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METHOD OF PUFFING TOBACCO STEMS BY MICROWAVE ENERGY

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3 Claims. (Cl. 131—121)

ABSTRACT OF THE DISCLOSURE

This disclosure relates to a method for treating tobacco stems having a moisture content of about 4% to 25% by weight whereby the tobacco stems are expanded or puffed to greatly increase their size and decrease their density by subjecting the stem alone or in the leaf to microwave energy for a period of from 7 to 220 seconds while the leaves or stems are resting on a converter belt positioned so that the longitudinal axes of the stems would be parallel to the energy source which belt carries them into proximity with a microwave generator having a power input of about ½ kw. to 15 kw. and a frequency of from above 900 mc. to below 5,000 mc. at operation temperatures of 0° C. to 200° C., subatmospheric pressures of 10 to 759 mm. Hg and at a distance from the power source of from about ½ inch to about 30 inches.

This invention relates to a method of manufacturing the same. More particularly, the invention relates to a method for treating stems and large veins or midribs which have been removed from tobacco leaves to convert the stems into a form in which they are available for use in smoking articles. The invention also relates to a method for the treatment of tobacco leaves whereby the removal of the stems from the leaves is not required before the leaves can be employed in tobacco products.

Tobacco stems have generally created problems in the tobacco industry and before tobacco could be utilized for the production of smoking articles, such as cigars, cigarettes, cigarillos and the like, it has been the practice to remove the stems and veins which form a part of tobacco leaves from the tobacco leaves. This removal has been accomplished by the use of threshing machines which break up the leaves and remove the stems and most of the veins from the leaves or by means of steaming machines which strip the stems from the tobacco leaves.

The stems and large veins which have been removed from tobacco leaves have not found a ready use in the tobacco industry and many attempts have been made to convert the stems and larger veins (all of which will hereinafter be referred to as "stems") to useful products. For example, attempts have been made to incorporate stems in cigars and cigarettes by crushing the stems and thereafter steaming and rolling the stems prior to their use in the cigarette or cigar filler. It has been found, however, that the undesirable hard wood-like characteristics of the stems have not been removed by such treatment and that the stems, when incorporated in the cigarettes or cigars, have been found to result in uneven burning and in a somewhat less desirable flavor. In addition, the use of stems prepared in such a manner has resulted in minute, rigid stem particles, many of which are readily dislodged from the ends of the tobacco products and can be readily detected by the person smoking the tobacco product due to their sharp nature. In addition, some such hard stem pieces have been found to penetrate the paper wrapper of cigarettes or to deform the cigarette or cigar in an undesirable manner.

Another method which has been proposed for the treatment of stems to make them more acceptable in tobacco

products has been to subject the stems, while still in the tobacco leaves, to a fluid pressure which is released to effect the expansion of the stems in the leaves. This method is disclosed in U.S. Patent No. 2,344,106 to Reed, which issued on Mar. 14 1944. It has been found, however, that such a method is difficult to operate, involving the use of pressure equipment and the like and involving the use of steam in order to prepare the product for the expansion step. Additional disadvantages of such a process include internal cell damage to the tobacco product, rupture of the epidermis and down-grading of the product resulting from the introduction of gases into the leaf. Further, the nature of such a process dictates that stems be treated batchwise so that production line methods cannot be employed.

Another attempt which has been made to treat tobacco stems or tobacco leaves containing stems has involved the use of a high frequency electrostatic field in order to expand the stems. This process is disclosed in U.S. Patent No. 2,739,599 to Abbott, which issued on Mar. 27, 1956. Such a process, while having the theoretical capability to eliminate some of the disadvantages of the crushing and steaming technique and of the pressure technique discussed above, has been found to have its own disadvantages. For example, when such a process is employed for the treatment of stems while still in the leaf, it has been found that the leaf itself is sometimes damaged, due to arcing between the plates which are employed to generate the high frequency electrostatic field. It is believed that such arcing occurs at areas in the leaf having a high mineral content. High spots in the leaf are also believed to be a cause of such arcing. The occurrence of such arcing has been found to require frequent machine shutdowns when such a process is employed. Another disadvantage of such a process results due to the fact that tobacco leaves vary in moisture content. The process is particularly susceptible to uneven absorption of electromagnetic energy from the dielectric field and a non-uniform tobacco product is thus produced. To overcome this disadvantage, it is necessary to employ expensive moisture control of the stem prior to utilizing the stem in such a process. Another disadvantage of such a process results in the fact that burning of the product could occur in portions of the stem which, due to their highly compacted nature, could absorb more energy throughout the highly compacted region. Such burned portions are brittle and have been found to crumble in the course of later treatment of the stems, whereby additional degeneration of the product results. Thus, prior to the present invention, no completely satisfactory process has been found for the utilization of stems.

