

[54] **METHOD OF DRYING GOODS
SUSPENDED IN A GAS STREAM**

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[51] Int. Cl. **F26b 3/10**

[58] Field of Search **34/57 R, 57 A, 10; 263/21 A;**
23/288, 35, 284

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Primary Examiner—Meyer Perlin

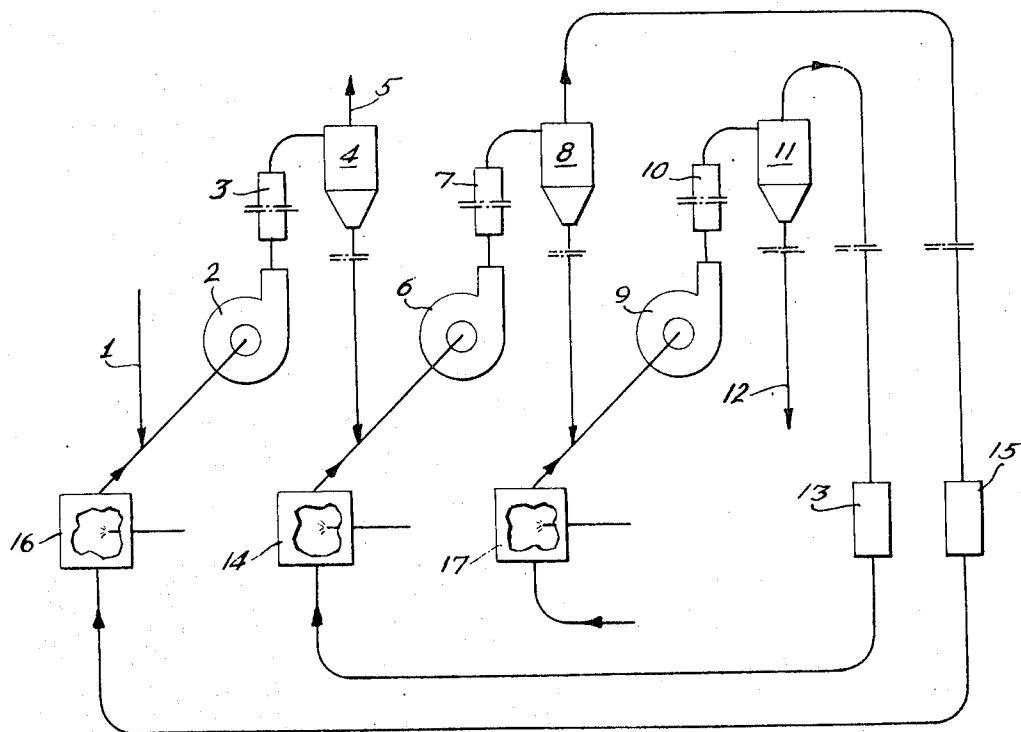
Assistant Examiner—W. C. Anderson

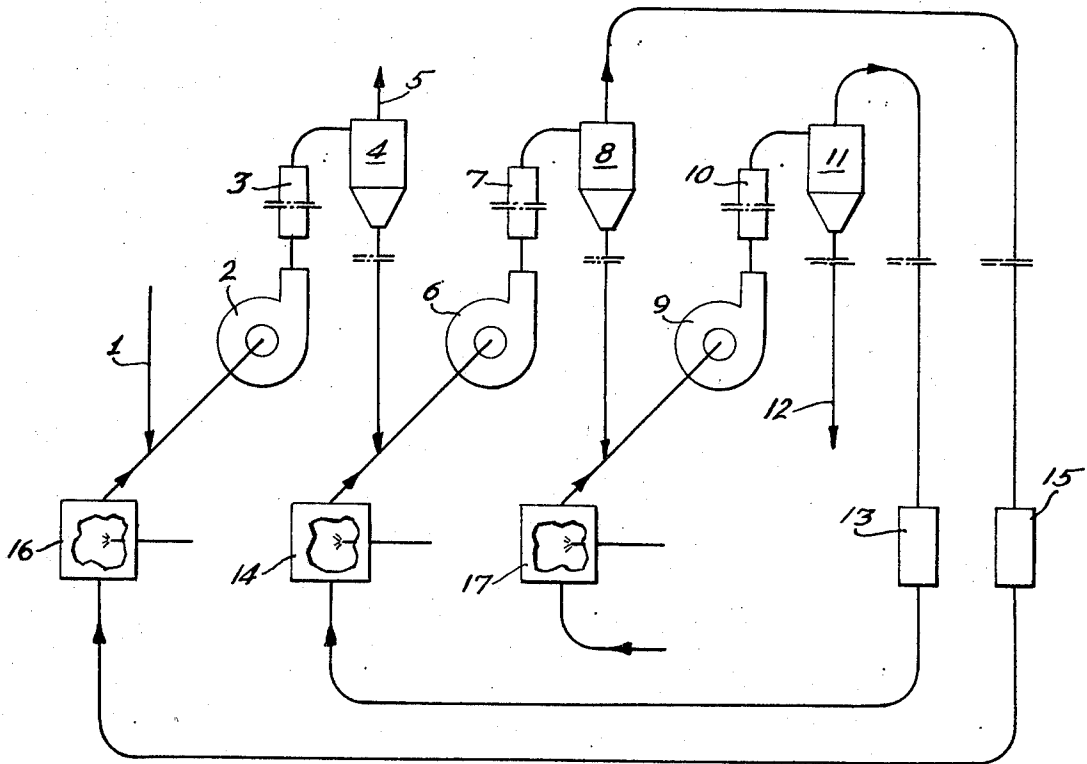
Attorney—Howson and Howson

[57] **ABSTRACT**

A method of drying material in which the drying material is suspended in a stream of gaseous drying medium in successive drying stages, the drying medium used being common to all of the stages and being circulated from the final stage into the preceding stage, and from the preceding stage into the initial stage and being heated between stages to an extent to elevate the temperature of the drying medium above its previous temperature whereby the drying medium in the first stage is at the highest temperature and highest moisture content and the temperature and moisture content decreases successively toward the final drying stage.

3 Claims, 1 Drawing Figure





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METHOD OF DRYING GOODS SUSPENDED IN A GAS STREAM

This invention relates to a method of drying finely distributed material sensitive to high temperatures, for example defibrated cellulose.

For the drying of finely distributed material usually a pneumatic dryer is used, i.e. a dryer where the material to be dried is suspended in the drying medium, and which comprises substantially a heat source, a fan, a drying coil and after the drying coil a separating means for separating the drying medium from the material dried.

At the drying of material not particularly sensitive to high temperatures, the method usually applied comprising the steps of passing drying medium through two or more drying steps in series and supplying the wet material to be dried to the dryer during the last step of the drying medium when the temperature of the drying medium is lowest, separating the material thus pre-dried and feeding