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[54] **PROCESS FOR INCREASING THE FILLING
 CAPACITY OF TOBACCO**
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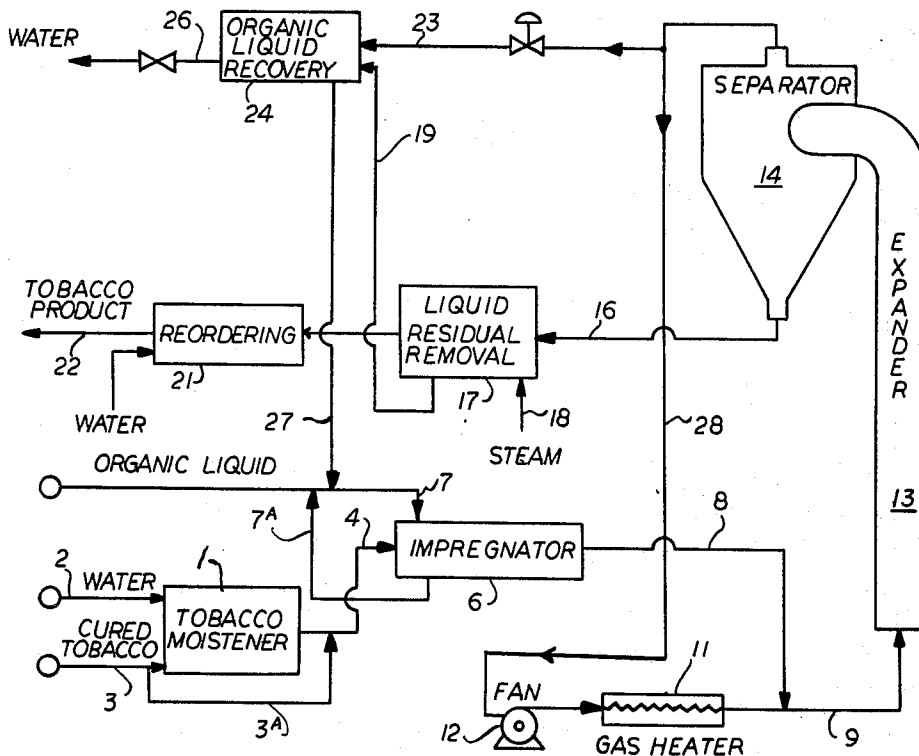
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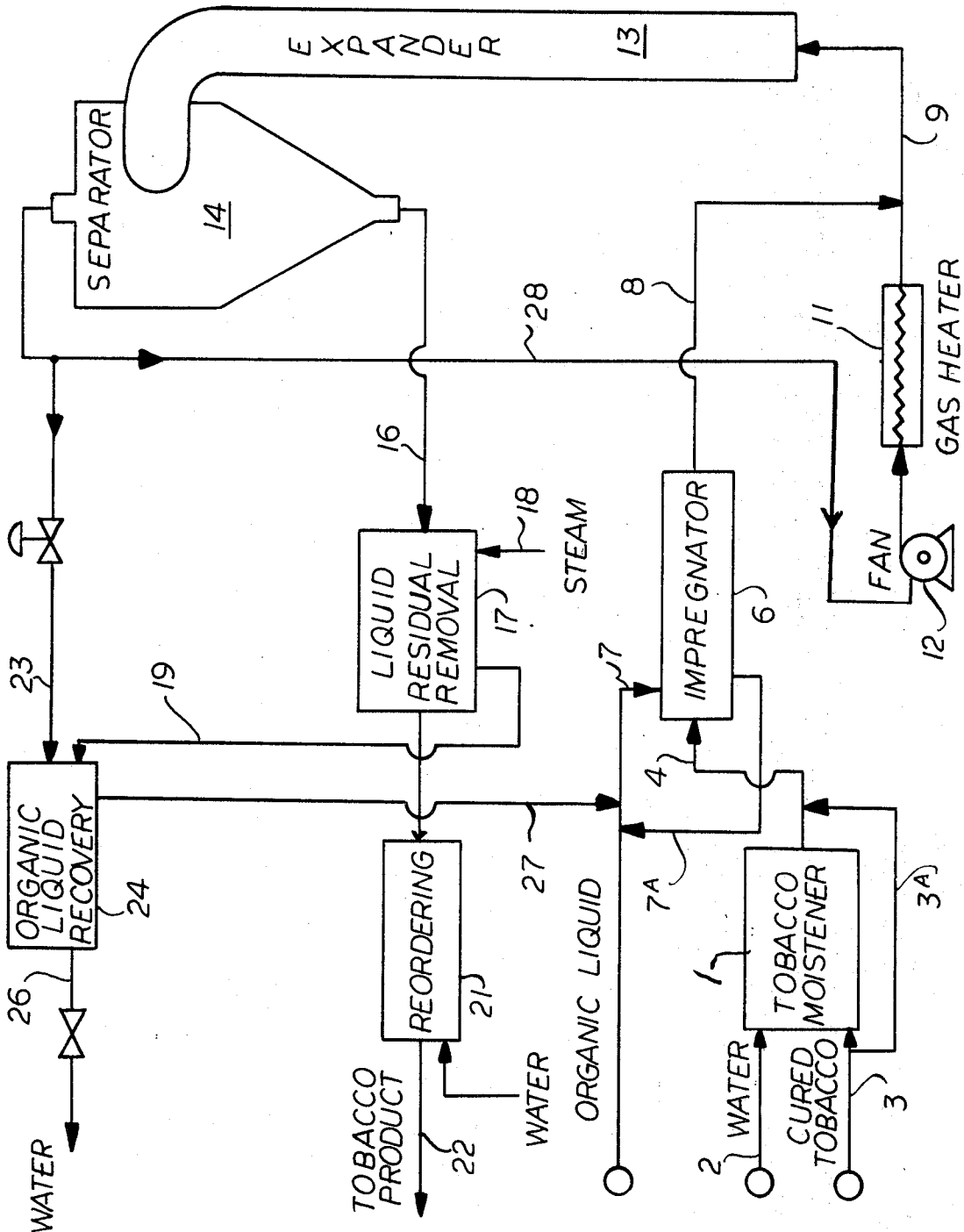
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ABSTRACT: The filling capacity stream of tobacco is increased by adjusting the moisture content of tobacco, wetting the tobacco with an inert organic liquid and rapidly vaporizing the liquid from the tobacco by passing the stream of tobacco into contact with a rapidly moving stream of gas heated to a temperature substantially above the boiling point of the organic liquid. The tobacco expansion occurs in the disclosed technique in a period of less than about 4 seconds.





