

PATENT SPECIFICATION

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(54) PROCESS FOR PREPARING TOBACCO

(71) We, R. J. REYNOLDS TOBACCO COMPANY, a Corporation organized under the laws of the State of New Jersey, United States of America, of Winston Salem, State of North Carolina, United States of America, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

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.

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 present invention provides a process for increasing the filling capacity of tobacco which

comprises contacting tobacco with a sufficient quantity of a volatile organic liquid to impregnate same and thereafter passing a gas into contact with said impregnated tobacco, said gas being heated to a temperature of at least 30° F. above the boiling point of said liquid at the prevailing pressure, whereby said tobacco is expanded and said liquid is separated therefrom in the vapor state.

The process of this 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. If the entire blend is to be treated, then cut filler is preferably utilized.

One of the preferred aspects of the invention is to use a moist cured tobacco.

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 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 ketone; 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 cyclohexane.

The halogen substituted hydrocarbons may be aliphatic, cycloaliphatic or aromatic in nature. One or more halogen atoms may be present in each halohydrocarbon molecule. Two or more different halogens may be present in a single halohydrocarbon molecule. Illustrative halohydrocarbons 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. (The word "Freon" is a registered Trade Mark). Illustrative of the preferred Freon liquids are trichloromonofluoromethane, dichlorodifluoromethane, monobromotrifluoromethane, monochlorodifluoromethane, trichlorotrifluoroethane, dichlorotetrafluoroethane, octafluorocyclobutane and tetrachlorodifluoroethane.

The amount of impregnating inert organic liquid is controlled for optimum results; broadly speaking it is between 15 parts by weight of liquid per 100 parts by weight 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 to 350 parts by weight per 100 parts by weight of tobacco. 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 to 250 parts by weight per 100 parts by weight 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 equilibrium step. Preferably it is carried out at a temperature below about 170° F. in order to avoid impairing the flavor of the tobacco.

After the tobacco has been impregnated with the organic liquid, it is preferred that the tobacco be allowed to equilibrate, i.e., remain in contact, with the liquid for a period of time. Here again this time will depend upon the physical state of the tobacco and the particular liquid that may be selected for impregnation. In the case of leaf, stems or strips, the contact time may be longer than for the treatment of more finely divided tobacco particles such as cut filler. Periods from a few minutes to as long as 24 hours are satisfactory. Also 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 moist strips and shreds are: 150° F., 0.5 to 1 hour; 100° F., 12-24 hours; 75° F., 40-100 hours.

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 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 a hot gas at a temperature of between 250 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 of at least about 30° F. and preferably at least 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

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15	80	15
20	85	20
25	90	25
30	95	30
35	100	35
40	105	40
45	110	45
50	115	50
55	120	55
60	125	60
65	130	65

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avoid flavor impairment of the tobacco compo-
sition. The gas is preferably maintained at a
temperature below about 350° F. The hot gas
is preferably steam or 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 or-
ganic 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 ex-
panded tobacco is adjusted to a desired value
such as, for example, 12—13% for cut filler
for cigarette making. In accordance with one
embodiment of this invention, a moist, cured
tobacco having a water content in the range
of about 10 to 100 parts by weight of water
per 100 parts by weight of tobacco is employed
prior to the organic liquid impregnation. Pre-
ferably, 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 by weight of water
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; toba-
co which is too dry tends to disintegrate and
to produce fines. The amount of water em-
ployed can be large enough to permit the to-
bacco to be soaking wet; however, the use of
water in amounts such that the tobacco is very
wet is preferably avoided because of mechan-
ical difficulties in handling such wet masses of
tobacco. The upper limit of 100 parts of mois-
ture per 100 parts of tobacco is a practical
preferred operating limit. The moistening
operation can be carried out at ambient tem-
peratures and also at elevated temperatures.
It is usually preferred to maintain the tobacco
below about 170° F. in order to avoid impair-
ing 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 accom-
plish thorough impregnation of the tobacco.

The process of the invention is further de-
scribed with reference to the drawing, the

single figure of which illustrates in block dia-
grammatic 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 drain-
ing 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 to-
bacco. In some instances the tobacco may al-
ready 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 con-
veyor line 4 to impregnator 6 which can, for
example, be a closed cylinder provided with
a screw for moving the moist tobacco there-
through. Here the moist tobacco is impregnat-
ed 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 moder-
ately elevated temperatures such as 140° F.;
usually at autogenous pressure. Imposed pres-
sures 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 introduc-
tion into tobacco expander 13. A gaseous mix-
ture 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 impregnat-
ed tobacco are thoroughly intermingled. A
sufficient flow of gas is used to effect evapora-
tive 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 intro-
duced into expander 13 at a temperature of
about 340° F. and a linear velocity of approxi-
mately 27 feet per second. With an expander
unit of 84 feet in height, the moist impregnat-
ed 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.

