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(54) **A METHOD AND A DEVICE FOR DRYING A FIBROUS OR GRANULAR MATERIAL.**

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Description

This invention relates to a method for drying a fibrous or granular material, preferably peat, in a rotary drier, primary drying air being supplied to the drier axially and being substantially moisture saturated at its passage through the drier due to absorption of water from the material to be dried. The invention also comprises a device for drying a fibrous or granular material.

A method and a device for drying wood chips and peat are previously known, the material being dried in a first space surrounding the space in which the final drying takes place. This two-step drying requires a relatively complicated device, the handling of the peat being relatively circumstantial as the peat must be transferred to the internal space for final drying after pre-drying in the external space.

A device for continuous dewatering of peat is also known, where peat is supplied to a stationary, perforated drum, electric current being conducted through the peat, which will then give off water vapour. Air is fed into the drum, absorbs the water vapour and is pressed out through the perforations in the drum.

Thus, the known technique for drying of peat is relatively complicated and slow. Moreover, it is not especially efficient as too low air temperatures are used.

US—A—892 901 discloses a method and a device for drying fibrous or granular material in a rotary drier whereby drying air is supplied radially to a drum through a great number of holes in the mantle of the rotary drier and the temperature is raised before introduction into the rotary drier by passing a number of heating pipes.

It is the object of this invention to provide a method and and a device for drying preferably peat in which drying air is supplied both axially and radially to a drier whereby the drying air meets the material to be dried both in a countercurrent and cross-flow direction which results in an extraordinarily efficient heat transfer. Besides, very high air temperatures, about 140°C, are used which means that the drying is carried out rapidly and efficiently. As the drying air is substantially moisture saturated during the whole drying process the risk of so-called dust explosion is in principle eliminated.

The object of the invention is realized by means of a method and a device given the characteristic features set out in the appended claims.

An illustrative example of a device according to the invention will be described below with reference to the enclosed drawing, where in Fig. 1 is shown schematically a longitudinal section of a drying unit according to the invention and Fig. 2 shows a section taken on the line II—II in Fig. 1.

The drying unit 1 shown in Figs 1 and 2 comprises a rotatry drier 2, which on its inside, see Fig. 2, is provided with flanges 3 ensuring good stirring of the material placed in the drum 2. The drum 2 is preferably cylindrical and has a great number of holes 4 on its mantle surface. These holes have preferably a diameter of about 3 mm.

As is apparent from Fig. 1 the rotary drier 2 has an inlet opening 5 and a discharge opening 6.

A great number of finned pipes 7 surround the drum 2 and are arranged at some distance from this. In operation of the drying unit 1 hot water or some other suitable medium is circulating in these finned pipes 7.

The drum 2 is supported by two bearings 8, which have the shape of rings running about the drum 2. The drum 2 is rotatable within these bearings 8. This rotation is created by a drive source, e.g. an electric motor, and suitable transmitting means.

An insulated mantle 9 is also included in the drying unit 1, which mantle extends along the major portion of the drum 2, the inlet and outlet openings 5 and 6 however not being surrounded by the mantle 9. As is apparent from Figs. 1 and 2 the mantle 9 has an upwardly tapering inlet 10 for drying air.

The drying unit described above works in the following way.

The drying principle of the unit 1 is built on the fact that raw peat is dried in the rotary drier 2 by evaporation of the water bound in the peat.

The primary drying air supplied to the drum 2 axially at the inlet opening has a relatively high temperature, about 150°C, when entering the drum 2. The supply of the primary drying air is preferably carried out by means of a fan not shown in the figures.

As the temperature of the primary drying air is so high a continuous disintegration of the particles takes place, the water in the particles being evaporated und taken up by the supplied drying air.

When the drying air supplied at the inlet opening 5 absorbs water vapour its temperature will sink to the order of 70°C when the air leaves the drum 2 at the outlet opening 6. At this stage the primary drying air is almost moisture saturated.

After the drying air has left the drum 2 via the outlet opening 6 it is dehydrated, e.g. in a heat exchanger or condenser not shown in the figures. After this the secondary drying air is blown via fans or the like (not shown) into the mantle 9 through the inlet opening 10. When the secondary drying air is supplied to the mantle 9 after the demoistening, its temperature is down to about 50°C. As mentioned above hot water or the like is circulating in the finned pipes 7, the temperature of the host water being of the order of 200°C. The hot water in the finned pipes 7 can e.g. consist of cooling water from some plant, waste heat thus being utilized for heating the drying air.

When the dehydrated drying air having a temperature of about 50°C is supplied to the drum 2 transversely via the holes 4, said drying air will pass past the hot water pipes 7, the drying air being heated at its passage of the pipes 7. The temperature of the so-called cross-flow air is raised from the above-mentioned about 50°C to about 140°C.