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PROCESS FOR INCREASING THE FILLING CAPACITY OF TOBACCO

This invention relates to a process for treating tobacco to increase its filling capacity.

Tobacco leaves, when harvested, contain a considerable quantity of water and during the tobacco curing process this water is removed by drying resulting in shrinkage of the leaf structure. In the usual process of preparing tobacco for storage and subsequent cigar and cigarette manufacture, the tobacco regains very little, if any, of the shrinkage resulting from drying so that a significant loss in the filling capacity of the tobacco is the result. Thus, the tobacco has a bulk density which is in excess of that necessarily required for making satisfactory cigars or cigarettes. Also, in the cutting of strips for making cut filler for cigarettes, frequently shreds are laminated together to form dense hard particles which occupy far less volume than the original shreds would occupy. This is, of course, wasteful.

Several procedures have been suggested in the prior art for increasing the normal filling capacity of dried or cured tobacco. Certain of these processes involve puffing operations in which tobacco is subjected to high pressure steam followed by sudden release of the pressure. Also, it has been suggested that the filling capacity of tobacco may be increased, i.e., bulk density reduced, by exposing the tobacco particles to the vapors of an organic liquid or to an organic liquid followed by air drying at ordinary temperatures. However, these prior procedures have not been wholly satisfactory because (a) they are not effective for expanding the filling capacity to any great extent or (b) they result in a shattering of the tobacco particles so that considerable waste incident to the formation of fines results.

The copending application of James Donald Fredrickson, Serial No. 720,406 filed April 10, 1968, discloses and claims a process for increasing the filling capacity of tobacco by moistening tobacco with a volatile organic liquid and then heating the moistened tobacco by means of a hot gas to volatilize the liquid and expand the tobacco. The present invention affords improvements on the Fredrickson process. Thus, it is a principal object of the present invention to provide a process for significantly and consistently increasing the filling capacity of tobacco in convenient manner.

A further object of the invention is to provide a process for significantly increasing the filling capacity of tobacco which process can be efficiently conducted while maintaining processing costs at a minimum.

A still further object of the present invention is to provide a process for increasing the filling capacity of tobacco which process can be conducted in a continuous manner using readily available equipment.

In accordance with this invention, a moist, cured tobacco having a water content in the range of about 10 to 100 parts of water per 100 parts of tobacco is employed. Preferably, the water content of the tobacco is within the range of 13 to 50 parts per 100 parts of tobacco and most preferably within the range of 18 to 30 parts per 100 parts of tobacco. The term "100 parts of tobacco" means tobacco on a water-free basis. To illustrate, a cured tobacco having a natural water content of 12.3% is described herein as having about 14.1 parts of water per 100 parts of tobacco. The lower moisture limit of the tobacco to be treated is for the main imposed by the fragility of the tobacco; tobacco which is too dry tends to disintegrate and to produce fines. The amount of water employed can be large enough to permit the tobacco to be soaking wet; however, the use of water in amounts such that the tobacco is very wet is preferably avoided because of mechanical difficulties in handling such wet masses of tobacco. The upper limit of 100 parts of moisture per 100 parts of tobacco is a practical preferred operating limit. The moistening operation can be carried out at ambient temperatures and also at elevated temperatures. It is usually preferred to maintain the tobacco below about 170° F. in order to avoid impairing flavor. In general, the moistening is carried out at ambient atmospheric

temperatures such as 60° F. to 100° F. The water can be added to the tobacco by any technique which results in a substantially uniform moistened mass, such as by spraying or soaking.

