

[54] **DEVICE FOR DRYING DAMP POWDERS**

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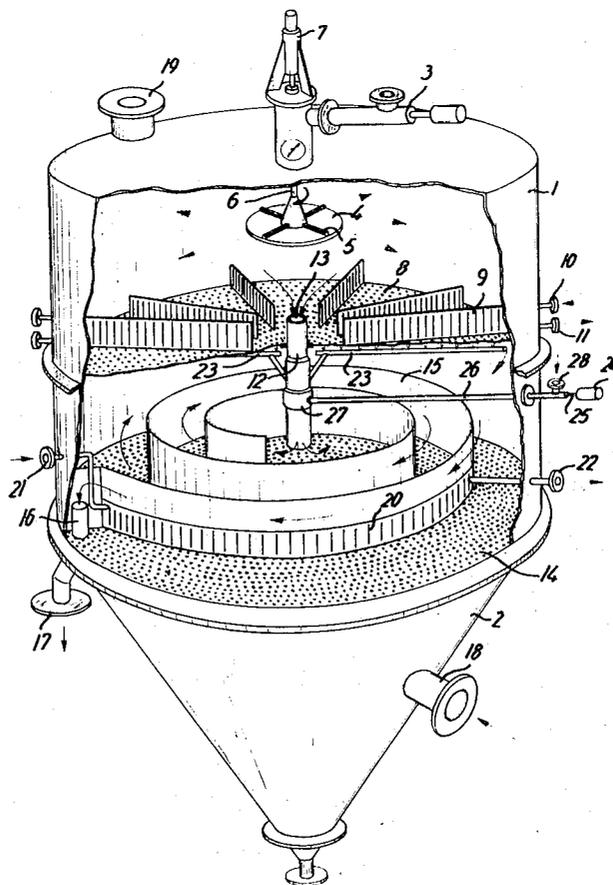
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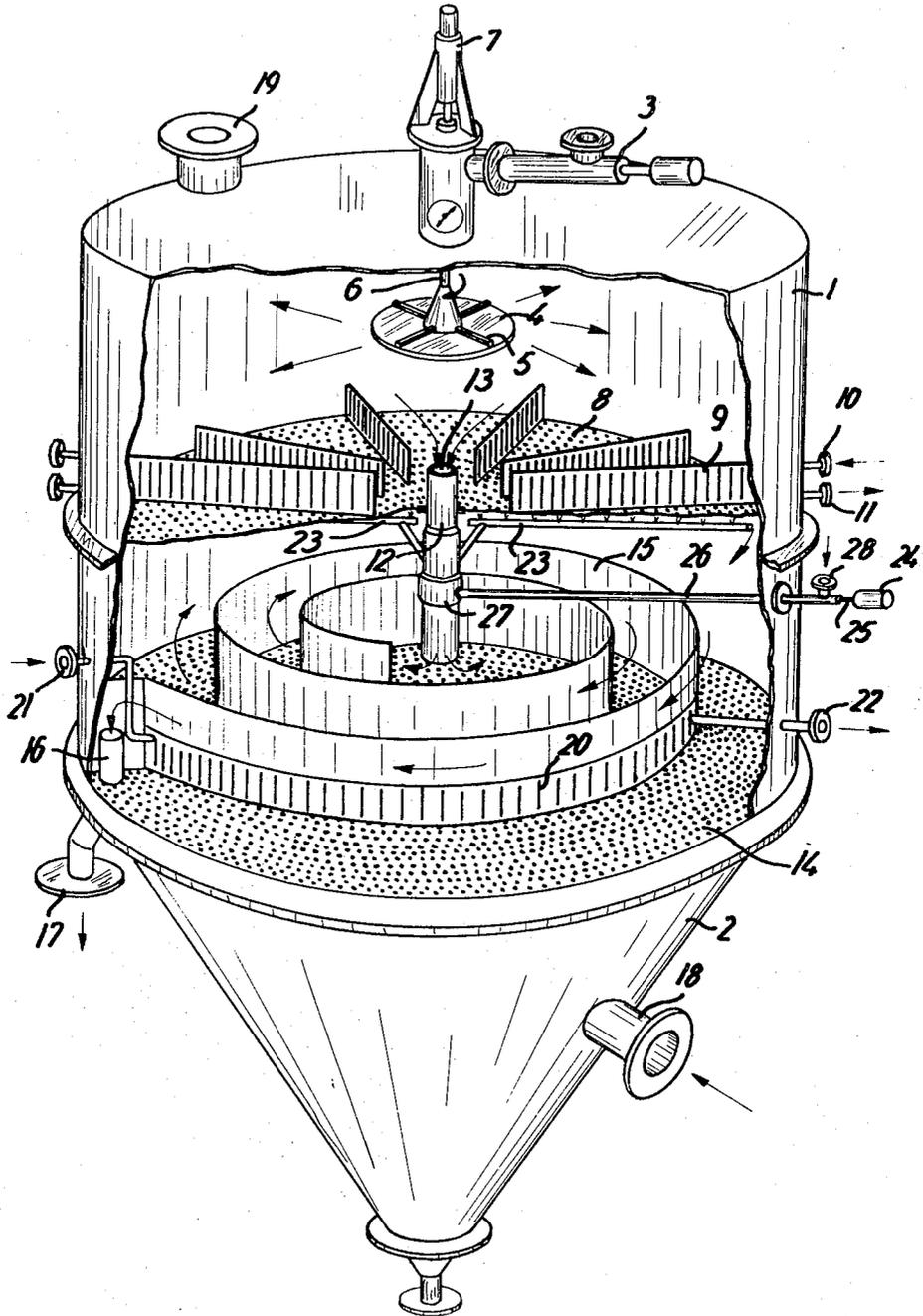
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[57] **ABSTRACT**

