United States Patent [19]

Stungis et al.

[11] **3,765,425**

[45] **Oct. 16, 1973**

[54] **PUFFING OF TOBACCO**

[75] Inventors: **George E. Stungis,** St. Matthews; **Steve L. Merker; Harlis A. Parish, Jr.,** both of Louisville, all of Ky.; **Richard G. Striegel,** Floyds Knobs, Ind.

[73] Assignee: **Brown & Williamson Tobacco Corporation,** Louisville, Ky.

[22] Filed: **Sept. 2, 1971**

[21] Appl. No.: **177,268**

[52] **U.S. Cl.** ..... **131/140 P,** 131/121, 219/10.55

[51] **Int. Cl.** **A24b 03/18**

[58] **Field of Search** 210/10.55; 131/140–144

[56] **References Cited**

UNITED STATES PATENTS

3,409,023	11/1968	de la Burde	131/140 P
3,622,733	11/1971	Smith et al.	219/10.55
3,666,905	5/1972	Muller et al.	219/10.55
3,524,452	8/1970	Moser et al.	131/140 P

Primary Examiner—Melvin D. Rein

Attorney—David S. Kane et al.

[57] **ABSTRACT**

Tobacco stems and lamina are puffed by microwave energy, employing intermeshed, slotted wave guides the wave pattern in the device is applied in successive means so that the microwave energy in one means is out of phase with its adjacent means. The tobacco may have a given moisture level, a microwave energy absorbing organic fluid impregnant, or a mixture of the two at the time of treatment.