By the process of this invention it is possible to increase the filling capacity of cured tobacco by as much as 20 to 100 percent or even more. This tobacco product, having decreased bulk density, is particularly useful for the manufacture of smoking products such as cigarettes, cigars and pipe tobacco. The bulk density having been decreased, considerable savings in tobacco cost are obtained in the manufacture of these smoking products without sacrificing quality.

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 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.

For a more complete understanding of this invention, reference will now be made to several examples which are illustrative thereof:

EXAMPLE 1

A cured cut cigarette tobacco containing 12.3% moisture and having a filling capacity of 458 milliliters when determined by the procedure previously indicated was mixed with a sufficient amount of ethanol (boiling point about 173° F.) to thoroughly impregnate the tobacco. The alcohol-treated tobacco was equilibrated in a closed container for about 20 hours, after which time a stream of steam having a temperature of 212° F. was passed through the alcohol-treated tobacco for a period of five minutes. After this time the tobacco had expanded and the alcohol had been completely removed by vaporization. The moisture content of the tobacco was then adjusted to 10.9% by weight. The resulting tobacco was suitable for use in the manufacture of cigarettes and had a filling capacity of 517 milliliters, which represents an increase of approximately 12.9% by volume over the original tobacco.

The procedure of Example 1 was repeated using steam and the results are noted in Table I.

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TABLE I

Example	Organic Liquid	Time subjected to steam in minutes	Filling capacity milliliters	Percent by volume increase in filling capacity	Adjusted moisture content in % by weight
2	acetone (b.p. 134°F.)	3	533	19.7	11.1
3	ethyl ether (b.p. 94.2°F.)	2	614	34.1	9.7
4	benzene (b.p. 176°F.)	5	522	14.0	12.0
5	hexane (b.p. 156°F.)	5	576	25.8	12.1
6	pentane (b.p. 95°F.)	2	704	53.7	12.1
7	pentane	1	921	101.0	9.6
8	dichloromethane (b.p. 104°F.)	1.25	605	32.2	10.0
9	Freon-11 trichloromonofluoromethane (b.p. 75°F.) under slight superatmospheric pressure	2	682	46.8	10.1

EXAMPLE 10

Shredded flue-cured tobacco stems (200 grams) were treated with 250 milliliters of pentane and equilibrated overnight in a closed container. The treated tobacco was then exposed to steam at 212°F. for a period of one minute and dried in air. The moisture content of the resulting tobacco was 13.5% and its filling capacity was 921 milliliters. A control sample which had not been treated with the pentane had a moisture content of 14.0 and a filling capacity of 466 milliliters. Thus, the filling capacity due to the pentane treatment followed by steaming was increased approximately 98.6%.

EXAMPLE 11

The experiment of Example 10 was repeated except that ethyl ether was used as the organic liquid. The moisture content of the final tobacco was 14.0% and the filling capacity was 563 milliliters, representing an increase of approximately 21% over the control.

EXAMPLE 12

The experiment of Example 10 was repeated using shredded burley tobacco stems with

pentane as the organic liquid. The final product had a moisture content of 12.5% and a filling capacity of 1036 milliliters. The control which had not been subjected to pentane had a moisture content of 12.6% and a filling capacity of 743 milliliters. Thus, the pentane-treated and steamed sample showed an increase in filling capacity over the control of approximately 39.4%.

EXAMPLE 13

The process of Example 12 was repeated using shredded burley tobacco stems and ethyl ether as the organic liquid. The final moisture content was 13.1% and the filling capacity was 821 milliliters, representing a 10.5% increase over the control.

EXAMPLE 14

A sample (2633 grams) of flue-cured tobacco strips was equilibrated with 4500 milliliters of pentane in a closed container for 20 hours. Small batches (100 grams or less) of the pentane-treated tobacco were then exposed to steam at 212°F. in a wire mesh basket for five to thirty seconds and then dried in air. The resulting expanded strips were shredded

in the conventional manner and the tobacco was fabricated into cigarettes. Control cigarettes were made from untreated strips and the

physical characteristics of the cigarettes from the expanded and untreated flue-cured tobaccos are compared in the following Table II:

TABLE II

Determination ¹	Control ²	Expanded ²
Weight, g.	1.036	0.769
Draft Resistance, in.	2.10	2.26
Firmness, 0.1 mm.	9.83	9.58
Circumference, mm.	25.33	25.27
Moisture, %	12.08	12.20

¹Data based on average of 50 cigarettes (70 mm).

