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(54) **System for producing expanded tobacco**

(57) The invention concerns a system for producing expanded tobacco, comprising a tobacco expansion apparatus (20), in which the tobacco is expanded, at least a first tobacco supply unit (30) for providing tobacco containing at least one suitable chemical solvent other than water to prepare the tobacco for expansion, at least a

second tobacco supply unit (35) for providing tobacco containing only water as a solvent to prepare the tobacco for expansion and at least a first feed unit (10) for introducing tobacco from the at least first tobacco supply unit (30) and the at least second tobacco supply unit (35) into the tobacco expansion apparatus (20)

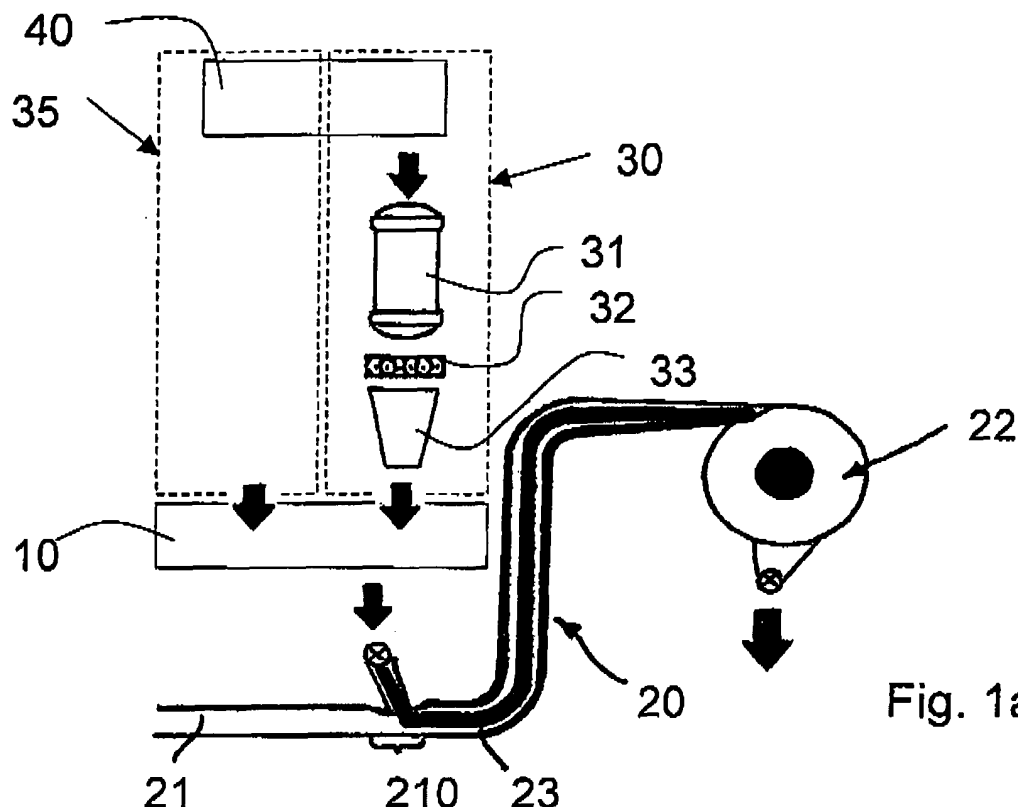


Fig. 1a

Description

[0001] The present invention relates to a system for producing expanded tobacco.

[0002] Various processes and systems for producing expanded tobacco are known in the art. Typically, the tobacco is treated before expansion, either only with water or with additional chemical solvents, for example liquid or gaseous carbon dioxide, nitrogen or iso-pentane or other suitable solvents in gaseous or liquid form. Typical expansion rates of tobacco treated only with water are in the range of from about 5 percent to about 15 percent. Typical expansion rates of tobacco treated with additional chemical solvents may be in the range of from about 80 percent to about 120 percent.