A device for drying powders with a high moisture content comprising a drying chamber with a powder inlet and a drying gas outlet at the top and a powder outlet and a drying gas intake at the bottom, a perforated supporting plate being mounted in the upper portion of the chamber, a rotating distributor being provided centrally beneath the powder inlet above the perforated plate. Immediately above the perforated plate a number of heating elements are arranged, whereas one or several overflows leads from the perforated plate down to an additional perforated supporting plate mounted below the first one and provided with a number of vertical guiding walls and a number of overflows communicating with the powder outlet.

3 Claims, 1 Drawing Figure





DEVICE FOR DRYING DAMP POWDERS

The present invention relates to a device for drying powders with a high moisture content, particularly powders whose moisture content is so elevated that they cannot be immediately fluidized, which device consists of a drying chamber, the principal portion of which is cylindrical in shape with a vertical axis and in which, at the top, a powder inlet and, at the bottom, a powder outlet are provided, in addition to which, at the bottom, a drying gas intake and, at the top, a drying gas outlet are provided.

For economically drying such powders, a multiple step drying operation is usually called for in that during the last step or steps, when sufficient moisture has been removed in advance, a fluidized layer of the powder is produced with the aid of the drying gas.

The object of the present invention is to provide a simplified construction of the equipment required for such a drying operation and this is achieved by the device according to the invention which is characterized in that a perforated supporting plate is mounted in the topmost portion of the chamber, above which, disposed centrally underneath the powder inlet, a rotating distributor is fitted while, immediately above this supporting plate, a plurality of heating elements are arranged, preferably in the form of radial, vertical walls and in that, from the supporting plate, a powder outlet is provided in the form of one or several overflows which leads or lead, as the case may be, down to an additional perforated supporting plate mounted below the first supporting plate which is fitted with one or several vertical guiding walls for the fluidized powder and with one or several overflows that communicate with the powder outlet of the device.

In spite of the fact that the material which is supplied cannot be immediately fluidized, it nevertheless is possible to build up a fluidized layer on the topmost supporting plate by the powder which is hurled from the distributing disc being spread out on the layer that has already been fluidized and by its sinking in it until enough has been dried to be fluidized. A particularly effective drying operation is achieved thereby already on the topmost supporting disc since, despite the fact that the material supplied cannot be fluidized at once, it is possible, however, to utilize the advantages presented by the good mass transfer and heat transfer conditions which, as is known, are achieved when drying in a fluidized layer. All that has to be ensured is that a fluidized layer is built up right from the start of the operation, which can be brought about either by first introducing an appropriate quantity of dry powder or by beginning to supply the material sufficiently slowly so that it will be dry before the layer has become too thick so that, in this manner, a fluidized layer can build up which is of a thickness corresponding to the height of the overflow level.

The powder then runs, via the overflow, down onto the lower supporting plate where fluidization takes place immediately and it is now possible for the process to continue at the normal operating speed in the sequence described in the foregoing.

The gas which passes from the lower supporting plate and up through the upper supporting plate will generally be totally inadequate for effecting the drying in the top layer that is necessary for achieving an even downflow of fluidizable powder via the overflow, however,

this gas flow through the top layer nevertheless is of considerable importance to the drying process owing to the movement it imparts to the powder present on the topmost supporting plate.

Primarily, a pure drying operation is aimed at with the device according to the invention, that is to say that the device is intended especially for drying powders of the type that do not possess a marked tendency towards forming agglomerates, e.g. materials such as polyethylene, polypropylene, polyvinyl chloride, acrylnitrilebutadiene-styrene and other polymeric products which, by way of example, may be supplied in the form of filter cakes or pressed cakes. In addition, mention may be made of vegetable protein and mineral materials in this connection.

The invention also pertains to a method of operating the device and, according to the invention, this consists in that, when starting up the device, a fluidized layer is built up on the topmost supporting plate by supplying a certain quantity of fluidizable powder or by supplying the wet powder in such a way that this is dried sufficiently so as to become fluidizable before the thickness of the layer exceeds the height of the overflow level.

Below the invention is described in greater detail with reference to the accompanying drawing which, in a perspective elevation and with a partially removed outer wall, shows an embodiment of the device according to the invention.

