(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 771 349 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
03.02.2021 Bulletin 2021/05

(51) Int Cl.:
A24B 5/16 *(2006.01)* ***A24B 3/18*** *(2006.01)*

(21) Application number: **19404004.4**

(22) Date of filing: **30.07.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **TOBACCO EXPANSION SYSTEM (TES)**

(57) An apparatus and method for increasing specific volume and moisture content of shredded tobacco material by steam and/or water. Apparatus consists of a cone-shaped horizontal (5) and vertical tubes (2). Material (T) is introduced into upright steam jet flow (7/7') and consequently, tobacco (T) is accelerated towards to lie down tube (5). At the end of the vertical tube (2), the tobacco (T) is contacted by horizontal steam jet flow (12). Deflected flow path of tobacco results in impregnation of steam into the tobacco homogeneously and increase the water content. Furthermore, high exit temperature of the material increases the performance of a dryer.

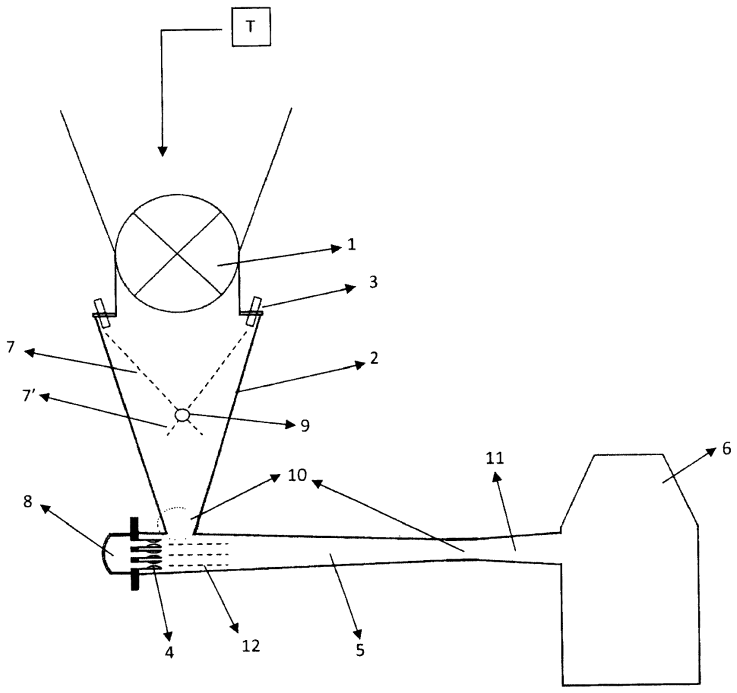

Figure 1

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Description

[0001] The present invention relates to an apparatus for increasing specific volume (also known as puffing) and moisture content of shredded tobacco material which improve the performance of the dryer. In particular, while the apparatus causes to enhance filling capacity of tobacco or tobacco-related materials and serve to improve the performance of the existing dryer in the process.

[0002] Tobacco-related materials refer to the tobacco stem. Tobacco "stem' as used herein includes stems and veins, which are already separated from tobacco leaf laminae of tobacco leaves. Filling capacity is defined as the efficiency of tobacco materials/blend to produce a standard firm cigarette rod. Higher filling capacity leads to use of less tobacco material (weight basis) for a cigarette rod. Expansion ratio and filling capacity are directly proportional.

[0003] There are two main reasons to obtain expanded stem in simple terms; taste and economic concerns. Due to biochemical structure, stem leaves an inconvenient taste when smoking a cigarette. To get out their unpleasant taste and odor, stem must be expanded. Approximately, depending on tobacco types, 30% of its weight of tobacco leaf is a stem. This ratio is too big to be a waste. Hence, utilizing stem in a cigarette making process becomes economically necessary.

[0004] A decrease in filling power starts with curing. Dramatic reduction in moisture content of tobacco material causes water-loss shrinkage. This shrinkage has a negative influence on the volume of tobacco (so filling capacity). Cutting, shredding or flattening (for stem) treatments also decrease filling capacity furthermore. Consequently, tobacco materials, especially stem, specific volume has to increase due to all above mentioned reasons.