[0003] The systems for expanding tobacco known in the art comprise a supply unit of tobacco, an expansion apparatus and a feed unit that feeds the tobacco from the supply unit into the expansion apparatus. The supply unit may comprise a treatment unit where the tobacco is treated to prepare the tobacco for expansion. These systems are for example known from US-A-4,340,073 or US-A-4,407,306. Once a system to expand tobacco is set up, the process of treating and expanding tobacco is fixed within narrow boundaries. The tobacco expansion apparatus can thus only expand tobacco which has been treated by the pre-selected specific process. Therefore the systems to expand tobacco are currently not flexible.

[0004] The present invention provides a system for producing expanded tobacco comprising at least a first tobacco supply unit for providing tobacco containing at least one suitable chemical solvent other than water to prepare the tobacco for expansion and at least a second tobacco supply unit for providing tobacco containing only water as a solvent to prepare the tobacco for expansion. The system for producing expanded tobacco further comprises a tobacco expansion apparatus and at least one feed unit. The feed unit is configured to introduce the tobacco into the tobacco expansion apparatus from the at least first tobacco supply unit or the at least second tobacco supply unit. Additionally, the feed unit may feed tobacco simultaneously from the first or the second supply unit.

[0005] The term "tobacco" is used throughout the specification to encompass all parts of any tobacco plant, treated or untreated, that are expandable. In particular, the term tobacco refers to cut or shredded tobacco. It is also meant to include other parts of the tobacco plant, for example stems or pre-treated tobacco, for example flavoured cut tobacco.

[0006] The term "chemical expansion" is used throughout the specification to refer to any process of expanding tobacco containing an additional suitable chemical solvent other than water to prepare the tobacco for expansion.

[0007] The term "tower drying" is used throughout the specification to refer to any process of expanding tobacco containing only water as a solvent to prepare the tobacco

for expansion.

[0008] The term "chemical solvent" is used throughout the specification to refer to any substance which is suitable to enhance the expansion of the tobacco inside the tobacco expanding apparatus, for example liquid or gaseous carbon dioxide, nitrogen or iso-pentane or other suitable solvents in gaseous or liquid form.

[0009] In an alternative embodiment of the system according to the invention the system comprises at least two feed units. Each feed unit is configured to feed tobacco from either one of the supply units to the tobacco expansion apparatus. For this purpose the tobacco expansion apparatus has two separate entries for the introduction of the tobacco.

[0010] In a further embodiment of the system according to the invention, more than two feed units are used to feed the tobacco from more than two supply units into the tobacco expansion apparatus at one or several locations. Preferably some of the supply units contain tobacco which has been treated by a different treatment process.

[0011] Accordingly, the same system according to the invention allows the expansion of tobacco that has been treated in different ways to facilitate expansion, that is, tobacco treated with water as a solvent and tobacco treated with at least an additional chemical solvent. The expansion apparatus is then operated with process parameters suited to the specific type of pre-treatment of the tobacco. In addition, the system allows combinations of both types of processes to be performed. Accordingly, substantial investments can be saved, since the system can be used for both types of processes, requiring only one tobacco expansion apparatus.

[0012] Accordingly, products which are produced using chemical expansion can be produced in the same system as products which are produced using tower drying. This allows using production capacities for chemical expansion systems which may otherwise be unused. The same holds for production capacities for tower drying.

[0013] It is also possible to upgrade either an existing chemical expansion system or an existing tower drying system with an additional supply unit of the other type at a considerable lower cost than a complete new installation would require.

[0014] Also, since it is possible to combine tower drying and chemical expansion in one system it is now possible to produce tobacco blends which are typically produced using chemical expansion technology at final moisture levels in the range of from about 8 percent to about 15 percent without the need of subsequent remoistening. This process step of remoistening, which is common in tobacco expansion, is often referred to in the art as "re-ordering". Expanded tobacco which has been produced using chemical expansion typically has a moisture content in the range of from about 2 percent to about 5 percent when leaving the tobacco expansion apparatus. This is considered as too low for further processing. Therefore, up to now in a subsequent reordering step the

expanded tobacco has been moisturized to achieve a moisture content of typically about 11 percent. Nonetheless, with the system according to the invention also expanded tobacco with a moisture level between about 2 percent to about 8 percent may be produced, requiring partial reordering afterwards.