²Cigarettes stored at 63% humidity for 94 hours.

EXAMPLE 15

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, i.e. allowed to stand one hour to permit even distribution of the added water throughout the tobacco mass. 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 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).

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

The procedure of Example 15 is carried out for examples 16 to 25 and the results noted in Table III.

Example

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TABLE III

Example	16	17	18	19	20	21	22	23	24	25
a	a ¹	a ¹	a ²	a ³	a ⁴	a ¹	a ¹	a ¹	a ²	a ²
b	4500	4500	5700	3920	5700	5700	5700	5700	5700	5700
c	12.7	12.1	11.3	11.6	11.6	18.75	18.85	18.1	17.3	17.4
d	450	225	570	392	570	—	—	—	—	—
e	over- night	over- night	1 hr.	over- night	1 hr.	—	—	—	—	—
f	26	19.3	24	24.4	24.4	—	—	—	—	—
g	8	8	12	7	11	10	8	8	10	6
h	300	298	350	—	322	318	225	—	313	—
i	90	90	90	90	90	45	60	60	60	60
j	133	133	134	127	127	149	149	151	147	145
k	31	31	37	26	27	40	39	39	40	33
l	50	50	50	50	50	50	50	50	50	50
m	20	40	12	20	12	20	8	11	16	10
n	3150	4200	3100	2700	4500	4950	4300	2400	4000	2000
o	182	142	259	—	190	161	118	—	188	—
p	330	341	343	335	339	347	347	347	343	344
q	1	0.75	0.7	0.7	0.7	0.7	0.7	0.7	0.65	0.65
r	20	—	17	7	13	16	13	12.25	12.75	9.75
s	12.7	12.1	11.3	11.6	11.6	12.7	12.1	12.1	11.3	11.3
t	422	430	463	427	415	430	430	473	463	463
u	12.2	11.8	11.6	12.1	12.0	12.5	12.1	12.0	12.0	12.0
v	595	612	731	496	567	613	628	620	725	720
w	41	42	58	16	37	45	46	44	57	56

a — Type of tobacco used.

a¹ — Regular blended cigarette cut filler.

a² — Flue-cured cut filler

a³ — Burley cut filler.

a⁴ — Turkish cut filler.

b — amount of tobacco in grams.

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Footnotes to Table III Continued

- c — % by weight of moisture.
- d — Milliliters of water sprayed.
- e — Time of water bulking.
- f — Parts by weight of water per 100 parts of tobacco for water bulking.
- g — Liters of Freon -MF liquid comprising that drained from a previous run.
- h — Parts by weight of Freon -MF per 100 parts of tobacco.
- i — Minutes for heating pressure vessel.
- j — °F. temperature of water used to heat the pressure vessel.
- k — Internal pressure of vessel in pounds per square inch, gauge.
- l — °F. temperature of water to cool vessel.
- m — Minutes for cooling vessel.
- n — Milliliters of excess liquid Freon -MF drained from the vessel.
- o — Net impregnation of parts by weight of Freon-MF per 100 parts of tobacco.
- p — °F. gas inlet temperature of air, water vapor, and Freon-MF gas.
- q — Contact time in seconds.
- r — Period in minutes of uniform tobacco feed rate.
- s — Percent by weight of moisture in control.
- t — Filling capacity in ml/100 grams of control.
- u — Percent by weight moisture in product treated by the Example.
- v — Filling capacity in ml/100 grams of treated product.
- w — Percent by volume increase in filling capacity of treated product.

EXAMPLE 26

- 5 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.

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

EXAMPLE 27

Flue-cured cut filler, 5,700 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 spray and bulked overnight.

	% Moisture	Filling Capacity ml/100 g.	% Increased Filling Capacity
Control	—	387	
Treated product	12.8 (Including alcohol)	654	69

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.

WHAT WE CLAIM IS:—

1. A process for increasing the filling capacity of tobacco which comprises contacting tobacco with a sufficient quantity of a volatile organic liquid to impregnate same and thereafter passing a gas into contact with said impregnated tobacco, said gas being heated to a temperature of at least 30° F. above the boiling point of said liquid at the prevailing pressure, whereby said tobacco is expanded and said liquid is separated therefrom in the vapor state.