[0005] Various techniques have been proposed to obtain expanded tobacco. They can be classified into two main techniques that take part in industry literature; physical and chemical techniques. Physical techniques are based on a phase change of impregnant. They include solid to gaseous change in phase, liquid to gaseous change in phase and dissolving in gaseous change in phase. Chemical methods are based on generating gas by thermal decomposition or exothermic reaction. They include solid to gaseous thermal decomposition, liquid to gaseous thermal decomposition, liquid to gaseous exothermic reaction.

[0006] Physical methods are accepted widely in industry because of their cost-effective and simple implementation in comparison to the chemical methods. Impregnation of tobacco with substances that extract from tobacco after expansion operation by creating pressure and/or temperature difference underlies physical methods. The impregnant may be solid, liquid or gas but generally gaseous impregnates are used. The most common impregnates which are utilized in this technique are steam, air, water, organic volatile liquids. The main underlying logic is to generate and/or expand a gas in the cell of tobacco materials. With liquid impregnant, gas is generated by phase change. In this technique, altered temperature and pressure process parameters are applied.

[0007] U.S. Pat. No. 4.523.598 discloses a method for expanding and drying of tobacco material. Tobacco material is sucked by free jet and accelerated with steam flow. The lower pressure prevailing in the core of the released jet or of the nozzle causes expansion of the tobacco material simultaneously with heat exchange and mass transfer.

[0008] U.S. Pat. No. 6.397.851 proposes cost-effectiveness in producing smoking articles. According to the invention, material continuously passes through a zone of elevated pressure, followed by a zone reduced pressure before ending up in a zone atmospheric pressure. It is claimed that increases in the filling capacity has not been achievable up until now.

[0009] U.S. Pat. No. 4.513.758 proposes simple and inexpensive method of expanding of the tobacco particle. The method includes the steps of introducing moist tobacco particles into a preliminary chamber and then second chamber, which is next to each other. Tobacco is transported from the first portion to second portion via a high-speed stream of gaseous fluid. The Second portion's area is smaller than that of the first portion.

[0010] U.S. Pat. No. 4.407.306 presents a method for treating cut tobacco to expand. Tobacco is inserted into venturi section and, during its rapid transport by the stream in the venturi section and the subsequent section, is expanded. Speed of tobacco travels from its entrance into the conduit until its discharge is such that the tobacco never reaches the speed of the fluid.

[0011] U.S Pat. No. 4.211.243 discloses a process for expanded tobacco stems, which comprises heating under a pressurized atmosphere in the presence of superheated steam tobacco stems. After the process, stems have an excellent smoking taste and a low apparent density.

[0012] In this patent, with the proposed apparatus being very compatible for industrial applications, it is expected to reach satisfactory expansion rate and higher throughput with a reasonable capital and operational expenses.

[0013] The aim of the present apparatus is to expand (increasing filling capacity) tobacco stem more effectively. Method covers the reoriented steam jet flows and the moist tobacco stem introduced into it. Any volatile fluid or solid have not been used. Even better, the process accomplishes only by steam and/or water mixture.

[0014] The method involves the treatment of the tobacco stem with steam jet streams homogeneously. Material passes through the vertical and horizontal tubes is evenly heated and moistened. Furthermore, the apparatus comprises two narrow passes in order to create pressure difference and to improve the steam application quality. Homogeneous impregnation of steam or/and water mixture into the stem is the key factor to improve process and

method quality. In this apparatus, the stem is accelerated twice through the steam jets. Acceleration causes to velocity difference between tobacco and steam/water mixture. Increasing the relative velocity between the steam medium and tobacco, enhances the expansion effect. Further, the method can deliver water (preferably finely atomized warm or cold) with steam.

[0015] When phase change occurs (liquid to gas), fluids' specific volume extremely increase. Likewise, the specific volume of the gaseous increase while the pressure reduces. As specific volume increases, fluid molecules exert pressure (or simply force) to cell membrane and cause expansion permanently.