The device is shaped like a chamber comprising an upper cylindrical portion 1 and a lower funnel-shaped portion 2. The material to be dried is supplied at the top by means of a screw feeder 3, whereby it drops onto a centrally mounted distributing disc 4 constructed with ribs 5 on the topside that are designed to hurl the powder from the disc. This disc 4 is secured on a shaft 6 which is driven by a motor 7, for example, a hydraulic motor. From distributing disc 4 the material is flung onto a perforated supporting plate 8 mounted topmost in the cylindrical portion 1 of the chamber, on the top-side of which plate a plurality of radial, vertically arranged heating elements 9 are fitted which are heated by means of steam and are provided with a steam inlet 10 and a steam outlet 11.

An overflow pipe 12 is passed centrally through supporting plate 8, whose topmost termination 13 is located at such a height above supporting plate 8 that a suitable layer thickness is determined thereby. This pipe 12 leads down to a lower perforated supporting plate 14 on which a spiral guiding wall 15 is mounted. In the proximity of the end of this guiding wall 15, an overflow pipe 16 is fitted which passes down through the funnel-shaped portion 2 of the chamber to a powder outlet, the height of which above supporting plate 14 determines the thickness of the layer on this plate.

The drying gas is supplied from below via the funnel-shaped chamber portion 2 by means of a gas intake 18. The gas passes the two supporting plates 14 and 8 and is removed from the chamber via a gas outlet 19 at the top.

The material that is to be dried is supplied with an elevated moisture content and it will consequently be somewhat cohesive, however, with the aid of distributing disc 4, a sufficiently high degree of disintegration of the material takes place so as to render a uniform distribution on supporting plate 8 possible on which the previously supplied material has already been dried to a sufficiently high degree so as to form a fluidized layer

in which the material hurled off the disc sinks and is rapidly dried sufficiently for fluidization to take place. The drying operation is effected mainly with the aid of the radial heating elements 9 in that the drying gas, subsequent to having passed supporting plate 14 and the layer disposed thereon, has a greatly diminished drying potential. The drying process in the layer on plate 8 takes place, mainly by surface evaporation from the particles in that the liquid that evaporates from the surface is continually replaced by liquid diffusing from the inside of the particles.

By means of the drying process taking place on supporting plate 8, sufficient moisture is removed for it being possible to fluidize the powder on supporting plate 14, on which it consequently, in a fluidized form and while subjected to continuously stepped-up drying, flows along a spiral path guided by guiding body 15 to overflow 16, from where it can be removed through powder outlet 17. The essential stage of the drying process on supporting plate 14 does not only take place from the surface but also from the inside of the particles.

In the embodiment illustrated, in order to additionally expedite the last stage of the drying process, a heating element 20 is incorporated into the outermost portion of the spiral wall 15 which, just like the radial heating elements 9, is supplied with steam by means of a steam inlet 21 and provided with a steam outlet 22.

In the embodiment shown, a cleansing device in the form of a pair of radial pipes 23 is mounted underneath plate 8, which cleansing device is pivotable around overflow pipe 12 by means of a motor 24, the shaft 25 of which is passed through pipe 26 to a gear 27 that is not shown in greater detail. Outside the chamber, pipe 26 is fitted with a gas intake 28 for cleaning gas which is conducted through pipe 26 to pipes 23, from which the cleaning gas is emitted against the underside of plate 8 through a plurality of nozzles. This cleansing device does not constitute the subject matter of the present invention but is described in greater detail in our copending patent application, corresponding to Danish Application No. 1798/71 and will, for this reason, not

be gone into in detail.

The build-up of the fluidized layer at the start of the operation of the device can be effected — in addition to dried material being supplied or by slowly supplying wet material — also by a suitable quantity of wet material being filled into the device, for instance, approximately up to the level of the overflow and by drying this material until it is fluidized, whereupon the feeding of material is commenced with.

The drying gas employed can be air or some other type of gas and the cleaning gas should preferably be of the same kind as the drying gas utilized in the device.

What is claimed is:

1. An apparatus for drying powders with a high moisture content including a generally cylindrical drying chamber having a vertical axis, a powder inlet and a drying gas outlet at the top, and a final powder outlet and a drying gas intake at the bottom, comprising: a first perforated supporting plate mounted in the topmost portion of the chamber, a rotating distributor disposed centrally underneath the powder inlet and above the supporting plate, a plurality of heating elements arranged immediately above the supporting plate in the form of radial, vertical walls, an intermediate powder outlet from the supporting plate in the form of at least one first overflow, a second perforated supporting plate mounted below the first supporting plate and the intermediate powder outlet, at least one vertical guiding wall for the fluidized powder fitted to the second supporting plate, and at least one second overflow fitted to the second supporting plate that communicates with the final powder outlet.

2. An apparatus as claimed in claim 1 wherein the rotating distributor comprises a rotating disc of small diameter in relation to the diameter of the chamber, the disc having ribs on its topside designed to hurl the powder from the disc.

3. An apparatus as claimed in claim 1 wherein the vertical guiding wall is in the form of a spiral, and has a heating element along part of its length.

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