6 Claims, 2 Drawing Figures

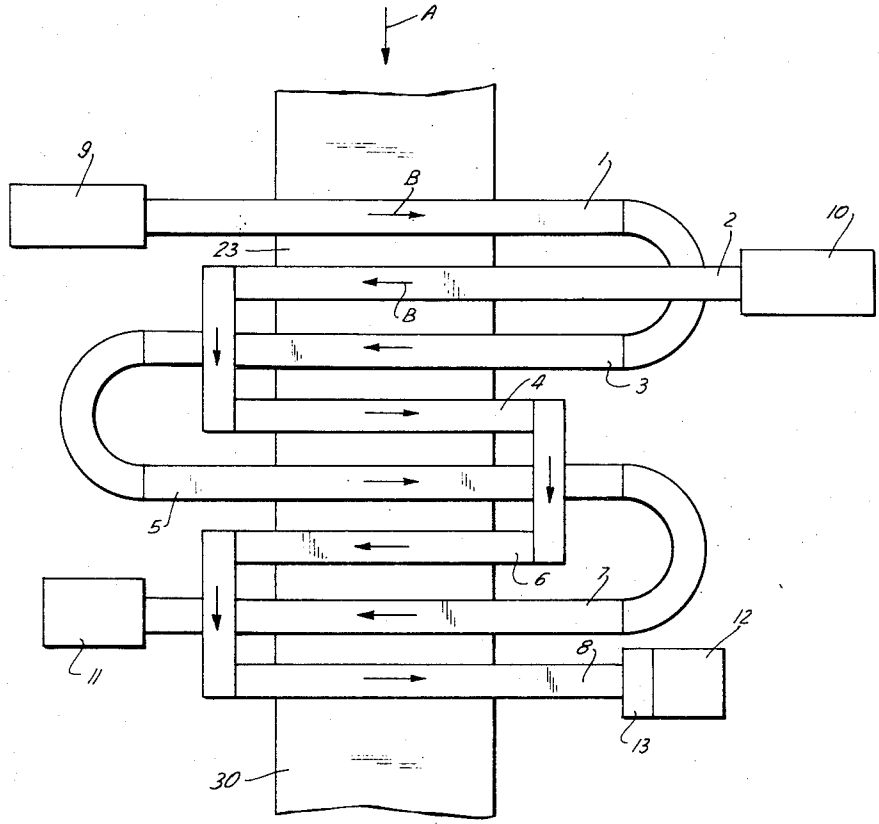


FIG. 1

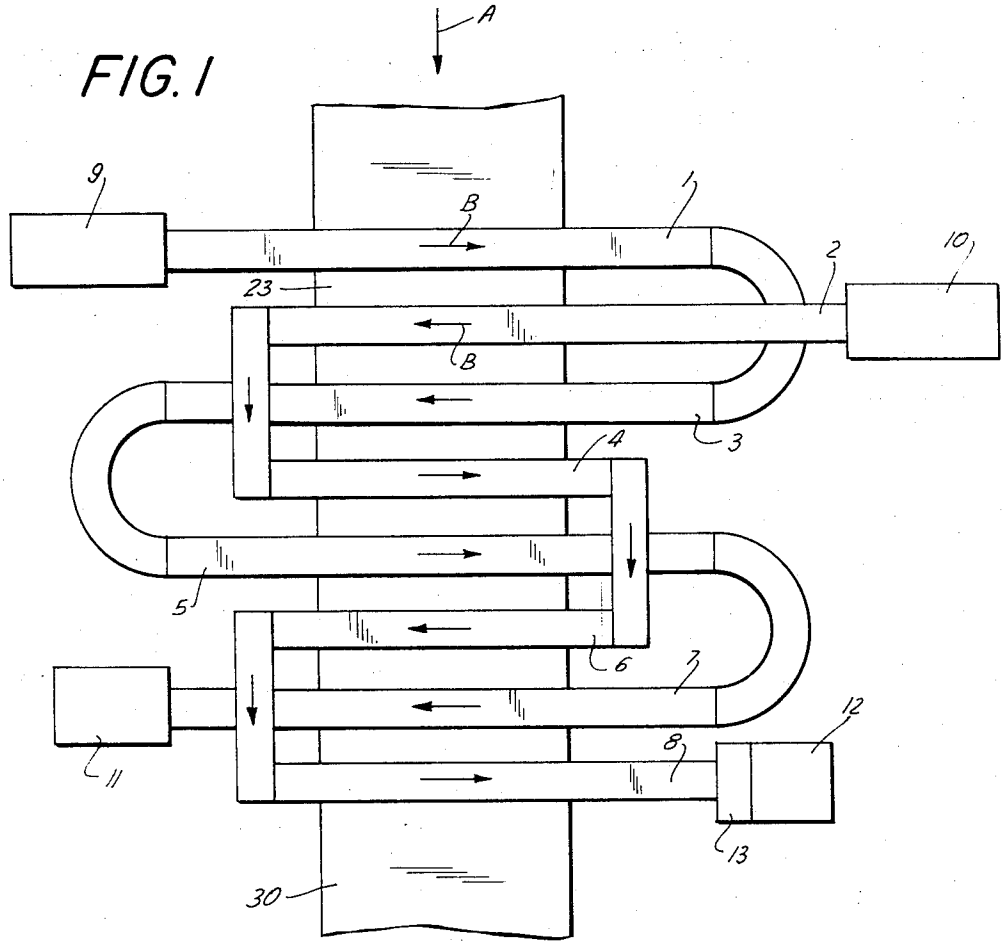
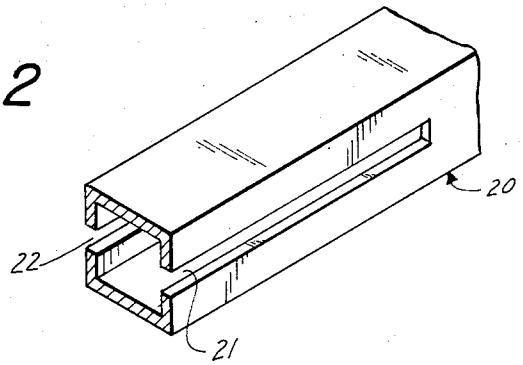


FIG. 2



INVENTORS
GEORGE E. STUNGIS
STEVE L. MERKER
HARLIE A. PARISH, JR.
RICHARD G. STRIEGEL

PUFFING OF TOBACCO

BACKGROUND OF THE INVENTION

The treatment of tobacco in order to puff or expand it has previously been disclosed. The use of microwave energy to accomplish this puffing has also been shown, for example, in U.S. Pat. Nos. 3,409,023 and 3,556,112. In each case, the puffing process has generally required that the tobacco material being puffed consist of or contain the stem portion of the tobacco plant. Further, it has generally been required that the tobacco material align in a particular manner with the microwave energy waves.

SUMMARY OF THE INVENTION

In accordance with the present invention it has unexpectedly been discovered that by generating the microwave energy in a particular way, puffing, not only of tobacco stems, but also of tobacco lamina, can be achieved without a particular alignment of the tobacco material to be puffed. In particular, a plurality of slotted wave guides are employed and the microwave energy waves are generated in adjacent, successive patterns. Employing such a method, it has been found that both stem and lamina can be puffed, without regard to the alignment of the tobacco materials with the generated waves.

