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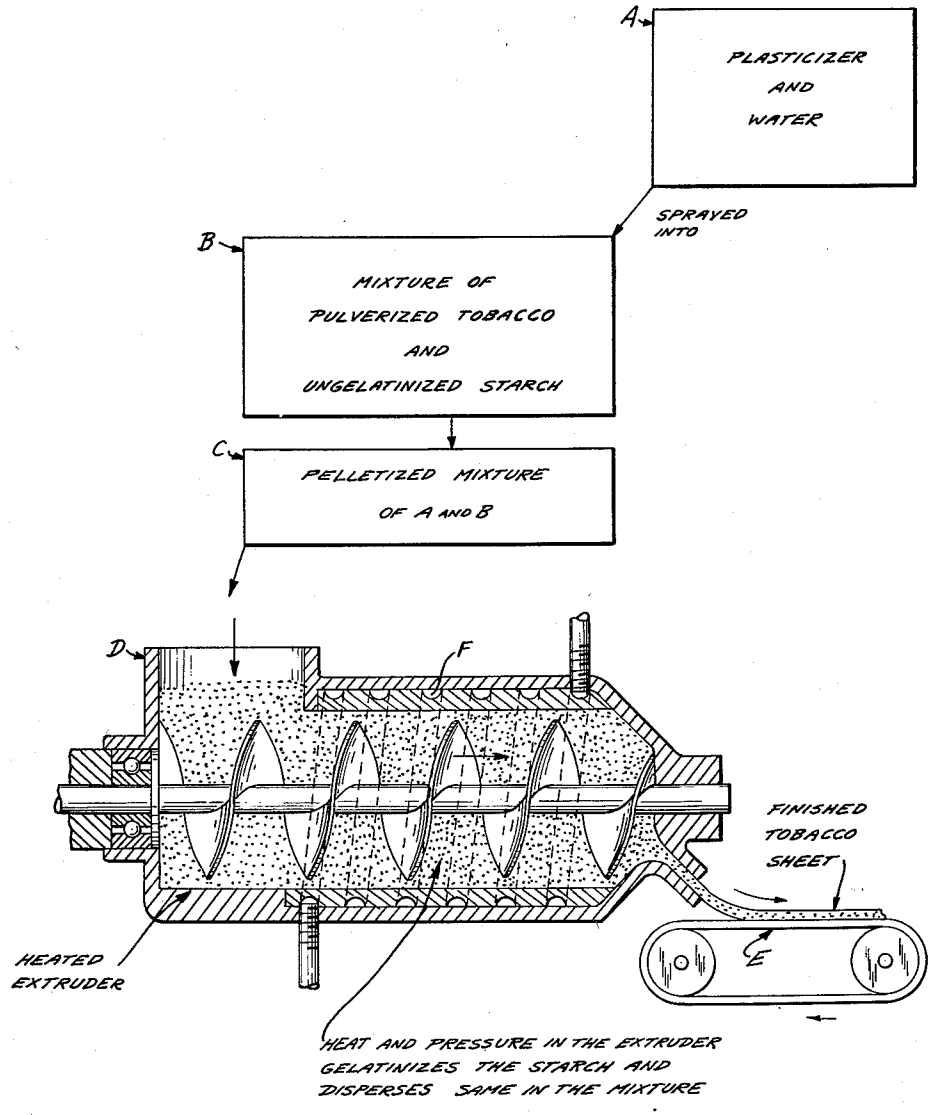

INVENTORS
OTTO B. WURZBURG
WALTER G. KUNZE
RAYMOND B. EVANS

BY James & Franklin

ATTORNEYS

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METHOD OF MAKING TOBACCO PRODUCT

Otto B. Wurzburg, Whitehouse Station, N.J., and Walter G. Kunze and Raymond B. Evans, Catonsville, Md., assignors to National Starch and Chemical Corporation, New York, N.Y., a corporation of Delaware

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This invention relates to the manufacture of tobacco products which consist essentially of adhesively bonded finely ground tobacco particles.

It is the object of this invention to provide for the manufacture of such tobacco products by means of a novel process which allows for their simplified and economical production.

Since the prior art in this field is for the most part concerned with the properties and manufacture of such products in the form of tobacco sheets, this disclosure will be described in terms of, and in comparison with, the methods heretofore employed for the manufacture of such sheets. It will be understood, however, that the process of our invention may be applied to the making of such products in a variety of other forms such as ribbons, rods, tubes and the like.