[0015] On the other hand it is possible with the system according to the invention to produce a superior quality of expanded tobacco in terms of expansion rate of a water solvent expanded product by lowering the moisture of the tobacco leaving the tobacco expansion apparatus below typical tower dryer conditions. For example moisture levels in the range from about 2 percent to about 15 percent may be achieved. The tobacco pre-treated with water for expansion may be exposed to the process parameters normally used for chemical expansion of tobacco. This results in a greater expansion rate and a reduced moisture level compared to conventional tower drying.

[0016] An additional advantage of the system according to the invention is that the combination of the chemical expansion with the tower drying reduces the fire risk in the tobacco expansion apparatus. The fire risk is reduced when the conditions of tower drying heat treatment are applied for chemical expansion, as the tower drying process runs at a lower temperature as the chemical expansion.

[0017] Optionally, in a preferred embodiment of the system the tobacco expansion apparatus comprises a expansion tower dryer.

[0018] Also, optionally, in a preferred system according to the invention the apparatus for providing the tobacco treated for expansion with at least one chemical solvent other than water comprises an impregnator where the tobacco is exposed to the chemical solvent, for example carbon dioxide. In the impregnator, the tobacco is exposed to liquid carbon dioxide, so that the tobacco is soaked. Alternatively, the chemical solvent to which the tobacco is exposed in the impregnator is gaseous carbon dioxide. This is possible for tobacco that has been cooled to a temperature below the temperature of the pressurized gaseous carbon dioxide which is at or near saturation. Then controlled condensation of carbon dioxide on the tobacco occurs and the tobacco gets soaked.

[0019] In a further embodiment of the system according to the invention, the apparatus for providing the tobacco containing water as a solvent comprises a silo for storing the tobacco. The silo has an outlet and a detangling unit for detangling the shreds of tobacco is arranged in the silo. Usually the silos for the tobacco are equipped with large slow moving doffers to feed tobacco from the entire height of the silo to the outlet of the silo. Depending on the moisture content of tobacco, tobacco may tend to form pads and clumps at the exit of the storage silos. The higher the moisture content, the more the tobacco tends to form pads and clumps. Such pads and clumps may have an adverse effect on tower drying systems, since they may cause blockage at the feed unit where the to-

bacco is introduced into the stream of process gas, for example superheated steam. As a consequence, this may lead to non-uniform heat treatment which may adversely affect the quality of the expanded tobacco.

[0020] While it is known to provide a detangling unit with a small number of doffers, for example two to five doffers between the outlet of a silo and the tobacco expansion apparatus, this separate detangling unit requires additional space. Also, due to the small number of doffers and the short residence time of the tobacco in the detangling unit, these doffers have to rotate with a comparatively high speed, for example with a speed of 100 rotations per minute and more. Accordingly, the tobacco is subjected to substantial mechanical stress which may result in substantial tobacco degradation.

[0021] Advantageously, in the system according to the invention the detangling unit comprise a plurality of slowly rotating short doffers which are arranged essentially over the entire width and height of the silo. Due to the larger number of doffers a high speed for detangling is not required and thus, the tobacco is slowly detangled and degradation of the tobacco is significantly reduced. Also, the detangling is performed in the silo thus eliminating the need for any additional space.

[0022] Further advantageous aspects of the invention will become apparent from the following description of preferred embodiments of the invention with the aid of the drawings, in which:

Fig. 1a is a schematic representation of a first embodiment of a system for producing expanded tobacco in accordance with the invention,
 Fig. 1b is a schematic representation of a second embodiment of a system for producing expanded tobacco in accordance with the invention, and
 Fig. 2 is a schematic representation of a silo comprising a detangling unit.