The tobacco material is conveyed through a microwave field by any of a variety of means. For example, the materials may be placed upon a moving belt which passes through the microwave field, or the materials can be conveyed by a moving air stream through the fields. Generally, the microwave energy is in the TE_{10} mode with a wave guide. The energy level will generally be between about 2 and 10 kilowatts, or even more, such as up to 50 kilowatts. Preferably, the energy level is in the range of from about 2 to 10 kilowatts.

In accordance with this invention, a first set of slotted wave guides is employed and downstream of the first set, but intermeshed with it, a second set of wave guides will be employed. The two sets of wave guides will be powered by two different power sources, the two power sources being out of phase with respect to each other.

The tobacco, prior to treatment, is brought to a moisture level of between 5 and 75 percent, preferably from 30 to 50 percent, if stem is to be treated and from 20 to 50 percent for tobacco lamina. Alternatively, the tobacco may be treated with a volatilizable organic material such as described, for example, in U.S. Pat. No. 3,524,451, so long as this organic material is capable of absorbing microwave energy. Still further, volatilizable organic materials which do not absorb microwave energy can be employed when the organic material is employed in admixture with water, the water absorbing the microwave energy and the resulting heat acting to volatilize the organic material.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. **1** is a top plan view of one system which can be employed in accordance with the present invention; and

FIG. **2** is a perspective view of a wave guide as employed in FIG. **1**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In accordance with the present invention a plurality of spaced microwave energy generating sources are provided. These sources are provided in a plurality of rows, the spaces between generating sources in one row being provided with generating sources in the second row, and so forth, so that the energy sources are intermeshed.

As illustrated in the accompanying drawings, slotted wave guides **1, 3, 5** and **7** are powered from a first microwave generator **9** to a first load **11,** acting as the power termination point. Wave guides **2, 4, 6** and **8** are powered from a second microwave generator **10** to a second load **12,** again acting as the point of power termination. The second load **12** is also provided with a phase shifter **13,** of a type well known in the art, in order to make certain that the energy generating pattern in wave guides **2, 4, 6** and **8** is not superimposable upon the pattern of wave guides **1, 3, 5** and **7.** A fragmentary perspective view of the types of wave guides employed for each of **1** through **8** in FIG. **1** is illustrated in FIG. **2.** The wave guide **20** of FIG. **2** is generally rectangular in cross-section. Slots **21** and **22** are provided on two opposite sides of the guide for a purpose to be hereinafter explained. The specific shape of the wave guide is, of course, not critical to the present invention.

As can be seen in FIG. **1,** the spaces between successive wave guides in the pattern are connected by inserts **23.** These inserts **23** connect a slot **22** on one wave guide with a slot **21** on the next adjacent wave guide so as to provide a continuous path for material passing through the slotted wave guides. As shown in FIG. **1,** a conveyor belt **30** having a tobacco loading is moved through the successive guides and inserts so that the tobacco may be acted upon by the microwave field. Of course, if desired, a moving air stream can be employed to conduct the tobacco to be treated in the same manner.

The direction of movement of the tobacco is illustrated by arrow A in FIG. **1,** so that the tobacco is acted upon by those wave guides closest to the generators before passing through downstream wave guides. However, this is not critical. The propagation energy flow in the various wave guides and connectors is illustrated by arrows D.

The phase shifter shown at **13** is particularly important to the present invention. The microwave field, of course, is generated in such a manner that there are peaks and valleys. Employing the phase shifter **13,** in accordance with the present invention, the field of the second set of wave guides **2, 4, 6** and **8** can be generated in such a manner that it is out of phase with the field of the first set of wave guides **1, 3, 5** and **7.** It is this point which is critical, according to the present invention, rather than the specific shape of the guide, the specific arrangement, the manner of conveying the tobacco, etc.

While the figure illustrates the invention with regard to a moving belt, obviously other means of conveying the tobacco can also be employed. For example, the tobacco may be conveyed through the wave guide pattern illustrated employing a moving air stream or other conveying methods can be used.

As previously indicated, the wave guides preferably operate in the TE_{10} mode. The individual sources **9** and

10 can be operated at from 2 to 50 kilowatts, and preferably generate from about 2 to 10 kilowatts. The frequency of energy generation can be any normally employed for industrial, scientific and medical uses, generally 915 or 2,450 megacycles. The tobacco being treated should have a moisture content of between 5 and 75% and this can be attained by any suitable means well known to the art. Preferably, the stems to be puffed by microwave energy have a moisture content of from 30 to 50 percent and the lamina a moisture content of from 20 to 50 percent. The temperature at which the puffing operation is carried out is not critical and need only be such as to allow maintaining the moisture level.