The present invention is an improvement over the above-described methods for utilizing tobacco stems and provides a commercially practical method for utilizing stems which have been removed from tobacco leaves by treating said stems in a manner such that they can be directly incorporated in a tobacco product, such as a cigarette or a cigar. The present invention also makes possible the use of the entire tobacco leaf by providing a method for treating the tobacco leaf in such manner that it can be directly conditioned and cut to be utilized as filler in cigarettes, cigars and the like.

The present invention provides a novel method for treating tobacco stems and/or tobacco leaves, whereby the stems contained in the tobacco leaves are expanded or puffed to greatly increase the size of the stems and thereby decrease their density. This is accomplished by exposing the stem, alone or in the leaf, to microwave energy under controlled conditions. This may be done in a batch process but is preferably accomplished by placing the stems or leaves on a conveyor belt which carries them into proximity with a microwave generator. For example,

a conveyor belt may be arranged so as to carry the stems into a magnetron microwave oven. Suitable for this purpose is the Raytheon Mark III one magnetron oven or the Raytheon Mark IV two magnetron oven. Other microwave sources which will work well in accordance with the invention include the Atherton Automatic Batch Process, Model B 10 and Microwave Conveyor, Model C-30. The operation can be carried out at an ambient temperature of 0° C. to 200° C. but operates most advantageously over the range at about 20° C. to 150° C. The stems are held at the same ambient temperature as the oven before being exposed to the microwave source. The stems puff well at atmospheric pressure but the invention will also yield a suitable end product when practiced at pressures of 10 to 759 mm. Hg.

The rate and degree of puffing depends on the amount of energy to which the stems are exposed. This in turn is a function of the power input to the microwave source, the length of time the stems are exposed to the source (i.e. the rate of advance of the conveyor belt when that embodiment is used), the frequency (or wave length) of the microwaves, the moisture content of the stem, and the orientation of the stems with respect to the source. The rate of advance of the conveyor belt is adjusted so as to expose the stems to the microwave energy for from 7 to 120 seconds. Longer periods of exposure are necessitated when using a less powerful microwave source. The range of power input to the source which is usable in accordance with the present invention is about ½ kw. to about 15 kw. While there is some puffing at about 900 mc. and at about 6000 mc. preferred conditions involve operation below 6000 mc. and above 900 mc. When a Raytheon Mark III or Mark IV is used, the Mark III may be operated at about 2,450 mc. at about 10 kw. input and the Mark IV at about 2,450 mc. at about 10 kw. input. The distance from the stems to the power source may vary from about ½ inch to about 30 inches. The moisture content of the stems chosen at random varies. Those stems having a higher moisture content tend to puff more rapidly due to the greater internal vapor pressure developed and a somewhat uneven product therefore results. Accordingly, it is desirable to pretreat the stems to bring their moisture content to a uniform level of about 4% to 25%. The invention may be practiced to puff stems having an initial moisture content of 8% to 14%. Each of these variables in turn affects the value of the other parameter. One variable which should be held constant, however, is the orientation of the stem with respect to the power source. The invention can best be practiced by aligning the axes of the stems in the direction of travel of the energy front.

The process is not, however, as sensitive to variation in leaf moisture content and to "hot spots" as are those of the prior art, for example the dielectric process.

The following examples are illustrative:

EXAMPLE 1

Bright stems and unstemmed whole tobacco leaves were exposed to microwave energy in a Raytheon Mark III one magnetron oven and a Raytheon Mark IV two magnetron oven. The leaves were placed at a distance of 4 inches from the source. Each magnetron was operated at 2,450 mc. with a power input of 10 kw. Six tests were conducted in each oven, each test consisting of exposing a different number of layers of stems and/or leaves to the microwave energy. The following exposure times were found necessary to effect satisfactory puffing.