[0023] Fig. 1a shows a schematic representation of a first embodiment of a system for producing expanded tobacco according to the invention. The shown embodiment of the system comprises a feed unit 10 for introducing tobacco into a tobacco expansion apparatus comprising a tower dryer 20. The tower dryer 20 is connected to a conduit 21 through which a stream of process gas flows during operation. The process gas may be, for example, hot air or superheated steam. The upper end of the tower dryer 20 opens out into a tangential separator 22. Alternatively, a cyclone may be used to separate the expanded tobacco from the process gas. During operation the stream of process gas carrying the tobacco is separated from the tobacco in the tangential separator. The tobacco discharges at the bottom of the tangential separator 22. The process gas is further processed, for example cleaned and reheated, and then reintroduced into the conduit 21.

[0024] A first supply unit 30 for providing the treated tobacco comprises a silo 40, an impregnator 31 and a

vibrating silo 33. The clump breaker 32 is optional and typically used only for a liquid carbon dioxide impregnation of the tobacco.

[0025] A second supply unit 35 for providing the tobacco containing water as a solvent comprises a silo 40 in which a detangling unit 400 is arranged. Both supply units 30, 35 may share the same silo 40. Alternatively, different silos 40 may be provided for tobacco to be expanded using chemical expansion and for tobacco to be expanded using tower drying. This may be especially useful since the moisture content of the tobacco to be expanded using chemical expansion typically is different from the moisture content of the tobacco to be expanded using tower drying. On the other hand, the moisture content of the tobacco from any one of the supply units 30, 35 may be changed after leaving the silo 40, as well.

[0026] The detangling unit 400 arranged in the silo 40 is schematically represented in Fig. 2. The detangling unit 400 comprises a number of small doffers 401, which are arranged in the silo essentially over the entire width and height of the silo 40. In Fig. 2, only some small doffers 401 are shown. The small arrows indicate the respective direction of rotation of the small doffers 401 during operation. Since the doffers 401 are arranged over the entire width and height of the silo 40 they need to rotate only slowly compared to the doffers of the detangling units according to the state of the art. Due to the continuous and careful detangling of the shreds of tobacco in the silo, tobacco degradation is substantially reduced if not completely avoided. Since the detangling unit is completely arranged in the silo 40, no additional space is needed.

[0027] The feed unit 10 comprises means to advance the tobacco to the entry section 210 of the conduit 21 of the tobacco expansion apparatus 20.

[0028] The tobacco is introduced into the stream of hot air at the entry section 210 of the conduit 21. A stream 23 of hot air loaded with tobacco then flows through the tower 20 and discharges into the tangential separator 22. The entry section 210 may include a rotary valve and a Venturi type nozzle.

[0029] In an alternative embodiment shown in Fig. 1b the system according to the invention comprises also a second feed unit 11. In this embodiment each feed unit 10, 11 is dedicated to a supply unit 30, 35 and feeds into a separate entry of the conduit 21.

[0030] The described embodiment of the system according to the invention works essentially as follows for chemical expansion. In the first supply unit 30 tobacco is introduced from the silo 40 into the impregnator 31. The impregnator 31 is then closed and purged with gaseous carbon dioxide to remove the air from the impregnator 31. The impregnator 31 is then pressurized for example at 30 bar, at the same time cooling the tobacco to about minus 10 degrees Celsius. Then the tobacco is soaked by liquid carbon dioxide. When the impregnator 31 is depressurized carbon dioxide hydrates are formed which act as a puffing agent of the tobacco. The depres-

surization cools the tobacco to about minus 80 degrees Celsius. Excessive carbon dioxide that has remained in the impregnator 31 upon depressurization forms dry ice. For this reason tobacco expanded by this process is sometimes referred to as dried ice expanded tobacco.

[0031] The thus treated tobacco leaves the impregnator 31 and enters the clump breaker 32 to break any clumps that may have formed. The tobacco then enters the vibrating silo 33 to achieve an essentially continuous flow of tobacco towards the first feed unit 10. In an alternative method tobacco is treated by gaseous carbon dioxide instead of liquid carbon dioxide. In this method no clumps are formed and accordingly the clump breaker 32 is not necessary.