As is known in the art, tobacco sheet provides a convenient and economical means for utilizing those portions of the tobacco plant which are ordinarily discarded during its harvesting and subsequent processing. The finely divided tobacco which is used in preparing tobacco sheet may thus be derived from such parts as stalks, stems and leaf veins as well as the fragments and dust fines which are left behind after the tobacco leaf has itself been fully processed. Tobacco sheet may also be produced from whole tobacco leaves.

In preparing tobacco sheet, the procedure ordinarily employed involves the grinding or milling of the tobacco to a fine, powdery consistency and then dispersing this powder in water containing, or to which is later added, a suitable adhesive binder. In general, the adhesives which are employed comprise film forming polysaccharides such as cellulose derivatives, starches, pectins, algins and natural gums such as locust bean and karaya. In using these adhesive susbtances for the preparation of tobacco sheet by means of the casting method hereinafter described, it is first necessary to completely disperse or dissolve them in water prior to their admixture with the aqueous tobacco slurry. In addition to the adhesive binder, the aqueous tobacco slurry may also contain flavoring or coloring materials, humectants, burn control additives, reinforcing fibers and such other additives whose presence may be desired by the practitioner. A thin layer or film of the dispersion, whose solids content is usually in the range of from 20–25% by weight, is then cast upon a suitable film forming surface such, for example, as a stainless steel belt. This belt is then slowly passed through a source of heat, thereby resulting in a drying of the film. After drying is complete, the resulting sheet must then be rehumidified so as to allow for its release from the casting belt whereupon it may then be rolled or stored until such time as it is to be used. Tobacco sheet prepared by such means has had extensive application as a wrapper or binder or as a shredded filler for various types of smoking products.

As is to be noted from the foregoing description, the method of casting tobacco sheet from an aqueous slurry, although resulting in certain suitable produucts, is nonetheless deficient in many respects. A particular drawback is the fact that the casting method is limited to the production of sheets, and that the evaporation of the large amounts of water contained in the dispersion or slurry is time consuming and costly. Other disadvantages of this

method are the need for rehumidification and the difficulties associated with separation of the resulting sheet from the casting surface.

We have now discovered a method for preparing tobacco products, including sheets, by means of an extrusion process which simultaneously disperses the binding agent during the actual product forming operation. By employing the novel process of our invention, the practitioner is able to produce tobacco articles in a wide variety of shapes and forms. Our process, in requiring only a minimal amount of water, has been found to reduce the amount of time required for the drying operation and also eliminates the rehumidification step which is necessary in the methods heretofore employed for preparing tobacco sheet.

In brief, the process of our invention involves the preparation of formed tobacco products by subjecting to both heat and pressure as by a hot extrusion, a mixture comprising pulverized tobacco, an ungelatinized starch which is normally non-dispersible or insoluble in cold water at room temperature but which is, nonetheless, gelatinized and dispersed during the process in water just sufficient in amount to effect the gelatinization, and a suitable plasticizer which imparts the necessary elastomeric or plastic consistency to the finished products thereby increasing their flexibility and crack resistance. Various other substances such as buffers, flavors, coloring agents, humectants, acids, sugars, burn control additives and reinforcing fibers may also be included in the extrusion mixture. In regard to the water or moisture content of this mixture, it is necessary to have present only that minimal amount of water which together with the requisite amount of heat and pressure is required to gelatinize the starch binder.

In extruding the above described mixture, one may employ any available device which is capable of applying both heat and pressure to a mass having the aforedescribed composition, and forcing or extruding such a mass through an opening of the desired size and shape such as a narrow slit, a set of closely adjusted rollers, or other appropriately shaped die. In some cases, it is desirable to employ an extruding screw fitted with a mechanism known in the art as a torpedo head which serves to rub out and uniformly distribute the starch binder and pulverized tobacco. As a result of the combined heating and extrusion pressure the normally non-dispersible, ungelationized starch is effectively gelatinized and dispersed in the water and plasticizer present within the extrusion mixture and is converted into a form wherein it is now capable of functioning as a binder for the pulverized tobacco.

By having the formation and dispersal of the adhesive binder component take place simultaneously with the actual extrusion of the tobacco product, it is no longer necessary to separately disperse an adhesive binder prior to its admixture with the pulverized tobacco slurry. By gelatinizing the starch in situ in the extrusion step, only that minimal amount of water is used which is required for such gelatinization and thus the time required for the drying of the tobacco product is considerably shortened and the process itself is simplified since the amount of water present within the initial extruded film represents only a fraction of its total weight in contrast to tobacco sheet prepared by casting techniques (as, for example, where the mixture is initially made with a gelatinized starch), wherein a major proportion of the weight is represented by water which must be removed from the final product. Finally, in the case of tobacco sheets, the need for any rehumidification or removal of the tobacco sheet from a casting surface is, of course, eliminated since the proper moisture content and flexibility of the resulting sheet can be easily controlled during the actual extrusion and festooning operations.