it into the next foregoing step of the drying medium. During the drying, thus, the material to be dried passes through the drying medium in a countercurrent flow, and the final drying is carried out with the hot drying medium entering the dryer. The drying medium, subsequent to its separation from the completely dried material, is utilized for pre-drying the material to be dried. Hereby the drying medium is utilized to a high degree, and as in other processes with countercurrent flow a high heat efficiency is obtained.

At the pneumatic drying of material highly sensitive to high temperatures, for example defibrated cellulose, it is however necessary, for preventing the material from being damaged by drying, to carry out the drying in a concurrent flow in two or more drying steps, in such a manner, that the wet material to be dried is supplied to the first drying step where it is dried with drying medium of a high temperature, and that the final drying takes place during subsequent drying steps at successively reduced temperatures. Hereby the material to be dried is subjected only to a slight heat treatment, and damages by drying are prevented. One disadvantage of this drying method, however, is the low heat efficiency, owing to the use of drying air of a low temperature with resulting large ventilation losses.

The present invention has as its object to eliminate the aforesaid shortcomings at the drying of finely distributed material sensitive to high temperatures, for example defibrated cellulose, in at least two drying steps, each of which operates with the finely distributed material to be dried suspended in a flow of a gaseous drying medium, in such a manner, that the material to be dried is supplied to the drying medium prior to and is separated from the drying medium subsequent to every drying step. The method is substantially characterized in that the material to be dried and the drying medium pass through the series of drying steps in a flow countercurrent to each other, and that the drying medium at every passage between the drying steps is reheated.

