



(11)

EP 1 703 240 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
20.09.2006 Bulletin 2006/38

(51) Int Cl.:
F26B 21/08 (2006.01) F26B 17/10 (2006.01)

(21) Application number: **06111088.8**

(22) Date of filing: **14.03.2006**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
SK TR**
Designated Extension States:
AL BA HR MK YU

(72) Inventors:
• **Sieredzinski, Marek**
26-600, Radom (PL)
• **Majewski, Cezary**
26-630, Jedlnia Letnisko (PL)

(30) Priority: **17.03.2005 PL 37374605**

(74) Representative: **Rachubik, Irena**
P.O. Box 168
Patpol,
00-950 Warsaw (PL)

(71) Applicant: **International Tobacco Machinery**
Poland Ltd
26 600 Radom (PL)

(54) **A method of drying in a superheated steam "flash" dryer**

(57) A method of drying in a "flash" type superheated steam dryer wherein a drying medium in a form of steam is delivered to a product to be dried and delivered to a separator, which separates the dried product from the drying medium, the medium being delivered to a superheater via a fan, whereupon again the product to be dried is added. According to the invention water is added to the path of the drying medium in a controlled manner, preferably directly via nozzles.

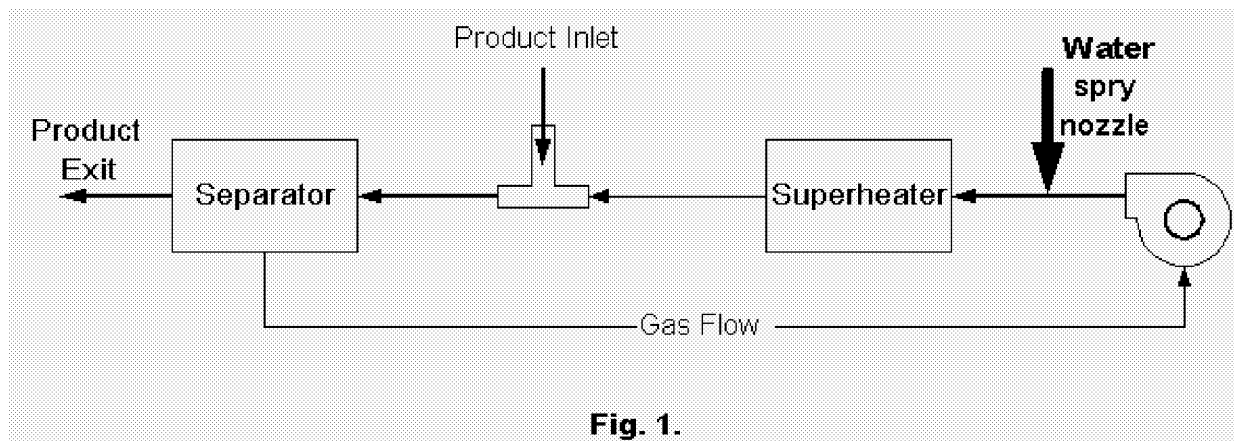


Fig. 1.

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Description

[0001] This invention relates to a method of drying in a "flash" type superheated steam dryer.

[0002] A "flash" type superheated steam dryer comprises a pipeline in which a drying medium flows, the medium being superheated steam, and a product, for example tobacco material, a fan propelling the drying medium and the product, a superheater for the drying medium, e.g., steam, a separator separating the product from the drying medium, and airlocks separating the interior of the drying pipeline from the surroundings, located at the inlet and outlet of the product, preventing losses, i.e., spilling out of the drying medium while allowing for the flow of the product, and a system of automatic control of the process parameters.

[0003] The operation of a "flash" type superheated steam dryer may be divided into the following stages:

- Preparing the machine for the process;
- Stand-by for the start of the drying process;
- Drying process (the actual process);
- Cooling the machine after the drying process;

[0004] The above mentioned functions are controlled by a system of automatic control of the process.

[0005] Process parameters are controlled during the process, such as the drying medium temperature, the oxygen contents in the drying medium, the mass inflow of the product, and the moisture content of the dried product at the outlet of the drying process, as the resulting quantity.

[0006] Since the moisture content of the dried product, suitable for further processing, must be confined within very narrow limits, typically less than $\pm 1\%$, precise control of the system and limiting duration of transient nonstationary states, generated at the moments of changing the process stages and by disturbances due to the inertia of the dryer, are of critical importance.

[0007] According to the state of the art, the drying process in "flash" type superheated steam dryers was based on controlled supplementation of steam, the steam replenishing losses of water. According to those methods of drying, when a dried product was added or exchanged, disturbances of the drying process were occurring, and the stabilization period was long, until the process achieved the steady state. Frequently, the obtained product had to be recirculated into the drying process or had inappropriate parameters, such as the moisture content, this being very adverse for such products as tobacco material. Often, obtaining an inappropriate product resulted in the necessity of stopping machines, and the start-up was a long-lasting process.