2. The process of claim 1 in which said gas is steam.

3. The process of claim 1 or 2 in which the liquid is a hydrocarbon or a halogenated hydrocarbon.

4. The process of claim 1, 2 or 3 wherein the tobacco is moist.

5. The process of any of the preceeding claims wherein said gas is at a temperature between 250° F. and 400° F.

6. The process of any of the preceeding claims wherein the impregnated tobacco is contacted in a vertical column with the gas being flowed upwardly therethrough.

7. The process of any of the preceeding claims wherein the hot gas carries the tobacco into a separator where the expanded tobacco is separated from the volatile organic liquid vapor.

8. The process of any of the preceeding claims wherein the volatile organic liquid is employed in an amount between about 25 parts and 350 parts per 100 parts of tobacco (dry basis).

9. The process of claim 8 wherein the amount of volatile organic liquid is between about 40 parts and 250 parts per 100 parts of tobacco (dry basis).

10. The process of any of the preceeding claims wherein the volatile organic liquid is trichloromonofluoromethane.

11. The process of any of the preceeding claims wherein the volatile organic liquid separated from the expanded tobacco is recovered.

12. The process of any of the preceeding claims wherein the impregnation with the volatile organic liquid is carried out at an elevated temperature below 170° F.

13. The process of any of claims 5 — 12 wherein contact of the impregnated tobacco with the hot gas effects said expansion of tobacco in a period of less than 4 seconds.

14. The process of any of claims 5—13 wherein the moisture content of the tobacco

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EXAMPLE 27

Flue-cured cut filler, 5,700 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 spray and bulked overnight.

	% Moisture	Filling Capacity ml/100 g.	% Increased Filling Capacity
Control	—	387	
Treated product	12.8 (Including alcohol)	654	69

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.

WHAT WE CLAIM IS:—

1. A process for increasing the filling capacity of tobacco which comprises contacting tobacco with a sufficient quantity of a volatile organic liquid to impregnate same and thereafter passing a gas into contact with said impregnated tobacco, said gas being heated to a temperature of at least 30° F. above the boiling point of said liquid at the prevailing pressure, whereby said tobacco is expanded and said liquid is separated therefrom in the vapor state.

2. The process of claim 1 in which said gas is steam.

3. The process of claim 1 or 2 in which the liquid is a hydrocarbon or a halogenated hydrocarbon.

4. The process of claim 1, 2 or 3 wherein the tobacco is moist.

5. The process of any of the preceding claims wherein said gas is at a temperature between 250° F. and 400° F.

6. The process of any of the preceding claims wherein the impregnated tobacco is contacted in a vertical column with the gas being flowed upwardly therethrough.

7. The process of any of the preceding claims wherein the hot gas carries the tobacco into a separator where the expanded tobacco is separated from the volatile organic liquid vapor.

8. The process of any of the preceding claims wherein the volatile organic liquid is employed in an amount between about 25 parts and 350 parts per 100 parts of tobacco (dry basis).

9. The process of claim 8 wherein the amount of volatile organic liquid is between about 40 parts and 250 parts per 100 parts of tobacco (dry basis).

10. The process of any of the preceding claims wherein the volatile organic liquid is trichloromonofluoromethane.

11. The process of any of the preceding claims wherein the volatile organic liquid separated from the expanded tobacco is recovered.

12. The process of any of the preceding claims wherein the impregnation with the volatile organic liquid is carried out at an elevated temperature below 170° F.

13. The process of any of claims 5—12 wherein contact of the impregnated tobacco with the hot gas effects said expansion of tobacco in a period of less than 4 seconds.

14. The process of any of claims 5—13 wherein the moisture content of the tobacco

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before impregnation is maintained within the range of 10 to 100 parts by weight of water per 100 parts of tobacco (dry basis).

- 5 15. The process of claim 14 wherein the moisture content of the tobacco before impregnation is maintained within the range of 18 to 30 parts by weight of water per 100 parts of tobacco (dry basis).

- 10 16. The process of any of claims 5—15 wherein the recovered expanded tobacco is steamed to remove residual organic liquid therefrom and the moisture content of the so-

treated tobacco is then adjusted to a moisture content suitable for cigarette making.

17. The process of any of claims 5—16 15 wherein the gas passed into contact with the impregnated tobacco is heated to a temperature of at least 200° F. above the boiling point of said liquid at the contacting pressure but below 400° F. 20

18. The process for increasing the filling capacity of tobacco substantially as herein described.

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