As has been previously indicated, the pulverized tobacco which may be used in the process of our invention may be derived from any part of the tobacco plant including stems, stalks, veins and leaves. Furthermore, it is also possible to blend different types of tobacco in preparing this powder so as to provide a final sheet having any desired flavor which is characteristic of such blends. In preparing this tobacco it should be cleaned and then ground to the desired mesh size by means of any appropriate milling device such as a ball or hammer mill. The mesh size to which the tobacco may be ground should preferably be within the range such that at least 75% by weight will pass through a 100 mesh U.S. standard sieve.

As for the adhesive binder, this requires the use of an ungelatinized starch of which, preferably, at least 75% by weight is non-dispersible or insoluble in water at a temperature of 25° C. It should be understood that in speaking of a starch "dispersion" or "solution" there is contemplated not necessarily a true solution, but rather the type of homogeneous, hydrated colloidal dispersion which is formed, for example when an aqueous starch suspension is heated past the gelatinization temperature of the starch, resulting in the swelling, disintegration and dispersal of the starch throughout the liquid. Thus, in referring to an "ungelatinized" starch we make reference to a starch which is entirely intact and unswollen as contrasted with gelatinized starches which have been previously gelatinized and then dried so that they will immediately disperse in cold water without the need for any additional heating. Also included in this concept of ungelatinized starches are those materials in which the original granule form has been destroyed or eliminated and the resulting product recovered in a form which is not completely dispersible in water at 25° C. Such materials might result, for instance, from the fractionation of starch to produce pure amylose as well as from those starches in which the granule structure has been ruptured and the starch drum dried or otherwise treated in such a manner that the resulting material will not swell significantly in cold water. Thus it is seen that in every case the starch used in our invention must be one which is relatively non-dispersible in cold water.

Ungelatinized starches applicable to the process of our invention may be derived from any of the known starch types such as, for example, corn, high amylose corn, sago, wheat, rice, sweet potato, waxy maize, potato or tapioca starches as well as from components of these starches such as amylose. In addition, derivatized starches from any of the above types, including thin boiling, dextrinized, etherified or esterified starches may also be used provided they are, again, ungelatinized and, preferably, at least 75%, by weight, non-dispersible in cold water which is at a temperature of 20° C. The use of amylose, amylose derivatives, high amylose starches and derivatives of the latter is particularly recommended as the tobacco products derived from these binders have exceptionally high tensile strength. The concentration of starch adhesive binder which may be used can be varied from 8 to 40% as based on the total weight of tobacco present within the extrusion mixture.

As for the plasticizer required in our extrusion process in order to provide the resulting tobacco products with their necessary degree of flexibility and crack resistance, one may use one or more of such plasticizers selected from the class of: polyhydroxy alcohols such as ethylene glycol, diethylene glycol, triethylene glycol, propylene glycol, glycerin, mannitol, sorbitol, and 1,2,6 hexanetriol; sugars such as glucose, maltose, or lactose; lactic acid; alkali metal nitrates such as sodium nitrate; and, alkaline earth nitrates such as calcium nitrate. The concentration of plasticizer which may be used can be varied from 8 to 40% as based on the weight of tobacco present in the extrusion mixture.

The amount of water which must be combined with the mixture of tobacco powder, starch, plasticizer and other desired additives, has been defined as that minimal quantity which is required to gelatinize the starch. This quantity is, of course, dependent upon many factors including the type and amount of starch being used, the type and amount of plasticizer, and the temperature of the extrusion equipment. This minimal concentration is thus best determined by the practitioner by means of simple experimentation. Generally speaking, however, amounts of water ranging from 30–80% of the weight of tobacco in the mixture have been found acceptable. The use of less than this suggested minimum amount of water is to be avoided as it results in a mixture which is too dry for extrusion. On the other hand, if more than our suggested amount of water is used, the resulting extruded product will be exceedingly weak and thus tend to be easily deformed during the subsequent festooning and other handling operations.

The actual composition of the tobacco products of our invention will, to a large extent, be determined by its proposed end use. Thus, a strong-water-resistant cigar wrapper would require the use of a high tensile strength starch binder such as high amylose corn starch, amylose or a partly derivatized amylose. The amount of starch in such a product would be high, amounting up to 50%, by weight, of the tobacco in some cases. An effective plasticizer such as glycerin would be used and only in an amount sufficient to produce the desired flexibility. In contrast, for a cigarette filler only the smallest amount of binder and plasticizer necessary to make a cohesive sheet would be used, and the amount of water would be adjusted accordingly. Obviously, the percent loading, i.e. the amount of actual tobacco in the sheet, should be kept as high as possible for reasons of taste. In this particular case as little as 8% starch would be used together with sufficient plasticizer to keep the resulting sheet flexible.