Mark III

Thickness:	Time, secs.
Single layer of stems	20
½" -----	40
1" -----	60
1½" -----	83
2" layer of stems and leaves	120

Mark IV

Single layer of stems	7
½" -----	15
1" -----	36
1½" -----	52
2" layer of stems and leaves	70

It was found that the volume of the stems expanded up to 2.5 times their original size. Puffing was also effected on the stems in the leaf thus obviating pretreatment stemming and the entire leaf was judged usable as filler and compared favorably with products prepared using prior art methods.

EXAMPLE 2

Between 1 and 20 bright and burley leaves containing stems were processed in batches in a two magnetron Raytheon Mark IV oven for from 12 to 190 seconds. It was found that the most efficient puffing operation was accomplished when three leaves were treated simultaneously for 30 to 40 seconds. The burley leaf did not puff as well as did the bright leaf stems. When the two samples were compared against bright leaves whose stems had been puffed by a dielectric method the product prepared in the microwave oven was found to be less burnt and more flavorful. The microwave product was judged less burnt on the basis of organoleptic examination and more flavorful on the basis of a pack aroma test and a smoke test.

EXAMPLE 3

The ease of puffing as a function of stem moisture content was determined for the instant process as well as by a dielectric puffing process.

The instant process consisted of exposing tobacco stems of the bright variety selected from various grades to microwave energy in a Raytheon Mark IV oven for 27 seconds at a distance of 7 inches.

The dielectric process was carried out in a Reeves Electronics (Chicago, Ill.) 10 kw. "Revlac" dielectric oven operating at 10 mc.

The table set out immediately below indicates the percentage of stems that puffed at different moisture levels using the two processes.

Percent Moisture	Dielectric Process	Microwave Process
3.0	Less than 1%-----	2%
5.5	Less than 2%-----	2%
6.3	Approx. 2%-----	4%
8.4	Approx. 3.5%-----	40%
10.0	Approx. 45%-----	80%

It will be appreciated that the microwave process puffed a greater percentage of stems.

EXAMPLE 4

Brightly and burley leaves containing stems were processed as in Example 2. The ambient temperature was varied from 12° C. to 34° C. It was found that the process could be most advantageously practiced in the range from 20° C. to 30° C. The exposure time was a function of the ambient temperature. A relation between the necessary exposure time and ambient temperature existed. At the lower extremity of the permissible ambient temperature range, the optimum exposure time was found to vary from 7 to 220 seconds. At the upper extremity of the permissible ambient temperature range, the optimum exposure time was found to vary between 30 to 160 seconds, depending on the stem material being processed.

EXAMPLE 5

Bright stems and burley stems contain 12% moisture were puffed in a Raytheon Mark V microwave oven to determine the optimum positioning of stems in the oven. The stems were selected so that the samples would be of similar diameter and length. The stems were treated with ultra high frequency microwave energy at horizontal,

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vertical, and intermediate positions to the magnetron source. The stems in the horizontal position required 2-4 times longer treatment than the stems treated in the vertical position. The stems placed at an angle of 45° required intermediate exposures. It was, therefore, determined that the most suitable treatment would be to orientate the stems on a moving belt so that their longitudinal axes would be parallel to the energy source.

I claim:

1. The method of treating tobacco stems which comprises exposing tobacco stems having a moisture content of at least 3% by weight located on a moving belt to a source of microwave energy for a period of from about 7 seconds, the stems being oriented so that their longitudinal axes are aligned in the direction of the travel of the energy front to about 220 seconds.

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2. The method of claim 1 wherein the microwave energy is generated at a frequency of from above 900 mc. to below 5,000 mc.

3. The method of claim 1 wherein the microwave energy is generated at a frequency of 2,450 mc.

References Cited

UNITED STATES PATENTS

2,739,599 3/1956 Abbott.

FOREIGN PATENTS

947,280 1/1964 Great Britain.

MELVIN D. REIN, *Primary Examiner*.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,409,023

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It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 19, "converter" should read -- conveyor --. Column 2, line 5, "14" should read -- 14, --. Column 4, line 55, "Brightly" should read -- Bright --. Column 5, line 14, after "seconds" insert -- to about 220 seconds --; line 16, cancel "to about 220 seconds".

Signed and sealed this 10th day of March 1970.

(SEAL)

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Commissioner of Patents