[0016] To obtain a reduction in pressure, steam is speeded up to the speed of sound by the ultrasonic nozzles. Venturi shaped tube allows to transport the high speed steam and tobacco along with from vacuum pressure to atmospheric pressure. Tobacco stem (having moisture at least equals or exceeds 35 percent and at the room temperature) enters to the apparatus from the vertical tube via drop-through airlock. A group of steam nozzles (flat or hollow cone type) are located in the vertical tube. When tobacco stem enters into the upright tube, steam jets (through steam nozzles) hit the tobacco. Steam is impregnated in stems and increases its moisture and temperature upon impact. This part of the apparatus/method is named as "pre-conditioning part." Furthermore, the conditioned tobacco stem particles are accelerated towards to horizontal tube by the help of the steam nozzles. Horizontal tube (also named as venturi tube) has the ultrasonic nozzles and the tapered section venturi pipe.

[0017] Ultrasonic nozzles located at the horizontal tube create vacuum. So, due to that vacuum, steam tobacco mixture that exists in pre-conditioning part is sucked into the horizontal tube.

[0018] High rate of heat and mass transfer induces an increase in both product moisture and temperature. Also, followed by flash evaporation of the water present in the tobacco cells as the particles accelerate away from the vertical tube into the horizontal tube. Instantaneous pressure drop of fluid in venturi tube induces further expansion of tobacco.

[0019] The Tobacco stem is transferred to discharge section, after the treatment of tobacco stem with steam in vertical and horizontal tube. A tobacco stem-steam separator, specifically, a centrifugal separator, separates steam and tobacco from each other. The separated tobacco is fed into dryer inlet and the waste steam is thrown out into scrubber.

[0020] The apparatus will now be explained in more detail by means of an exemplary embodiment of the device according to the invention illustrated in the figure, in which:

Fig. 1 shows a cross section view of the front side of the device according to the apparatus;

[0021] In the figs. 1, reference numbers; 1 an airlock, 2 a pre-conditioning tube, 3 steam nozzles, 4 ultrasonic nozzles (also named as Laval nozzles), 5 a venturi tube, 6 separator, 7-7' steam jets pathway, 8 nozzle antechamber, 9 take-up point, 10 neck, 11 exit diffuser, 12 another steam jet's pathway. T denotes tobacco material.

[0022] Fig. 1 is a schematic illustration of an apparatus of the present invention for expanding tobacco material. The shredded tobacco stem, T from after cutter is fed into pre-conditioning tube 2, by an airlock 1 which is workable under high temperature, and differential pressure. Pre-conditioning tube 2 is conical shaped metallic tube and includes steam nozzles 3. At the preconditioning part 2, stem fall freely reaches up to take-up point 9 where steam jets 7-7' intersect with each other, then stem is mixed with steam or steam-water mixture that emerges from nozzles 3. Four mutual nozzles 3 are positioned at an angle of 10° to 70° with respect to the pre-conditioning tube's 2 axis. Stem heat and moist and accelerate towards to venturi tube 5, by steam jets 7-7'. Main reason of heating and moistening is impregnation of steam into stem. The mass flow rate of steam jets 7-7' set simply (at 2 bar pre-pressure, approx. 120°C pre-temperature) relative to desired expansion ratio. Operational ratio is in the range of 0 to 0.1kg steam flow per kg tobacco.