With the system illustrated in FIG. 1, and a belt width of 2 feet, a significant degree of puffing would be obtained at a belt speed of 20 feet per minute with a moisture content of 40 percent, a tobacco depth of 20 millimeters, and a frequency of 2,450 megacycles. If the frequency were changed to 915 megacycles, the depth could be increased to about 30 millimeters. This would be employing a power level of approximately 5 kilowatts for each of generators 9 and 10. If the belt speed is increased, the power must be correspondingly increased.

In place of, or in addition to, the moisture found in the tobacco, various volatile, inert, organic compounds can be employed. Generally, these organic compounds are those which have a boiling point below that of water, or close to the boiling point of water. Among these inert, organic materials are aromatic hydrocarbons, including benzene; ketones, such as acetone, methylethyl ketone, methyl isopropyl ketone, and diethyl ketone; ethers, such as diethyl ether and dimethyl ether; aliphatic alcohols, such as ethyl alcohol and methyl alcohol; aliphatic hydrocarbons, such as propane and butane; and halohydrocarbons, such as ethyl chloride, propyl chloride, isopropyl chloride, methylene chloride, methylene bromide, chloroform, carbon tetrachloride, ethylene dichloride, etc. Those materials which will absorb microwave energy can be employed without regard to the moisture content of the tobacco, as long as the tobacco is at a workable level, while those which are not capable of absorbing such energy must be employed with at least the minimum amount of water present for absorption of the energy to generate the necessary heat. Such a process, though employing solvents similar to or the same as those used in U.S. Pat. No. 3,524,451 provide the advantage of more uniform puffing as the heat is generated internally of the tobacco material, resulting in expansion of the organic materials from within.

The following examples are provided that those skilled in the art may be better enabled to practice the process of the present invention. These examples should not be considered as limiting in any way the full scope of the invention as covered in the appended claims.

EXAMPLE 1

Cut tobacco stems were conditioned to a variety of water levels varying from 10 to 70 percent. These stems were introduced into a wave guide system as illustrated in FIG. 1 on a non-lossy belt. Each of the power sources was operated at power levels of from 0 to 5 kilowatts and the frequency of the microwave energy was at 2,450 megacycles. A fill factor increase of from 4 to 50 percent was realized at the varying parameters.

EXAMPLE 2

Tobacco stems and lamina were treated for a sufficient period of time with methylene chloride to completely impregnate the tobacco. This tobacco was then inserted into a microwave energy field having intermeshed fields and treated. The water temperature was rapidly increased as a result of the microwave energy and this water acted as a thermal reservoir to initiate the vaporization of the methylene chloride.

While the invention has been shown and described with a plurality of microwave generators to generate the intermeshing fields, when proper care is taken, the wave guides can be offset in such a manner that intermeshing patterns are generated by a single generator.

We claim:

1. A method for expanding cut stem or lamina tobacco comprising:
   a. treating said cut stem or lamina tobacco with a material capable of absorbing microwave energy including bringing the moisture content of the cut stem tobacco to at least 30 percent;
   b. providing at lease one source of microwave energy;
   c. providing a plurality of means for applying said microwave energy;
   d. continuously conveying said treated cut stem or lamina tobacco in a random orientation in juxtaposition to said means for applying said microwave energy, wherein the wave pattern in successive means for applying said microwave energy is out of phase with respect to adjacent means substantially from one end of said applying means to the other end thereof.

2. The method of claim 1 wherein the material capable of absorbing microwave energy is water.

3. The method of claim 1 wherein said material capable of absorbing microwave energy is an inert volatile liquid organic compound capable of being removed by vaporization.

4. The method of claim 1 wherein the material capable of absorbing microwave energy is a mixture of water and an inert volatile liquid organic liquid compound capable of being removed by vaporization.

5. The method of claim 1 wherein the means for applying microwave energy is a slotted wave guide.

6. The method of claim 1 wherein at least two sources of microwave energy are provided, each of said sources powering a plurality of means for applying said microwave energy, said means powered by said first set being intermeshed with said means powered by said second set, the terminal of said second power source being provided with a phase shifter.

* * * * *