[0032] The impregnated tobacco is now introduced into a stream of hot air flowing through the conduit 21, for example at the entry section 210 of conduit 21. To produce a negative pressure at the entry section 210 of the conduit a venturi nozzle may be used. This avoids expansion of the treated tobacco before the tobacco expansion apparatus 20.

[0033] The hot air which is typically at a temperature in the range of from 300 degrees Celsius to 380 degrees Celsius causes the tobacco to be expanded. The stream of hot air 23 carrying the expanded tobacco is then discharged into the tangential separator 22, at the outlet of which the expanded tobacco can be recollected.

[0034] Among the parameters that affect the expansion rate of the tobacco are the impregnation solvent, the load of the tobacco expansion apparatus, the steam concentration in the conduit 21, the process gas velocity and the temperature of the process gas.

[0035] It is also possible to perform this type of process using chemical solvents other than carbon dioxide, for example nitrogen or iso-pentane or other suitable solvents. Also, it is possible to introduce the chemical solvent to the impregnator 31 either in liquid or in gaseous form in order to soak the tobacco with the solvent.

[0036] When leaving the tobacco expansion apparatus 20 expanded tobacco which has been produced using only the afore-described chemical expansion technology typically has a moisture content which is in the range of from about 2 percent to about 5 percent. However, this moisture content is considered too low for further processing. Therefore, the expanded tobacco is typically moisturized in a subsequent reordering step (not shown in the drawings) to achieve a final moisture content for the processed tobacco of typically about 11 percent.

[0037] In the tower drying process the tobacco is removed from the silo 40 with the aid of the small doffers 401 of the detangling unit 400. Substantially pad-free and clump free tobacco is forwarded to the first feed unit 10, or, if two feed units 10, 11 are used to second feed unit 11, so that no blockage occurs at the second feed unit 11. The tobacco is then introduced into a stream of non-saturated superheated steam, which may typically have a temperature in a range of about 180 degrees Celsius to about 400 degrees Celsius, preferably between about

180 degrees Celsius to about 250 degrees Celsius. The speed of the stream of superheated steam typically may be within the speed range of from about 18 meters per second to about 25 meters per second. The moisture content of the tobacco in the silo 40 typically may be within the range of from about 20 percent to about 32 percent. The moisture content of the tobacco when rec-

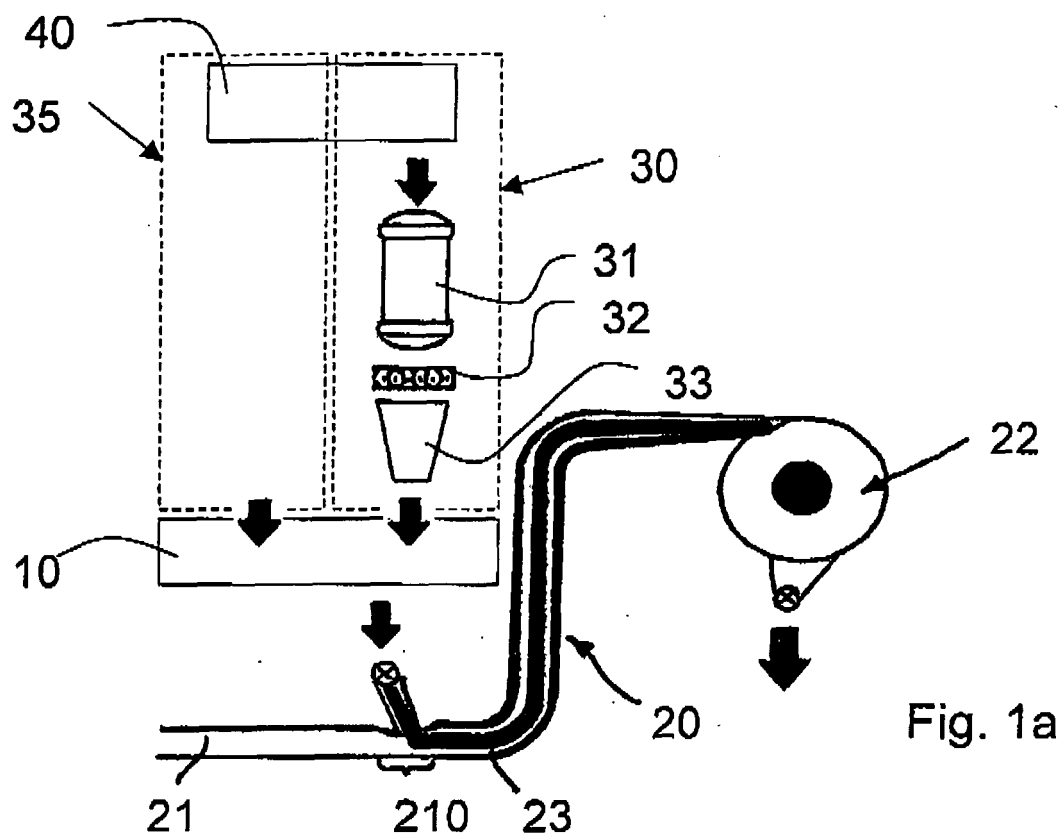
collected from the tangential separator 22 typically may be within the range of from about 11 percent to about 14 percent.