[0023] The moistened and heated stem and the steam mixture transfer perpendicularly to the horizontal located venturi tube 5, after passing through a neck. Venturi tube 5 is conical shaped metallic tube. Another group of steam nozzles 4 (ultrasonic nozzles) create slightly vacuum at downside of the neck so that tobacco steam mixture can penetrate high-velocity steam jets 12 that emerge from nozzles 4. At the out of the ultrasonic nozzles 4, steam jets 12 reach to 800 m/s velocity and while the velocity of tobacco-containing jets is approximately 150 m/s in the venturi tube 5. The mass flow rate of steam jets 12 set simply (up to 6 bar pre-pressure, approx. 150°C pre-temperature) relative to desired thrust force. Operational ratio is in the range of 0 to 0.3 kg steam flow per kg tobacco. Additional heat and mass transfer is occurred in venturi tube 5 by steam jets 12, so the stem gets homogeneously warmer and moistened pretty well. Since the tapered cross-section of the venturi tube 5, pressure is dropped throughout the tube. While stem passes lower pressure zone (vacuum zone), heated moisture in the stem cannot be as a liquid phase, so moisture evaporates to gaseous phase. Furthermore, in the vacuum zone, the specific volume of non-condensed vapor in stem will increase. As a result of increasing volume, tobacco cell membrane harms permanently, and expansion happens. Further expansion occurs in the dryer that is located after the apparatus.

[0024] After mixture passes through the venturi tube 5, it is transported into separator 6 by the help of exit diffuser 11. Exit diffuser 11 is a conical shaped metallic tube. As mixture travels along in exit diffuser 11, its velocity is reduced thereby and the stem is not damaged. In the end, the tobacco stem and the steam are separated each other by separator 6.

Claims

1. An apparatus/method for increasing the specific volume of tobacco stem particles by steam and steam/water mixture, said apparatus consists of the steps of introducing tobacco stem into the pre-conditioning part the first part of the apparatus and then the second part, the venturi part that its cross-sectional area is less than the first conditioning part; both parts have adjustable mass flow ratio steam jets; said tobacco stem is accelerated twice by jet flows; apparatus comprises of two narrow cross sectional pipes to improve treatment quality.

2. The method of claim 1 wherein said jet flows can be superheated or saturated steam.

3. The method of claim 1 wherein said jet flows can be mixed with cold/hot water.

4. The method of claim 1 wherein velocity of said jet flows at least one of them equals or greater than speed of sound.

5. The apparatus as mentioned in claim 1, consists of two conical pipes, they connect each other perpendicularly.

6. The method of claim 1 wherein said steam pressure is between 2 bars to 6 bars.

7. The method as claimed in claim 1, wherein said velocity of jet flows containing said tobacco stem is between 20m/s to 200 m/s.

8. The method of claim 1 wherein total mass flow ratio of steam to the tobacco stem is in a range of 0.1 to 0.5.

Amended claims in accordance with Rule 137(2) EPC.

1. An method for increasing the specific volume of tobacco stem particles by steam and steam/water mixture, said-method-consists of the steps of

    - introducing tobacco stem into the pre-conditioning part (feed part prior to acceleration zone the first part of an apparatus and
    - then the second part, the venturi part that its cross-sectional area is less than the first conditioning part ;

    the second part has adjustable mass flow ratio steam jets; said tobacco stem is accelerated by jet flows; apparatus comprises of one narrow cross sectional pipe to improve treatment quality,

    characterized in that:

    - both parts have adjustable mass flow ratio steam jets; said tobacco stem is accelerated twice by jet flows ;
    - apparatus comprises of two narrow cross sectional pipes to improve treatment quality.

2. The method of claim 1 wherein said jet flows can be superheated or saturated steam.

3. The method of claim 1 wherein said jet flows can be mixed with cold/hot water.

4. The method of claim 1 wherein velocity of said jet flows at least one of them equals or greater than speed of sound.

5. The method as mentioned in claim 1, consists of two conical pipes, they connect each other perpendicularly.

6. The method of claim 1 wherein said steam pressure is between 2 bars to 6 bars.

7. The method as claimed in claim 1, wherein said velocity of jet flows containing said tobacco stem is between 20m/s to 200 m/s.