In preparing tobacco sheet by means of the process of our invention, the requisite amounts of tobacco and ungelatinized starch are first mixed together. Simultaneously, the plasticizer and any other water dispersible additives are dissolved in water, which is then sprayed onto the mixture of ungelatinized starch and tobacco, the entire mass then being agitated until fairly uniform in consistency. The resulting damp mass is next preferably pelletized, i.e. the mass is compacted up into small aggregates, by the use of any type of commercial pelletizing equipment such as is available from the Sprout, Waldron Co., Inc., of Muncy, Pa. By pelletizing the extrusion mixture in this manner it is put into a free flowing form while at the same time any entrapped air is expelled. The pelletized mixture is thereupon fed into the extruder.

This is illustrated in the flow sheet section of the accompanying drawings. The plasticizer and water solution in A is sprayed into B containing the mixture of pulverized tobacco and ungelatinized starch, where the entire mass is then agitated until fairly uniform in consistency. The resulting damp mass is then pelletized by equipment designated as C, the pelletized mixture being thereupon fed into the heated extruder D. In the operation of the extruder, heat and pressure gelatinizes the starch, dispersing the same in the mixture.

The material is heated in the extruder D by means of the flow of heating medium through the passage F.

The barrel of the extruder should be kept at such a temperature so that the ungelatinized starch will take up the admixed water, swell and burst, i.e. gelatinize. As the mixture is tumbled along the screw flights of the extruder a uniform plastic mass will be formed. This composition can, if desired, be made more intimate by the rubbing action of a torpedo head which may be fitted on the extruder screw. The temperature used in the extruder barrel again obviously depends upon the amount and type of starch binder, the amount and type of plasticizer, as well as on the amount of water present. Usually this tem-

perature, as measured on the outside of the barrel by use of a thermocouple, may range from 200°–275° F. As for the pressure exerted by the extruder screw this may range from about 1000–5000 pounds per square inch. The temperature of the die should be kept in the range of from 50°–250° F., depending again on the type and amount of starch and plasticizer as well as on the amount of water present.

In the case of sheeting dies, film thickness may be varied from about 4 to 10 mils, depending on the type of sheet and its proposed end use.

As the extruded tobacco film emerges from the die it may be pulled out and straightened into a perfectly flat sheet by being nipped with a set of nip rollers. Other procedures may also be employed for this purpose. The finished tobacco sheet as it emerges from the die may be cast, as in the customary manner above described, upon a suitable film forming surface such, for example, as a stainless steel belt E. Drying of the film is simplified as its water content is extremely low; thus, it may be conveniently dried without the need for any prolonged exposure to heat by merely festooning the sheet in a warm air chamber, after its emergence from the nip rollers. After drying is completed to the desired degree, the tobacco sheet produced by the process of our invention may then be trimmed and wound on a spool until such time as it is to be used. The necessity for any rehumidification of the sheet is eliminated since its high degree of flexibility permits it to be readily handled without any danger of creasing or tearing while being wound on a spool or during any other subsequent processing steps.

In the case of dies other than sheeting dies, such as those of the type used to produce strands or rods, for example, similar procedures are employed. Thus, strands may be directly extruded into a vertical hot air duct, and rods may be cut off at regular intervals and dried in heated conveying equipment. It is also possible to produce ribbons of varying widths which at the moment of their extrusion, or at any time thereafter, may be spirally wrapped around an endless core of twisted tobacco strands which may be made from either natural leaf or by extrusion, thus producing an endless cigar/cigarette type smoking article. In another modification, the stranded core may be omitted and the entire smoking article will thus be produced solely from a multitude of spirally wound ribbons having the desired width, thickness and degree of tightness. For the production of cylinders, tubes or shells, a circular die may be used and the extruded article can be kept from collapsing and simultaneously dried by keeping it inflated and surrounded by a stream of warm, dry air.

The following examples will further illustrate the embodiment of our invention. In these examples all parts given are by weight unless otherwise noted.

