ft. per minute through a dryer 74 about 32 ft. long containing electrical resistance elements 75 about 3 inches above screen 72 to which 1.3 million B. t. u. per hour (384 kw.) is fed, causes the evaporation of about 650 lbs. of water per hour, and the production of about 936 lbs. per hour of coherent sheet material resembling leaf tobacco in its flexibility and strength and having a moisture content of about 12%. When about 3% of such sheet material was blended with about 97% of leaf tobacco similar in blend to the original fragmented tobacco and the blend was incorporated in a cigarette, the smoking qualities of the latter were indistinguishable from those of a cigarette made wholly of the same blend of all leaf tobacco.

The process and its several steps may be carried out in any form of apparatus suitable for the purpose. The apparatus shown is not claimed in this application.

What is claimed is:

1. In the process of converting fragmented tobacco into coherent material, in combination, the steps of mixing together dry finely-divided tobacco and powdered plant gum consisting essentially of galactomannan, spraying moisture into said mixture while the same is being agitated to obtain a uniform moistening thereof, and working the mixture under mechanical shearing action while in moist condition.

2. In the process of converting fragmented tobacco into coherent material, in combination, the steps of mixing together dry finely-divided tobacco and guar gum, spraying moisture into said mixture while the same is being agitated to obtain a uniform moistening thereof, and working the mixture under mechanical shearing action while in moist condition.

3. In the process of converting fragmented tobacco into coherent material, in combination, the steps of mixing together dry finely-divided tobacco and locust bean gum, spraying moisture into said mixture while the same is being agitated to obtain a uniform moistening thereof, and working the mixture under mechanical shearing action while in moist condition.

4. In the process of converting fragmented tobacco into coherent material, in combination, the steps of mixing together dry finely-divided tobacco and powdered plant gum consisting essentially of galactomannan, spraying moisture into said mixture while the same is being agitated to obtain a uniform moistening thereof, working the mixture under mechanical shearing action while in moist condition, and heating said worked moistened mixture to expel a major part of the moisture therefrom.

5. In the process of converting fragmented tobacco into coherent material, in combination, the steps of mixing together dry finely-divided tobacco and powdered plant gum consisting essentially of galactomannan, spraying moisture into said mixture while the same is being agitated to obtain a uniform moistening thereof, and passing the moistened mixture between a pair of closely-spaced powered rollers rotating at different peripheral speeds.

6. In the process of converting fragmented tobacco into coherent material, in combination, the steps of mix-

ing together dry finely-divided tobacco and powdered plant gum consisting essentially of galactomannan, spraying moisture into said mixture while the same is being agitated to obtain a uniform moistening thereof, and passing the moistened mixture successively between a plurality of pairs of closely-spaced powered rollers, one of the rollers in each pair rotating at a different peripheral speed from the other roller in said pair whereby the mixture is subjected to mechanical shearing action as it passes between them.

7. In the process of converting fragmented tobacco into coherent material, in combination, the steps of mixing together dry finely-divided tobacco and powdered plant gum consisting essentially of galactomannan, spraying moisture into said mixture while the same is being agitated to obtain a uniform moistening thereof, passing the moistened mixture successively between a plurality of pairs of closely-spaced powered rollers, one of the rollers in each pair rotating at a different peripheral speed from the other roller in said pair whereby the mixture is subjected to mechanical shearing action as it passes between them, and heating said sheared moistened mixture to expel a major part of the moisture therefrom.

8. In the process of converting fragmented tobacco into coherent sheet-like material, in combination, the steps of mixing together dry finely-divided tobacco and powdered plant gum consisting essentially of galactomannan, spraying moisture into said mixture while the same is being agitated to obtain a uniform moistening thereof, working the mixture under mechanical shearing action while in moist condition, discharging said worked mixture in the form of a thin damp sheet upon a supporting surface, and subjecting said sheet to heat sufficient to expel a major part of the moisture therefrom while said sheet remains undisturbed upon said supporting surface.

9. In the process of converting fragmented tobacco into coherent sheet-like material, in combination, the steps of mixing together dry finely-divided tobacco and powdered plant gum consisting essentially of galactomannan, spraying moisture into said mixture while the same is being agitated to obtain a uniform moistening thereof, working the mixture under mechanical shearing action while in moist condition, discharging said moistened mixture in the form of a thin damp sheet upon a movable support, and moving said support through a heated zone while said sheet remains undisturbed thereon.

10. In the process of converting fragmented tobacco into coherent material, in combination, the steps of mixing together dry finely-divided tobacco and powdered plant gum consisting essentially of galactomannan, moistening the said mixture, passing the moistened mixture between a pair of closely-spaced powered rollers rotating at different peripheral speeds, and supplying moisture to at least one of said rollers while the mixture is passing between them.

11. In the process of converting fragmented tobacco into coherent material, in combination, the steps of mixing together dry finely-divided tobacco and powdered plant gum consisting essentially of galactomannan, moistening the said mixture, passing the moistened mixture successively between a plurality of pairs of closely-spaced powered rollers, one of the rollers in each pair rotating at a different peripheral speed from the other roller in said pair whereby the mixture is subjected to mechanical shearing action as it passes between them, and supplying moisture to at least one of said rollers in each of said pairs while the mixture is passing between said pair.