[0038] Up to today, it has not been possible to use the same system for chemical expansion and tower drying, since the respective systems were specifically designed for one type of process. Now, the combination of the two types of processes (chemical expansion and tower drying) is also possible with the system according to the invention. Furthermore it is possible, for example, to introduce tobacco treated with a chemical solvent into a stream of superheated steam. This allows producing expanded tobacco having virtually any moisture content between about 8 percent to about 15 percent without the need of subsequent complete or partial reordering of the expanded tobacco. Alternatively expanded tobacco with a moisture content between about 2 percent and about 8 percent may be produced which is then completely or partially reordered. Accordingly, the system of the invention allows producing expanded tobacco by using only tower drying, only chemical expansion, and any combinations thereof to achieve any desired final tobacco moisture contents within predetermined ranges, and corresponding expansion rates. Also, the system allows to use capacities for one type of process which would remain otherwise unused, or it avoids additional investments in a system for the respective other type of process. Also, since the system allows combinations of the described types of processes to be performed, it may substantially reduce the fire risk when tower drying heat treatment conditions are applied to tobacco treated with a chemical solvent for the expansion.

Claims

1. A system for producing expanded tobacco, comprising
a tobacco expansion apparatus (20), in which the tobacco is expanded,
at least a first tobacco supply unit (30) for providing tobacco containing at least one suitable chemical solvent other than water to prepare the tobacco for expansion,
at least a second tobacco supply unit (35) for providing tobacco containing only water as a solvent to prepare the tobacco for expansion and
at least a first feed unit (10) for introducing tobacco from the at least first tobacco supply unit (30) and the at least second tobacco supply unit (35) into the tobacco expansion apparatus (20).

2. A system for producing expanded tobacco, comprising
a tobacco expansion apparatus (20), in which the tobacco is expanded,
at least a first tobacco supply unit (30) for providing tobacco containing at least one suitable chemical solvent other than water to prepare the tobacco for expansion,
at least a second tobacco supply unit (35) for providing tobacco containing only water as a solvent to prepare the tobacco for expansion,
at least a first feed unit (10) for introducing tobacco from the at least first tobacco supply unit (30) into the tobacco expansion apparatus (20) and
at least a second feed unit (11) for introducing tobacco from the at least second tobacco supply unit (35) into the tobacco expansion apparatus (20).
3. A system according to claim 1 or claim 2, wherein the tobacco expansion apparatus comprises a tower (20).
4. A system according to any one of the preceding claims, wherein the at least a first supply unit (30) for providing the tobacco containing a chemical solvent other than water comprises an impregnator (31) where the tobacco is exposed to the chemical solvent, for example liquid or gaseous carbon dioxide.
5. A system according to any one of the preceding claims, wherein the at least a second supply unit (35) for providing the tobacco containing water as a solvent comprises a silo (40) for storing the tobacco, the silo (40) having an outlet, with a detangling unit (400) for detangling the shreds of tobacco being arranged in the silo (40).
6. A system according to claim 5, wherein the detangling unit (400) comprises a plurality of slowly rotating small doffers (401) which are arranged essentially over the entire width and height of the silo (40).