Example

This example presents a number of formulations which were employed in the production of the extruded tobacco products of our invention. In preparing these tobacco products the procedure employed, in each case, involved first mixing the requisite amounts of tobacco powder and ungelatinized starch. At the same time, the plasticizer was dissolved in the water and this solution was sprayed onto the starch-tobacco mixture. The entire mass was then agitated until it had attained a uniform consistency, whereupon it was pelletized by running it through a commercial pelletizing apparatus wherein the outlet holes were 3/16" in diameter. The resulting pellets were then fed into a ¾" screw extruder whose barrel temperature was maintained within a range of from 220°–250° F. In one case, this extruder had a sheeting die which was maintained at a temperature of between 210°–230° F. and whose opening was 4 mils thick. As the extruded tobacco sheet left this die it was nipped by a set of nip rollers and pulled out into a straight, flat ribbon which was then festooned and dried for 20 minutes at a temperature of 150° F. The resulting sheets were employed in the production of various tobacco products including cigarette fillers and cigar wrappers.

It should be noted that the high amylose starch employed in several of the following formulations had an inherent amylose content of 55%, by weight. Moreover, the binder used in Formulation #17 was at least 75%, by weight, non-dispersible in water at a temperature of 25° C.

#1	Parts
Corn starch	50
Sorbitol	25
Glycerin	25
Tobacco powder	125
Water	35

#2	
High amylose starch	10
Glycerin	10
Tobacco powder	125
Water	50

#3	
High amylose starch	10
Glycerin	30
Tobacco powder	125
Water	60

#4	
Tapioca starch	50
Glycerin	50
Tobacco powder	125
Water	50

#5	
High amylose starch	50
Glycerin	50
Tobacco powder	125
Water	50

#6	
High amylose starch	50
Ethylene glycol	50
Tobacco powder	125
Water	50

#7	
High amylose starch	50
Propylene glycol	50
Tobacco powder	125
Water	50

#8	
High amylose starch	50
Glycerin	35
Sorbitol	15
Tobacco powder	125
Water	50

#9	
High amylose starch acetate	50
Glycerin	50
Tobacco powder	125
Water	50

#10	
Hydroxyethyl corn starch	50
Glycerin	50
Tobacco powder	125
Water	50

#11	
High amylose starch	50
Glycerin	50
Tobacco powder	125
Water	35

#12

Corn starch	50
Glycerin	50
Tobacco powder	125
Water	35

#13

Potato starch	50
Glycerin	50
Tobacco powder	125
Water	50

#14

Hydroxypropyl amylose	40
Glycerin	20
Tobacco powder	100
Water	35

#15

High amylose starch	10
Glycerin	30
Tobacco powder	125
Water	100

#16

Tapioca starch	50
Sodium nitrate	25
Tobacco powder	125
Water	60

#17

Amylose acetate	50
Glycerin	25
Tobacco powder	125
Water	50

#18

Corn starch acetate	50
Glycerin	50
Tobacco powder	125
Water	50

All of the above formulations were also used in the production of formed articles other than sheets. In the case of rods, for instance, a die having a round hole 1/32" in diameter was employed. This die was kept at a temperature of 150°–170° F. and extrusion was carried out in the manner described above. The resulting thin rod was cut off in 6" lengths and dried in a circulating hot air oven for 15 minutes at 180° F. Dies with openings up to 1/4" were also used and performed as described above except that longer drying times were required.

Summarizing, our invention is thus seen to provide a process which is adaptable to the simplified preparation of a wide selection of shaped tobacco products. Variations may be made in proportions, procedures and materials without departing from the scope of this invention which is limited only by the following claims.

We claim:

1. The method of making a tobacco product comprising mixing a pulverized tobacco, an ungelatinized starch, a plasticizer and water, and forcing said mixture through an extruder with the application of both heat and pressure within said extruder sufficient to simultaneously effect the gelatinization of the starch and its dispersion in the mixture and the ejection of the mixture from said extruder in product form, the amount of water within said mixture being from 30% to 80% by weight of the tobacco.

2. The method of making a tobacco product comprising mixing a pulverized tobacco, an ungelatinized starch, a plasticizer and water to a plastic consistency, and forcing the plastic mixture through an extruder with the application of heat and pressure sufficient to simultaneously effect the gelatinization of the starch and its dispersion as a binder in the plastic mixture and the ejection of the mixture from said extruder in product form, the amount of water in said mixture being from 30% to 80% by weight of the tobacco.

3. The method of claim 1, wherein the amount of water in the mixture is the minimal amount which together with the heat and pressure is required to gelatinize the starch.

4. The method of claim 1, wherein the mixture of pulverized tobacco, ungelatinized starch and plasticizer is first compacted into small aggregates prior to being subjected to heat and pressure.

5. The method of claim 1, wherein said ungelatinized starch and said plasticizer are each present within said mixture in a concentration ranging from 8% to 40% by weight of the tobacco present in said mixture.

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