When the moisture content of the tobacco is within the desired range, the tobacco is then contacted with sufficient quantity of a volatile organic liquid for a time sufficient to accomplish thorough impregnation of the tobacco. The impregnation can be carried out at any suitable temperature but preferably is carried out at a temperature below about 170° F. in order to avoid impairing the flavor of the tobacco. It has been observed that the time needed to impregnate substantially uniformly the mass of tobacco is temperature dependent; also the time of impregnation is dependent upon the particle size of the tobacco. The larger the particle size the longer the time. The illustrative times for strips and shreds are: 150° F., 0.5 to 1 hour; 100° F., 12-24 hours; 75° F., 40-100 hours.

A variety of organic liquids that can be evaporatively removed can be used for impregnation but preferably the organic liquid is one having a boiling point below that of water. It is thought that in addition to helping to expand tobacco structure the inert organic liquid helps to set the cells in expanded condition. The organic liquid should not be one which does combine irreversibly to a significant degree with the tobacco; in other words it must not alter the smoking qualities of the product to an undesirable extent, i.e., it should be chemically inert. Broadly the liquid falls into the classes of aliphatic hydrocarbons, aromatic hydrocarbons, alkanols, ketones, aliphatic esters, ethers, halogen substituted hydrocarbons and mixtures thereof. It is preferred to operate with the lower boiling members of these classes. It is intended that "lower boiling" include those liquids having a boiling point below about 231° F. (110.7° C.) and preferably below about 155° F. (68.5° C.).

Illustrative suitable inert organic liquids are: benzene and toluene; acetone, methyl ethyl ketone, methyl isopropyl ketone, diethyl ketone and diacetyl; methyl ethyl ether, diethyl ether, dipropyl ether, diisopropyl ether, methyl butyl ether, ethyl butyl ether, ethylene glycol dimethyl ether, and tetrahydrofuran; methanol, ethanol, propanol, isopropanol, sec-butyl alcohol, t-butyl alcohol, t-amyl alcohol, and allyl alcohol; butane, pentane, hexane, heptane, and the corresponding unsaturated hydrocarbons; and cyclobutane, cyclopentane, cyclohexane and cyclohexene.

The halogen substituted hydrocarbons may be aliphatic, cycloaliphatic or aromatic in nature. One or more halogen atoms may be present in each halo-hydrocarbon molecule. Two or more different halogens may be present in a single halo-hydrocarbon molecule. Illustrative halo-hydrocarbons are ethyl chloride, propyl chloride, isopropyl chloride, vinylidene chloride, n-butyl bromide, isobutyl chloride, sec-butyl chloride, t-butyl chloride, t-butyl bromide, methylene chloride, methylene bromide, chloroform, carbon tetrachloride, ethylene dichloride, ethylidene chloride, acetylene dichloride, trichloroethylene and fluorobenzene.

Preferred classes of inert organic liquids are aliphatic hydrocarbons having 3 to 6 carbon atoms and the halogen substituted alkane hydrocarbons (halo-alkane) having 1-2 carbon atoms and the halocycloalkanes having 3-4 carbon atoms. Those compounds generally known as Freon fluorocarbons are especially preferred. Illustrative of the preferred Freon liquids are trichloromonofluoromethane, dichlorodifluoromethane, monobromotrifluoromethane, monochlorodifluoroethane, trichlorotrifluoroethane, dichlorotetrafluoroethane, octafluorocyclobutane, and tetrachlorodifluoroethane.

The amount of impregnating inert organic liquid is controlled for optimum results; broadly speaking it is between 15 parts of liquid per 100 parts of tobacco and about the maximum impregnation amount of liquid. The maximum impregnation amount is the maximum amount which can be taken up by the tobacco. In general the amount of impregnating liquid used is between about 25 parts and about 350 parts per 100 parts of tobacco. As with water there is a tendency to

impart mechanical difficulties in the handling of the tobacco impregnated with the higher amounts of liquid.

When operating with the preferred organic liquids it is preferred to use between about 40 and 250 parts per 100 parts of tobacco.

The temperature and pressure conditions under which the tobacco is contacted with the organic liquid are not critical, and generally speaking, ordinary room temperatures and pressures are entirely satisfactory. No special equipment is required for impregnating the tobacco with the inert organic liquid and impregnation can be carried out in any suitable type of tank, drum or other container. However, in the case of liquids having a low boiling point or high vapor pressure, the impregnation should be carried out at reduced temperatures or elevated pressures so that the liquid does not vaporize during the equilibration step.