[0008] According to the invention, a method of drying in a flash type superheated steam dryer wherein a drying medium in a form of steam is delivered to a dried product and then delivered to a separator, which separates the product from the drying medium, the medium being delivered to a superheater via a fan, whereupon again the product is added, is characterized in that water is added to the path of the drying medium in a controlled manner, preferably directly via nozzles.

[0009] Water is delivered before the steam superheater and, preferably, oxygen content is controlled in a range of 0% to 5%.

[0010] Water is delivered before the fan.

[0011] Water is delivered before the product inlet into the dryer.

[0012] Preferably, one delivers cold water, warm water, hot water, or superheated water.

[0013] Delivery of water before the steam superheater allows for replenishing steam in the dryer and for regulation of the oxygen contents in the range from 0% to 5%.

[0014] Introduction of water before the fan decreases the volume while increasing the density of the steam, this resulting in an increase of the flow rate in the process zone.

[0015] Introduction of water before the product inlet into the dryer gives the possibility of rapid change of temperature and flow rate.

[0016] The method according to the invention significantly reduces periods of transient nonstationary states related to the beginning, interrupting and terminating the drying process, allowing for better stability of parameters of the dried product during the drying process, thanks to the increase of elasticity of parameters of the dryer operation, and significantly increases the effective production time, thus increasing the efficiency. After injection of water, almost immediately adjustment of the drying process occurs and no product degradation happens.

[0017] Furthermore, using the method according to the invention one obtains fast compensation of disturbances of the drying process and better stability - resulting in better product quality.

[0018] Furthermore, according to the invention, the delivery of water may be used to accelerate cooling the dryer after the drying process.

[0019] According to the invention, the dryer becomes more dynamical, particularly when a product is being changed. The quality of the drying process increases, stoppages are avoided, and neither overdried nor underdried products are obtained.

[0020] The method according to the invention eliminates the necessity of using an external source of steam for approaching the process capacity quickly (achievement of appropriate parameters during the startup of the dryer) when the drying medium is superheated steam.

[0021] The present invention will be understood more fully in conjunction with the drawings in which:

Fig. 1 shows an arrangement of the dryer in which water is delivered before a steam superheater;

Fig. 2 shows an arrangement of the dryer in which water is delivered before the inlet of the product into the dryer;

Fig. 3 shows an arrangement of the dryer in which water is delivered before a fan.

[0022] Figs 1 - 3 show a modern arrangement of a dryer comprising a pipeline in which a drying medium flows, the medium being superheated steam, and a product, for example tobacco material, a fan propelling the drying medium and the product, a superheater for the drying medium, for example steam, a separator separating the product from the drying medium, and - air-locks (not shown) separating the interior of the drying pipeline from the surroundings, located at the inlet and outlet of the product, preventing losses, i.e., spilling out of the drying medium while allowing for the flow of the product, and a system of automatic control of the process parameters (not shown).

[0023] In the method of drying according to the invention water is added to the path of the drying medium in a controlled manner, preferably directly via nozzles.

[0024] Water is added before a steam superheater (Fig. 1), before the product inlet into the dryer (Fig. 2), or before a fan (Fig. 3).

[0025] Water may be added as cold water, warm water, hot water, or superheated water via the same nozzles, depending on needs. Possibility of adding water in a few states, such as hot water heated up to 160 - 300°C or cold water, allows for adjustment of desired product parameters, i.e., heats the product up or rapidly cools it down, thus avoiding unnecessary stopping machines.

[0026] Adding water before a steam superheater allows for replenishing steam in the dryer and for regulation of the oxygen contents in the range from 0% to 5%.

Claims

1. A method of drying in a "flash" type superheated steam dryer wherein a drying medium in a form of steam is delivered to a dried product and then delivered to a separator, which separates the product from the drying medium, the medium being delivered to a superheater via a fan, whereupon again the product is added, **characterized in that** water is added to the path of the drying medium in a controlled manner, preferably directly via nozzles.
2. A method according to claim 1, **characterized in that** water is added before a steam superheater.
3. A method according to claim 1, **characterized in that** water is added before a fan.
4. A method according to claim 1, **characterized in that** water is added before the product inlet into the dryer.
5. A method according to claim 2, **characterized in that** oxygen contents is regulated in the range of 0% - 5%.
6. A method according to claim 1 or 2 or 3 or 4, **characterized in that** cold water is added.
7. A method according to claim 1 or 2 or 3 or 4, **characterized in that** warm water is added.
8. A method according to claim 1 or 2 or 3 or 4, **characterized in that** hot water is added.
9. A method according to claim 1 or 2 or 3 or 4, **characterized in that** superheated water is added.