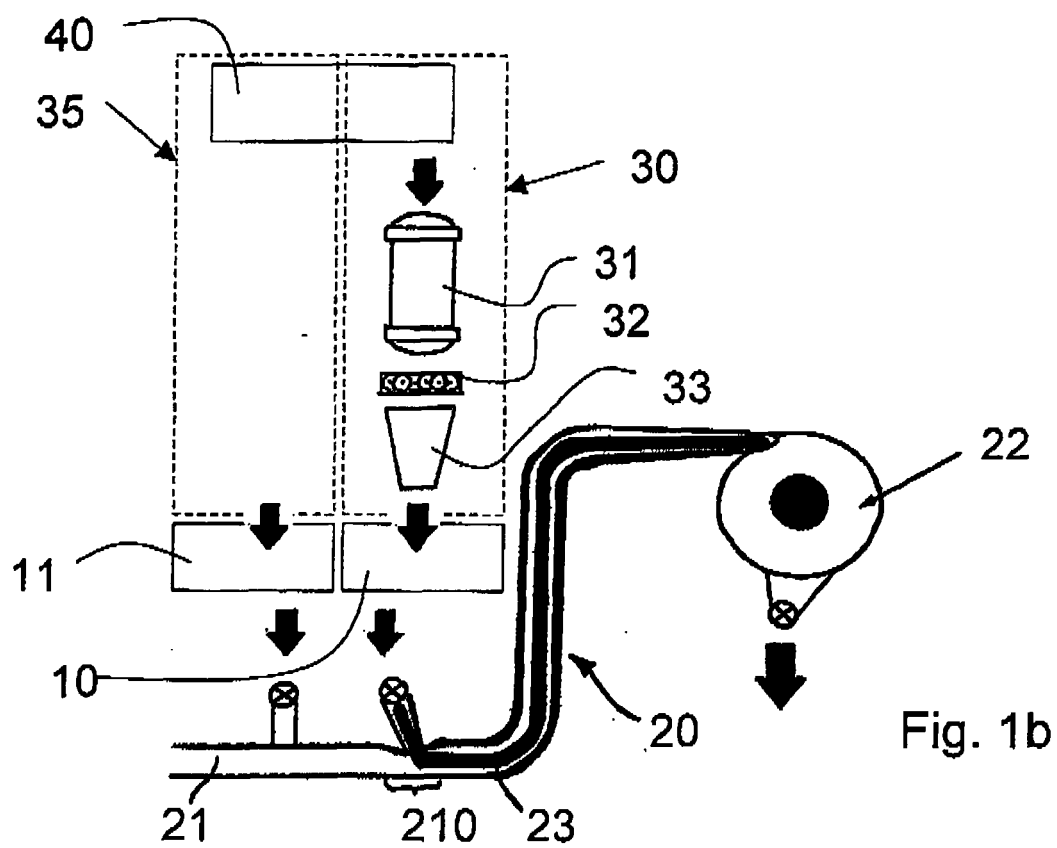


Fig. 1b

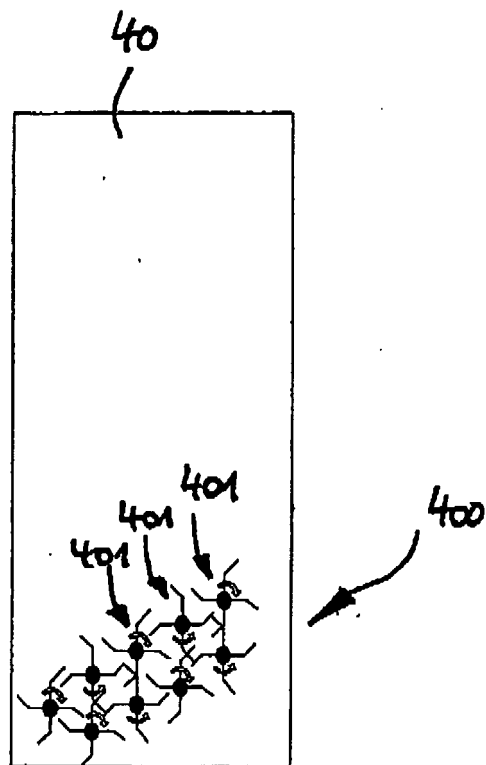


Fig. 2



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 06 40 5497

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	EP 0 651 951 A2 (PHILIP MORRIS PROD [US]) 10 May 1995 (1995-05-10) * column 8, line 48 - column 9, line 5; figure 2 *	1,2	INV. A24B3/18
A	US 5 810 019 A (BEARD HOYT STURDIVANT [US] ET AL) 22 September 1998 (1998-09-22) * column 6, line 49 - column 14, line 29; figures *	1,2	
A	US 2004/182404 A1 (POINDEXTER DALE BOWMAN [US] ET AL) 23 September 2004 (2004-09-23) * paragraph [0022]; figures *	1,2	
A	EP 0 629 352 A (REYNOLDS TOBACCO CO R [US]) 21 December 1994 (1994-12-21) * abstract; figures *	1,2	
A	US 4 519 407 A (HELLIER JOHN A [US]) 28 May 1985 (1985-05-28) * the whole document *	1,2	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			A24B
Place of search		Date of completion of the search	Examiner
Munich		23 April 2007	MARZANO MONTEROSSO
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 40 5497

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23-04-2007

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0651951	A2	10-05-1995	AT 206588 T	15-10-2001
			BR 9404360 A	04-07-1995
			DE 69428563 D1	15-11-2001
			DE 69428563 T2	27-06-2002
			JP 7184624 A	25-07-1995

US 5810019	A	22-09-1998	AR 002777 A1	29-04-1998
			AU 697870 B2	22-10-1998