After the tobacco has been thoroughly impregnated with the organic liquid the organic liquid is rapidly removed therefrom. This is accomplished by passing a hot gas through the impregnated tobacco to rapidly remove the organic liquid in a short period, such as on the order of a few seconds, as for example a period of less than about 4 seconds. In order to obtain the desired volume increase of tobacco and avoid impairing flavor quality, it is particularly advantageous to remove the organic impregnating liquid rapidly. Use of hot gas at a temperature of between 250° F. and 400° F. effectively removes the impregnating liquid very rapidly so as to cause expansion of the tobacco structure while avoiding shattering the tobacco into dust or fines. When processing cigarette cut filler, the expansion of the structure also causes delamination of laminated shreds which serves to increase the filling capacity and also improves the burning qualities of the filler. The organic liquid removal is preferably carried out at substantially atmospheric pressure but it can be carried out at super-atmospheric pressures when using very low boiling liquid. The gas is employed at a temperature at least about 200° F. higher than the boiling point of the organic liquid employed for impregnation. The temperature of the gas thus depends on the boiling point of the organic impregnating liquid. It is preferred to avoid use of gas temperatures higher than about 400° F. so as to avoid flavor impairment of the tobacco composition. The gas is preferably maintained at a temperature below about 350° F. The hot gas is preferably a mixture of vaporized organic liquid and steam, but other hot gases such as, for example, air, nitrogen, carbon dioxide, gaseous organic liquid or mixtures thereof or any other gas which is inert with respect to the tobacco and the volatile organic impregnating liquid can be advantageously employed.

After evaporative removal of the organic impregnating liquid from the tobacco the organic liquid can be recovered, condensed and recycled for further use. The expanded tobacco is then reordered to the water content desired for the particular end use. By reordering it is meant that the moisture content of the expanded tobacco is adjusted to a desired value such as, for example, 12-13% for cut filler for cigarette making.

The process of the invention is further described with reference to the drawing, the single figure of which illustrates in block diagrammatic form an embodiment of the process of the invention.

Tobacco moistener 1 is a unit adapted for adding water from line 2 to cured tobacco feed from line 3. Moistener 1 may add the water by means of spraying, or passage through a pool of water with provisions made for draining off excess water and for a period of time during which the water diffuses throughout the mass of tobacco. In order to maintain the water soluble components in the tobacco, any water which is drained from the moist tobacco is recycled by way of line 2, thus preventing net extraction of soluble material from the tobacco. In some instances the tobacco may already have a moisture content equal to the desired water content of the moist tobacco. In this case moistener 1 would be bypassed (by way of line 3A).

The moist tobacco is passed by way of conveyor line 4 to impregnator 6 which can, for example, be a closed cylinder provided with a screw for moving the moist tobacco therethrough. Here the moist tobacco is impregnated with organic liquid from line 7. The organic liquid can be added in much the same manner as is the water in moistener 1. Also, any drained liquid from impregnator 6 is recycled (via line 7A) to line 7 in order to reduce losses of liquid soluble components from the tobacco. Impregnator 6 is adapted to operate at moderately elevated temperatures such as 140° F.; usually at autogenous pressure. Imposed pressures can be used to help maintain the organic liquid in the liquid state and to increase the impregnation rate. Illustratively, 700 pounds of cut filler tobacco, 180 pounds of water and 1200 pounds of Freon 11 can be introduced into impregnator 6 with the tobacco remaining in the impregnator for approximately 30 minutes.

The moist, impregnated tobacco is then passed by way of line 8 to line 9 for introduction into tobacco expander 13. A gaseous mixture such as Freon and steam is passed from gas heater 11 by way of line 9 into expander 13 where the hot gas and the moist impregnated tobacco are thoroughly intermingled. A sufficient flow of gas is used to effect evaporative removal of the impregnated liquid from the tobacco at a rapid rate. Fan 12 is employed for flowing the hot gas through expander 13. Illustratively, when expanding 700 pounds of moist, impregnated tobacco per hour a gaseous mixture of 280,000 pounds of Freon 11 and 38,700 pounds of steam per hour are introduced into expander 13 at a temperature of about 340° F. and a linear velocity of approximately 27 feet per second. With an expander unit of 84 feet in height, the moist impregnated tobacco is contacted with the hot gas for approximately 3.1 seconds.

In expander unit 13 the tobacco is expanded (increased in filling capacity) with the hot gas carrying the expanded tobacco into separator 14. Separator 14 can be any conventional form of separator such as a cyclone type. The expanded tobacco product is withdrawn from separator 14 by way of line 16 and passed, if desired, for processing economy, into a residual liquid removal operation in unit 17. Conveniently the expanded tobacco is contacted with steam introduced through line 18 in an amount sufficient to vaporize all of the residual organic liquid. The condensed steam from residual removal operation 17 is passed by way of line 19 to a recovery operation for recovery of the organic liquid content.

Normally, the organic liquid-free tobacco from residual liquid removal operation 17 is reordered to a water content suitable for storage or immediate use. If reordering is desired, the liquid-free tobacco is passed to reordering operation 21 where it is brought to the desired moisture content by drying or moistening operations well known to the tobacco industry. The reordered expanded tobacco composition (product) is then passed to storage for subsequent use through line 22.