12. In the process of converting fragmented tobacco into coherent material, in combination, the steps of mixing together dry finely-divided tobacco and powdered plant gum consisting essentially of galactomannan, moistening the said mixture, passing the moistened mixture between a pair of closely-spaced powered rollers rotating at different peripheral speeds, supplying moisture to

at least one of said rollers while the mixture is passing between them, and heating said mixture as it comes from said rollers to expel a major part of the moisture therefrom.

13. In the process of converting fragmented tobacco into coherent sheet-like material, in combination, the steps of mixing together dry finely-divided tobacco and powdered plant gum consisting essentially of galactomanan, moistening the said mixture, passing the moistened mixture between a pair of closely-spaced powered rollers rotating at different peripheral speeds, supplying moisture to at least one of said rollers while the mixture is passing between them, discharging said mixture in the form of a thin damp sheet upon a supporting surface, and subjecting said sheet to sufficient heat to drive off a major part of the moisture contained therein while said sheet remains undisturbed upon said supporting surface.

14. In the process of converting fragmented tobacco into coherent sheet-like material, in combination, the steps of mixing together dry finely-divided tobacco and powdered plant gum consisting essentially of galactomanan, moistening the said mixture, passing the moistened mixture between a pair of closely-spaced powered rollers rotating at different peripheral speeds, supplying moisture to at least one of said rollers while the mixture is passing between them, discharging said mixture in the form of a thin damp sheet upon a movable support, and moving said support through a heated zone whereby to produce a coherent sheet of moisture content and tensile strength approximating that of leaf-tobacco.

15. In the process of converting fragmented tobacco into coherent material, in combination, the steps of passing a moistened mixture of finely-divided tobacco and mucilaginous plant gum successively between a plurality of pairs of closely-spaced rollers, one roller in each pair rotating at a different peripheral speed from the other roller in said pair whereby the mixture is subjected to mechanical shearing action as it passes between them, and heating said mixture as it comes from the final pair of said rollers to expel a major part of the moisture therefrom.

16. In the process of converting fragmented tobacco into coherent sheet-like material, in combination, the steps of passing a moistened mixture of finely-divided tobacco and mucilaginous plant gum successively between a plurality of pairs of closely-spaced rollers, one roller in each pair rotating at a different peripheral speed from the other roller in said pair whereby the mixture is subjected to mechanical shearing action as it passes between them, discharging said mixture as it comes from the final pair of said rollers in the form of a thin damp sheet upon a movable support, and moving said support through a heated zone whereby to produce a coherent sheet of moisture content and tensile strength approximating that of leaf tobacco.

17. In the process of converting fragmented tobacco into coherent material, in combination, the steps of passing a moistened mixture of finely-divided tobacco and mucilaginous plant gum between a first pair of closely-spaced powered rollers rotating at different peripheral speeds from each other, permitting the mixture which has been submitted to mechanical shearing action between the first pair of rollers to fall by gravity between a second pair of closely-spaced powered rollers rotating at different peripheral speeds from each other, discharging material which has been submitted to mechanical shearing action in both said first and second pairs of rollers upon a movable support, and moving said support through a heated zone to drive off a major part of the moisture contained in the discharged material while the same remains undisturbed upon said support.

18. In the process of converting fragmented tobacco

into coherent material, in combination, the steps of passing a moistened mixture of finely-divided tobacco and mucilaginous plant gum between a first pair of closely-spaced powered rollers rotating at different peripheral speeds from each other, permitting mixture which has been submitted to mechanical shearing action between the first pair of rollers to fall by gravity between a second pair of closely-spaced powered rollers rotating at different peripheral speeds from each other, supplying moisture to at least one roller in at least one of said pairs while the mixture is passing between them, discharging material which has been submitted to mechanical shearing action in both said first and second pairs of rollers upon a movable support, and moving said support through a heated zone to drive off a major part of the moisture contained in the discharged material while the same remains undisturbed upon said support.

19. In the process of converting fragmented tobacco into coherent material, in combination, the steps of passing a moistened mixture of finely-divided tobacco and mucilaginous plant gum between a first pair of closely-spaced powered rollers rotating at different peripheral speeds from each other, permitting mixture which has been submitted to mechanical shearing action between the first pair of rollers to fall by gravity between a second pair of closely-spaced powered rollers rotating at different peripheral speeds from each other, supplying moisture to said rollers while the mixture is passing between them, discharging material which has been submitted to mechanical shearing action in both said first and second pairs of rollers upon a movable support, and moving said support through a heated zone to drive off a major part of the moisture contained in the discharged material while the same remains undisturbed upon said support.

20. In the process of converting fragmented tobacco into coherent sheet material, in combination, the steps of mixing together dry finely-divided tobacco and dry finely-divided mucilaginous plant gum in the absence of free moisture until the two substances are dispersed in each other with substantial uniformity, spraying moisture into said mixture while the same is being agitated, and working the mixture under mechanical shearing action while in a moist condition.

21. In the process of converting fragmented tobacco into coherent sheet material, in combination, the steps of mixing together dry finely-divided tobacco and dry finely-divided mucilaginous plant gum in the absence of free moisture until the two substances are dispersed in each other with substantial uniformity, spraying moisture into said mixture while the same is being agitated, passing the moistened mixture successively between a plurality of pairs of closely-spaced powered rollers, one of the rollers in each pair rotating at a different peripheral speed from the other roller in said pair, whereby the mixture is subjected to mechanical shearing action as it passes between them, and drying the mixture in the form of sheets.

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