According to an advantageous further development of the invention the drying medium is reheated at every passage between the drying steps to such a degree, that its temperature upon the feed of the medium to the drying step in question successively increases in the flow direction of the drying medium and, thus, successively decreases in the transport direction of the material to

be dried. Hereby a pneumatic drying method is obtained which has a heat efficiency as high as and in certain cases even higher than that obtained by the aforementioned countercurrent flow principle, and which involves as low a temperature treatment of the material to be dried as at the aforementioned concurrent flow principle, so that damages by drying are avoided.

It is particularly suitable to filter the drying medium drawn off from every drying step, except for the first step in the transport direction of the material to be dried, and substantially freed from said material, before reheating it and feeding it to the next foregoing drying step.

An embodiment of the invention is described in greater detail in the following with reference to the accompanying drawing. The drying, which can be carried out in two or more steps, is shown in the drawing divided into three steps. At 1, wet material to be dried is supplied to drying medium coming from drying step two. Said drying medium has been filtered in a filtering arrangement 15 and heated by a burner 16 before it is utilized for pre-drying in the drying step one. During the drying the material passes through a fan 2 and a drying coil 3 whereafter it is separated in a separator 4 from which the drying medium used is discharged upwardly at 5. The material to be dried falls down into the drying medium coming from the last drying step, which medium also has been filtered in a filtering arrangement 13 and been heated by a burner 14. As in the first drying step, the material to be dried passes through a fan 6 and a drying coil 7 whilst being dried in the second step and thereafter is separated in a separator 8 and falls down to the third drying step for its final drying. Into this drying step is fed the drying medium, which has been heated by a burner 17. The material to be dried is subjected to final drying at its passage through a fan 9 and a drying coil 10. The completely dried material 12 is discharged from a separator 11.

The heating of the drying medium in the burners 14, 16 and 17 is so adjusted that the drying medium has the lowest temperature when the material to be dried is subjected to its final drying in the last drying step, and has its highest temperature in the first drying step when the material to be dried is wettest and, thus, cannot be damaged by the high temperature. The drying medium entering at 17 is used in all drying steps by circulation and heating, which results in a high utilization degree of the drying medium and, thereby, in a high heat efficiency of the installation. Certain types of material to be dried include certain very fine fractions. These fractions are not separated in the separators, which usually are cyclones and, therefore, the drying medium has to be filtered in a special filtering means in order to prevent spark and soot formation in the burners.

The invention has been described with reference to one embodiment thereof, but it may arbitrarily be varied within the scope of the following claims.

I claim:

1. A method of drying finely distributed material sensitive to high temperatures in at least two drying stages comprising the steps of causing a predetermined flow of drying medium to flow through the drying stages, suspending the drying material into the drying medium in advance of each stage and separating the drying material from the drying medium subsequent to each

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stage, causing the same drying medium to flow generally countercurrent to the drying material by exhausting the drying medium separated from the drying material subsequent to the first stage, and directing all of the predetermined flow of drying medium separated from the material subsequent to the second stage into the inlet of the first stage, and heating said predetermined flow of drying medium intermediate said second stage and said first stage to a temperature above the temperature at which the drying medium enters the second stage so that the drying medium when it enters the first stage is at a higher temperature and has a higher moisture content than when it enters the second stage.

2. A method according to claim 1 wherein the drying is effected in at least three stages including the step of passing all of the predetermined flow of drying medium

separated from the drying material after the third stage into the inlet of the second stage and separately heating said predetermined flow of drying medium separated from the third stage so that its temperature is elevated above the temperature at which it entered the third stage whereby the temperature and heat content of the drying medium successively decrease throughout the entire three stages.

3. A method according to claim 1 including the step of filtering the predetermined flow of drying medium when it is drawn off from every drying stage, except from the first stage in the transport direction of the drying material, and substantially separated from the drying material before it is reheated and fed to the next foregoing drying step.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,707,775 Dated January 2, 1973

Inventor(s) Berndt Kaltin

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

In the heading before [52] U.S. Cl., the following should be added:

[30] Foreign Application Priority Data

October 10, 1969 Sweden.....13 971/69

Signed and sealed this 22nd day of May 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

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