The heating gas and organic liquid vapor and water vapor removed from the moist impregnated tobacco are recycled from separator 14 via line 28 to gas heater 11, thence to expander 13 via line 9. Excess gases from the recycle circuit are bled by way of line 23 into liquid recovery operation 24. Here the water and liquid are condensed. Water is removed by way of line 26 and organic liquid is recycled to impregnator 6 by way of line 27. Where organic liquid immiscible with water is employed, simple decantation is used for separation. Distillation is used for recovery of organic liquids which are miscible with water.

The significant increase in the filling capacity of tobacco achieved in accordance with this invention is readily apparent from the data of the following examples. In order to measure the filling capacity of a cut filler tobacco product as described in the following examples, a compressometer is used which is essentially composed of a cylinder 9.5 centimeters in diameter with a graduated scale on the side. A piston 9.4 centimeters in diameter slides in the cylinder. Pressure is applied to the piston and volume in milliliters of a given weight of tobacco, 100 grams, is determined. Experiments have shown that this

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apparatus will accurately determine the volume (filling capacity) of a given amount of cut tobacco with good reproducibility. The pressure on the tobacco applied by the piston in all examples was 2.30 pounds per square inch applied for five seconds, at which time the volume reading was taken. This pressure corresponds closely to the pressure normally applied by the wrapping paper to tobacco in cigarettes. The moisture content of the tobacco affects the filling capacity values determined by this method, therefore comparative filling capacities were obtained at similar moisture contents.

EXAMPLE 1

Regular blended cigarette cut filler, 4500 grams containing 12.7% moisture (14.5 parts of water per 100 parts of tobacco), was sprayed with 1125 milliliters of water and bulked one hour. The moist tobacco was dipped in Freon-MF liquid utilizing a total of 8 liters of the liquid (300 parts of Freon-MF per 100 parts of tobacco). The tobacco was sealed in a pressure vessel, which was then heated 75 minutes by water at 133° F.; internal pressure was 30 pounds per square inch, gauge, at the end of the heating period. The vessel was then cooled by water at 50° F. for 15 minutes, and 2650 milliliters of excess liquid Freon-MF was drained from the vessel affording a net impregnation of 201 parts of Freon-MF per 100 parts of tobacco. The tobacco was then intimately contacted in a vertical column with a hot gas mixture, comprising air, water vapor, and gaseous Freon-MF, at a gas inlet temperature of 330° F. for a contact time of about 2 seconds. Tobacco from the hot gas contacting was reordered with a water spray and bulked overnight (allowed to stand in a closed vessel overnight to equilibrate the moisture).

	Percent Moisture	Filling Capacity, ml./100 g.	Percent Increased Filling Capacity
Control.....	12.7	422	
Treated product.....	12.4	596	41

EXAMPLE 2

Regular blended cigarette cut filler, 4500 grams containing 12.7% moisture, was sprayed with 450 milliliters of water and bulked overnight (26 parts of water per 100 parts of tobacco). The moist tobacco was dipped in Freon-MF liquid comprising that drained from a previous run, utilizing a total of 8 liters of the liquid (300 parts of Freon-MF per 100 parts of tobacco). The tobacco was sealed in a pressure vessel, which was then heated for 90 minutes by water at 133° F.; internal pressure was 31 pounds per square inch, gauge, at the end of the heating period. The vessel was then cooled by water at 50° F. for 20 minutes, and 3150 milliliters of excess liquid Freon-MF was drained from the vessel providing a net impregnation of 182 parts of Freon-MF per 100 parts of tobacco. The tobacco was then intimately contacted in a vertical column with a hot gas mixture, comprising air, water vapor, and Freon-MF gas, at a gas inlet temperature of 330° F. for a contact time of about 1 second. Tobacco feed rate was uniform over a period of 20 minutes. Tobacco from the hot gas contacting was reordered with a water spray and bulked overnight.

	Percent Moisture	Filling Capacity, ml./100 g.	Percent Increased Filling Capacity
Control.....	12.7	422	
Treated product.....	12.2	595	41

EXAMPLE 3

Regular blended cigarette cut filler, 4500 grams containing 12.1% moisture, was sprayed with 225 milliliters of water and bulked overnight (19.3 parts of water per 100 parts of tobacco). The moist tobacco was dipped in Freon-MF liquid com-

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prising that drained from a previous run, using a total of 8 liters of the liquid (298 parts of Freon-MF per 100 parts of tobacco). The tobacco was sealed in a pressure vessel, which was then heated for 90 minutes by water at 133° F. The vessel was then cooled by water at 50° F. for 40 minutes, and 4200 milliliters of excess liquid Freon-MF was drained from the vessel providing a net impregnation of 142 parts of Freon-MF per 100 parts of tobacco. The tobacco was then intimately contacted by passing it through a vertical column with a hot gas mixture, comprising air, water vapor, and Freon-MF gas, at a gas inlet temperature of 341° F. for a contact time of about 0.75 seconds. Tobacco from the hot gas contacting was reordered with a water spray and bulked overnight.