8. The method of claim 1 wherein total mass flow ratio of steam to the tobacco stem is in a range of 0.1 to 0.5.

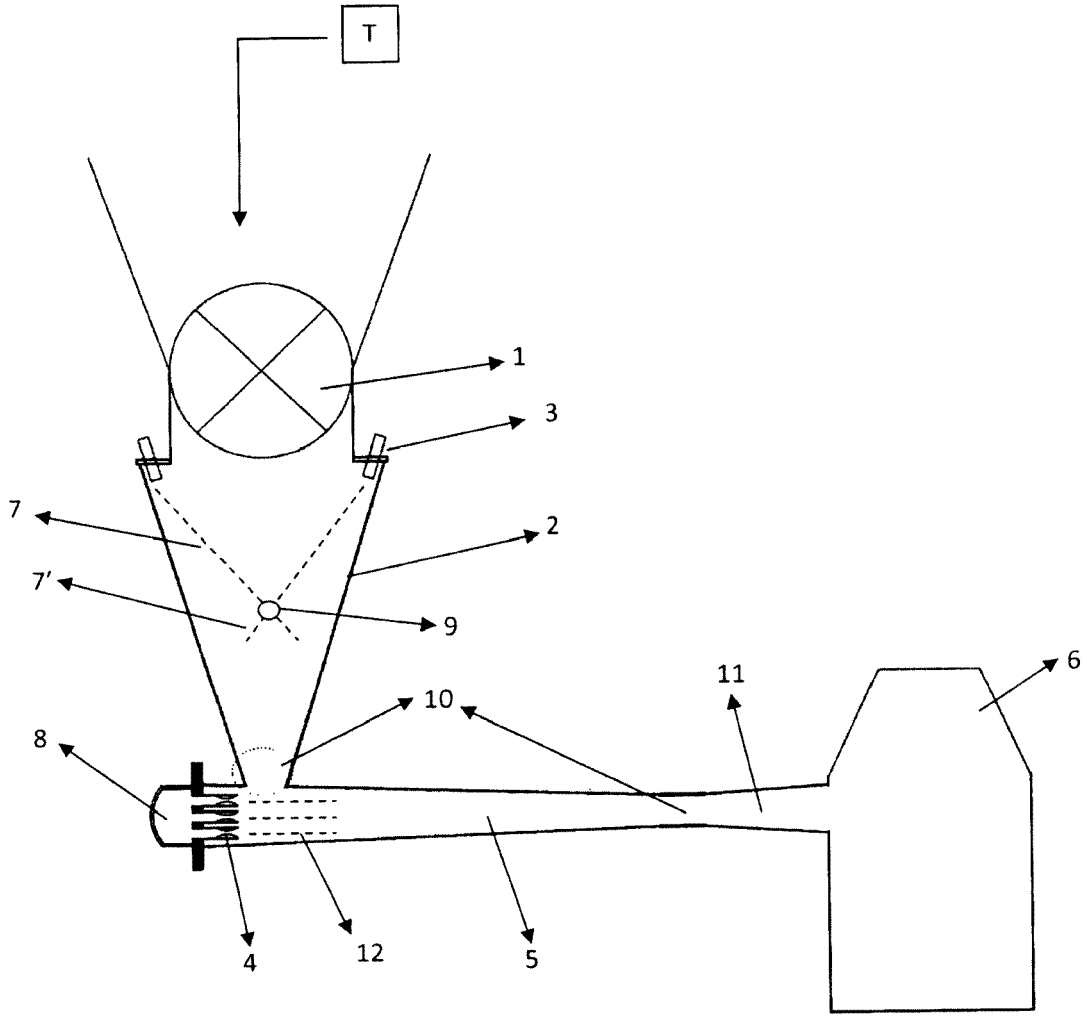

Figure 1

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EUROPEAN SEARCH REPORT

Application Number
EP 19 40 4004

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	US 4 523 598 A (WEISS ARNO [DE] ET AL) 18 June 1985 (1985-06-18) * column 3, line 39 - column 4, line 42; figures 1,3,5 *	1-8	INV. A24B5/16 A24B3/18
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TECHNICAL FIELDS SEARCHED (IPC)

A24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 February 2020	Schwarzer, Bernd

CATEGORY OF CITED DOCUMENTS

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