			AU 5833896 A	23-01-1997
			BG 62470 B1	30-12-1999
			BG 100690 A	31-01-1997
			BR 9602978 A	28-04-1998
			CA 2180318 A1	11-01-1997
			CN 1140034 A	15-01-1997
			CZ 9601920 A3	14-01-1998
			EP 0754411 A2	22-01-1997
			HR 960293 A2	28-02-1998
			HU 9601878 A2	28-05-1997
			JP 9023863 A	28-01-1997
			NO 962885 A	13-01-1997
			PL 315094 A1	20-01-1997
			RU 2156596 C2	27-09-2000
			SK 87796 A3	07-05-1997
			TR 970036 A2	21-01-1997
			US 5657771 A	19-08-1997
			ZA 9605437 A	24-01-1997

US 2004182404	A1	23-09-2004	AU 2004224453 A1	07-10-2004
			BR PI0408531 A	07-03-2006
			CA 2519153 A1	07-10-2004
			CN 1774183 A	17-05-2006
			EP 1603412 A2	14-12-2005
			JP 2006520599 T	14-09-2006
			WO 2004084657 A2	07-10-2004

EP 0629352	A	21-12-1994	AU 669797 B2	20-06-1996
			AU 6349294 A	15-12-1994
			BG 98820 A	31-03-1995
			BR 9402386 A	17-01-1995
			CA 2125628 A1	15-12-1994
			CN 1099587 A	08-03-1995
			CZ 9401348 A3	16-08-1995
			FI 942810 A	15-12-1994
			HR 940353 A2	31-08-1996
			HU 70803 A2	28-11-1995
			JP 7067611 A	14-03-1995

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 40 5497

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23-04-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0629352	A	NO 942209 A	15-12-1994
		PL 303823 A1	09-01-1995
		SK 69394 A3	13-09-1995

US 4519407	A	28-05-1985	NONE

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 4340073 A [0003]
- US 4407306 A [0003]