	Percent Moisture	Filling Capacity, ml./100 g.	Percent Increased Filling Capacity
Control.....	12.1	430	
Treated product.....	11.8	612	42

EXAMPLE 4

Flue-cured cut filler, 5700 grams containing 11.3% moisture, was sprayed with 570 milliliters of water and bulked one hour (24 parts water per 100 parts of tobacco). The moist tobacco was dipped in Freon-MF liquid comprising that drained from a previous run, using a total of 12 liters of the liquid (350 parts Freon-MF per 100 parts of tobacco). The tobacco was sealed in a pressure vessel, which was then heated for 90 minutes by water at 134° F.; internal pressure was 37 pounds per square inch, gauge, at the end of the heating period. The vessel was then cooled by water at 50° F. for 12 minutes and 3100 milliliters of excess liquid Freon-MF was drained from the vessel giving a net impregnation of 259 parts of Freon-MF per 100 parts of tobacco. The tobacco was then intimately contacted by passing it through a vertical column with a hot gas mixture comprising air, water vapor, and Freon-MF gas, at a gas inlet temperature of 343° F. for a contact time of about 0.7 seconds. Tobacco feed rate was uniform over a period of 17 minutes. Tobacco from the hot gas contacting was reordered with a water spray and bulked overnight.

	Percent Moisture	Filling Capacity, ml./100 g.	Percent Increased Filling Capacity
Control.....	11.3	463	
Treated product.....	11.6	731	58

EXAMPLE 5

Burley cut filler, 3920 grams containing 11.6% moisture, was sprayed with 392 milliliters of water and bulked overnight (24.4 parts of water per 100 parts of tobacco). The moist tobacco was dipped in Freon-MF liquid comprising that drained from a previous run, using a total of 7 liters of the liquid. The tobacco was sealed in a pressure vessel, which was then heated for 90 minutes by water at 127° F.; internal pressure was 26 pounds per square inch, gauge, at the end of the heating period. The vessel was then cooled by water at 50° F. for 20 minutes, and 2700 milliliters of excess liquid Freon-MF was drained from the vessel. The tobacco was then intimately contacted by passing it through a vertical column with a hot gas mixture, comprising air, water vapor, and Freon-MF gas, at a gas inlet temperature of 335° F. for a contact time of about 0.7 seconds. Tobacco feed rate was uniform over a period of 7 minutes. Tobacco from the hot gas contacting was reordered with a water spray and bulked overnight.

	Percent Moisture	Filling Capacity, ml./100 g.	Percent Increased Filling Capacity
Control.....	11.6	427	
Treated product.....	12.1	496	16

EXAMPLE 6

Turkish cut filler, 5700 grams containing 11.6% moisture was sprayed with 570 milliliters of water and bulked one hour (24.4 parts water per 100 parts of tobacco). The moist tobacco was dipped in Freon-MF liquid comprising that drained from a previous run, using a total of 11 liters of the liquid (322 parts Freon-MF per 100 parts of tobacco). The tobacco was sealed in a pressure vessel, which was then heated for 90 minutes by water at 127° F.; internal pressure was 27 pounds per square inch, gauge, at the end of the heating period. The vessel was then cooled by water at 50° F. for 12 minutes, and 4500 milliliters of excess liquid Freon-MF was drained from the vessel giving a net impregnation of 190 parts of Freon-MF per 100 parts of tobacco. The tobacco was then intimately contacted by passing it through a vertical column with a hot gas mixture, comprising air, water vapor, and Freon-MF gas, at a gas inlet temperature of 339° F. for a contact time of about 0.7 seconds. Tobacco feed rate was uniform over a period of 13 minutes. Tobacco from the hot gas contacting was reordered with a water spray and bulked overnight.

	Percent Moisture	Filling Capacity, ml./100 g.	Percent Increased Filling Capacity
Control.....	11.6	415	-----
Treated product.....	12.0	567	----- 37

EXAMPLE 7

Regular blended cigarette cut filler, 5700 grams containing 18.75% moisture, was dipped in Freon-MF liquid comprising that drained from a previous run, using a total of 10 liters of the liquid (318 parts Freon-MF per 100 parts of tobacco). The tobacco was sealed in a pressure vessel, which was then heated for 45 minutes by water at 149° F.; internal pressure was 40 pounds per square inch, gauge, at the end of the heating period. The vessel was then cooled by water at 50° F. for 20 minutes, and 4950 milliliters of excess liquid Freon-MF was drained from the vessel giving a net impregnation of 161 parts of Freon-MF per 100 parts of tobacco. The tobacco was then intimately contacted by passing it through a vertical column with a hot gas mixture, comprising air, water vapor, and Freon-MF gas, at a gas inlet temperature of 347° F. for a contact time of about 0.7 seconds. The tobacco feed rate was uniform over a period of 16 minutes. Tobacco from the hot gas contacting was reordered with a water spray and bulked overnight.

	Percent Moisture	Filling Capacity, ml./100 g.	Percent Increased Filling Capacity
Control.....	12.7	422	-----
Treated product.....	12.5	613	----- 45

EXAMPLE 8

Regular blended cigarette cut filler, 5700 grams containing 18.85% moisture, was placed in a pressure vessel, and 8 liters of Freon-MF liquid, comprising that drained from a previous run, was introduced into the vessel (225 parts Freon-MF per 100 parts of tobacco). The vessel was sealed and heated for one hour by water at 149° F.; internal pressure was 39 pounds per square inch, gauge, at the end of the heating period. The vessel was then cooled by water at 50° F. for 8 minutes, and 4300 milliliters of excess liquid Freon-MF was drained from the vessel giving a net impregnation of 118 parts of Freon-MF per 100 parts of tobacco. The impregnated tobacco was then intimately contacted by passing it through a vertical column with a hot gas mixture, comprising air, water vapor, and Freon-MF gas, at a gas inlet temperature of 347° F. for a contact time of about 0.7 seconds. The tobacco feed rate was

uniform over a period of 13 minutes. Tobacco from the hot gas contacting was reordered with a water spray and bulked overnight.

	Percent Moisture	Filling Capacity, ml./100 g.	Percent Increased Filling Capacity
Control.....	12.1	430	-----
Treated product.....	12.1	628	----- 46

EXAMPLE 9

Regular blended cigarette cut filler, 5700 grams containing 18.1% moisture, was placed in a pressure vessel and 8 liters of Freon-MF liquid, comprising that drained from a previous run, was poured over the tobacco, and 2700 milliliters of excess liquid Freon-MF was drained from the vessel. The vessel was then sealed and heated for one hour by water at 151° F.; internal pressure was 39 pounds per square inch, gauge, at the end of the heating period. The vessel was then cooled by water at 50° F. for 11 minutes, and 2400 milliliters more excess liquid Freon-MF was drained from the vessel. The impregnated tobacco was then intimately contacted by passing it through a vertical column with a hot gas mixture, comprising air, water vapor, and Freon-MF gas, at a gas inlet temperature of 347° F. for a contact time of the tobacco with the hot gases of about 0.7 seconds. The tobacco feed rate was uniform over a period of 12 1/4 minutes. Tobacco from the hot gas contacting was cooled and reordered with a water spray, and bulked overnight.

	Percent Moisture	Filling Capacity, ml./100 g.	Percent Increased Filling Capacity
Control.....	12.1	430	-----
Treated product.....	12.0	620	----- 44

EXAMPLE 10

Flue-cured cut filler, 5700 grams containing 17.3% moisture, was placed in a pressure vessel, and 10 liters of Freon-MF liquid, comprising that drained from a previous run, was poured over the tobacco (313 parts Freon-MF per 100 parts of tobacco). The vessel was sealed and heated for one hour by water at 147° F.; internal pressure was 40 pounds per square inch, gauge, at the end of the heating period. The vessel was then cooled by water at 50° F. for 16 minutes, and 4000 milliliters of excess liquid Freon-MF was drained from the vessel giving a net impregnation of 188 parts of Freon-MF per 100 parts of tobacco. The liquid-impregnated tobacco was then intimately contacted by passing it through a vertical column with a hot gas mixture, comprising air, water vapor, and Freon-MF gas, at a gas inlet temperature of 343° F. for a contact time of about 0.65 seconds. The tobacco feed rate was uniform over a period of 12 3/4 minutes. Tobacco from the hot gas contacting was cooled, and reordered with a water spray, and bulked overnight.

	Percent Moisture	Filling Capacity, ml./100 g.	Percent Increased Filling Capacity
Control.....	11.3	463	-----
Treated product.....	12.0	725	----- 57

EXAMPLE 11

Flue-cured cut filler, 5700 grams containing 17.6% moisture, was placed in a pressure vessel and 8 liters of Freon-MF liquid, comprising that drained from a previous run, was poured over the tobacco, and 2000 milliliters of excess liquid Freon-MF was drained from the vessel. The vessel was then sealed and heated for one hour by water at 151° F.; internal

pressure was 31 pounds per square inch, gauge, at the end of the heating period. The vessel was then cooled by water at 50° F. for 6 minutes, and 1500 milliliters more excess liquid Freon-MF was drained from the vessel. The tobacco was then intimately contacted by passing it through a vertical column with a flowing hot gas mixture, comprising air, water vapor, and Freon-MF gas, at a gas inlet temperature of 339° F. for a contact time of tobacco with hot gas of about 0.65 seconds. The tobacco feed rate was uniform over a period of 10 minutes. Tobacco from the hot gas contacting was reordered with a water spray and bulked overnight.

	Percent Moisture	Filling Capacity, ml./100 g.	Percent Increased Filling Capacity
Control.....	11.3	463	
Treated product.....	12.3	704	52

EXAMPLE 12

Flue-cured cut filler, 5700 grams containing 17.4% moisture, was placed in a pressure vessel, and 6 liters of Freon-MF liquid, comprising that drained from a previous run, was poured over the tobacco. The vessel was sealed and heated for one hour by water at 145° F.; internal pressure was 33 pounds per square inch, gauge, at the end of the heating period. The vessel was then cooled by water at 50° F. for 10 minutes, and 2000 milliliters of excess liquid Freon-MF was drained from the vessel. The impregnated tobacco was then intimately contacted by passing it through a vertical column with a hot gas stream, comprising a mixture of air, water vapor, and Freon-MF gas, at a gas inlet temperature of 344° F. for a tobacco-hot gas contact time of about 0.65 seconds. The tobacco and hot gas feed rates were uniform over a period of 9 3/4 minutes. Tobacco was separated from the hot gas contacting, was cooled and reordered with a water spray and bulked overnight.

	Percent Moisture	Filling Capacity, ml./100 g.	Percent Increased Filling Capacity
Control.....	11.3	463	
Treated product.....	12.0	720	56

EXAMPLE 13

Flue-cured cut filler, 5700 grams, was placed in a pressure vessel and 28 liters of a mixture consisting of three parts Freon-MF and one part isopropanol, by volume, was poured over the tobacco. The vessel was then sealed and heated for one hour by hot water (140° F.); internal pressure was 60 pounds per square inch, gauge, at the end of the heating period. Pressure was relieved by draining off the excess liquid with consequent flashing off of vapors; 13.2 liters of the liquid was collected. The vessel was further cooled by tap water and an additional 2.3 liters of excess liquid drained from the vessel. The treated tobacco was then intimately contacted with a flowing hot gas mixture, comprising air, water vapor, isopropanol vapor, and Freon-MF gas. Tobacco from the hot gas contacting was reordered with a water spray and bulked overnight.

	Percent Moisture	Filling Capacity, ml./100 g.	Percent Increased Filling Capacity
Control.....		387	
Treated product.....	12.8	654	69

¹ Including alcohol.

Freon-MF employed in the specific examples hereof is trichloromonofluoromethane having a boiling point of about 75° F.

The process of the present invention can be applied to cured tobacco in the form of leaf (including veins and stems), strips (leaf with stems removed) or cut filler (strips shredded for cigarette making). By using leaf or strips, the types or grades of tobacco can be selected for which the process is most effective, thereby achieving results near the maximum while holding processing costs to a minimum. Where treatment of stems is not necessary, strips are preferred rather than leaf, and in any event stems can be processed separately. If the entire blend is to be treated, then cut filler is preferably utilized.

The advantages of the invention are readily apparent from the foregoing. By the process of the invention, the filling capacity of tobacco can be significantly increased with the attending economic advantages. Vaporization and removal of the organic liquid from the impregnated tobacco at high temperatures and short contact times permits the advantages of the invention to be realized with the use of minimum size equipment and with high production rates.

Those modifications and equivalents which fall within the spirit of the invention and the scope of the appended claims are to be considered part of the invention.

We claim:

1. A process of increasing the filling capacity of tobacco which comprises providing a stream of tobacco moistened with a volatile organic liquid, flowing said moistened tobacco stream into a rapidly moving stream of a gas heated to a temperature substantially above the boiling point of the organic liquid at the prevailing pressure whereby the liquid is rapidly volatilized and the tobacco is expanded in a period of less than about 4 seconds, and separating the expanded tobacco from the hot gas and volatilized liquid stream.
2. The process of Claim 1 in which the organic liquid is a halogenated hydrocarbon.
3. The process of Claim 1 in which the organic liquid is trichloromonofluoromethane.
4. The process of Claim 1 in which the amount of organic liquid in the moistened tobacco flowed to the gas stream is at least 15 parts by weight of liquid per 100 parts by weight of tobacco (dry basis).
5. The process of Claim 1 wherein at least a portion of the volatilized liquid separated from the expanded tobacco is heated and recycled as the gas stream into which said moistened tobacco is flowed.
6. A process of increasing the filling capacity of tobacco which comprises contacting tobacco having a moisture content of between 10 and 100 parts of water per 100 parts of tobacco (dry basis) with a volatile organic liquid in an amount to impregnate the moist tobacco with said liquid, suspending the moist tobacco impregnated with said organic liquid in a stream of rapidly moving gas heated to a temperature substantially above the boiling point of the organic liquid at the prevailing pressure whereby the organic liquid is rapidly vaporized within the tobacco and the tobacco is expanded in a period of less than about 4 seconds, and then separating the tobacco from the gas stream containing vapors of said organic liquid.
7. The process recited in Claim 6 wherein the last mentioned gas stream including said vapors is at least in part heated and recycled to form at least a part of the first mentioned stream in which the tobacco is suspended.
8. The process of Claim 6 in which the tobacco has an initial moisture content of between 13 and 50 parts of water per 100 parts of tobacco (dry basis) and the organic liquid content of the impregnated tobacco when initially contacted with the hot suspending gas is in excess of about 15 parts per 100 parts of tobacco (dry basis).
9. The process of Claim 6 in which the tobacco is shredded tobacco.
10. The process of Claim 6 in which the tobacco is shredded tobacco and the amount of organic liquid in the moistened tobacco when initially suspended in the hot gas is between about 25 and 350 parts of liquid per 100 parts of tobacco (dry basis).