The fact that the drum 2 is rotating and that the drying air meets the peat both in a countercurrent and cross-flow direction contributes to an extraordinarily efficient heat transfer. The result of said heat transfer, in turn, is that the peat balls successively burst and are converted into peat granulate having a diameter of 4—6 mm. By the bursting the moisture transmitting surface is increased with a simultaneous increase of the dry content in the peat. Despite the increasing dry content in the peat and drying effect is constant during the entire drying process due to the continuous bursting of the particles.

The risk of so-called dust explosion in the drum 2 is very slight when using the process of the present invention as the drying air during the whole drying process has a high moisture content due to the fact that the water released at bursting is absorbed by the drying air in the form of water vapour. As there is a possibility within the scope of the invention of using exhaust gases as drying air this is also positive considering the risk of explosion as exhaust gases always contain water vapour in principle.

The peat granulate obtained as the result of peat drying is extraordinarily well suited for automated solid fuel systems.

The drying air used with the drying process according to the claimed invention can be obtained in many ways. A so-called hot air boiler is possible, which is e.g. fired with oil. This boiler has then preferably a water-carried cooling system. The heated air is used as primary drying air, but it can be mixed with the exhaust gases formed in the oil combustion. Cooling water from the boiler can be circulated in the finned pipes 7 for heating the secondary drying air.

It is also possible within the scope of the invention that the secondary drying is preheated in another way than through passage of the finned pipes. The temperature of the secondary drying air can e.g. be raised in such a way that it passes through a hot air boiler.

The invention is of course by no means restricted to the illustrative example described above and considering the generation of the primary drying air in particular the variations are numerous. Thus, the invention can be freely varied within the scope of the accompanying drawings.

Claims

1. A method for drying a fibrous or granular material, preferably peat, in a rotary drier (2), preheated primary drying air having a temperature of the order of 100—200°C, preferably about 140°C, being axially supplied to the rotary drier (2) and being substantially moisture saturated at its passage through the drying drum (2) due to absorption of water from the material to be dried, characterized in that when said primary, moisture saturated drying air leaves the rotary drier (2) it is dehydrated and is supplied radially to the drum (2) as secondary drying air through holes (4) in the mantle of the rotary drier, the temperature of said secondary drying air being raised before introduction into the rotary drier (2) to a temperature of the order of 100°—200°C, preferably about 140°C.

2. The method of claim 1, characterized in that the temperature of the secondary drying air is raised in that said air passes a number of finned pipes (7) surrounding the drum (2), in which hot water or another comparable medium is circulated.

3. The method of claim 1 or 2, characterized in that a bursting of the particles takes place at drying of peat particles or other particles with bound water.

4. The method of any of the preceding claims, characterized in that the dehydration of the drying air takes place in a heat exchanger or condenser.

5. A device for drying of fibrous or granular material preferably peat, which device comprises a rotary drier (2), which has inlet and outlet openings (5 and 6, respectively) for primary drying air at its ends, characterized in that the device comprises means for supplying primary drying air axially to the rotary drier (2); the mantle of the rotary drier (2) has a great number of holes (4) of a relatively small diametre, the device having means (9, 10) for supply of a secondary drying air radially through the holes (4) and means (7) for raising the temperature of the secondary drying air before it passes through the holes (4).

6. The device of claim 5, characterized in that finned pipes (7) in which hot water or another comparable medium can circulate are arranged around the drum (2) at some distance from this.

7. The device of claim 5, characterized in that the supply means for secondary drying air consist of a mantle (9) extending substantially along the whole drum (2), said mantle being provided with an inlet opening (10) located at about half the length of the drum (2).

Patentansprüche

1. Verfahren zum Trocknen von Faser- und Teilchenmaterialien, vorzugsweise Torf, in einen rotierenden Trockner (2), wobei vorgewärmte primäre Trockenluft mit einer Temperatur in der Grössenordnung von 100—200°C, vorzugsweise ca. 140°C, dem rotierenden Trockner (2) axial zugeführt und bei ihrem Durchgang durch den rotierenden Trockner (2) wegen Wasserabsorption von dem zu trocknenden Material wesentlich feuchtigkeitsgesättigt wird, dadurch gekennzeichnet, dass wenn die erwähnte primäre, feuchtigkeitsgesättigte Trockenluft den rotierenden Trockner (2) verlässt, sie dehydratisiert wird und durch Löcher (4) im Mantel des rotierenden Trockners (4) als sekundäre Trockenluft dem Trockner (2) radial zugeführt wird, wobei die Temperatur der erwähnten sekundären Trockenluft vor Einführung in den rotierenden Trockner (2) auf eine Temperatur in der Grössenordnung von 100—200°C, vorzugsweise ca. 140°C, erhöht wird.

2. Verfahren nach Anspruch 1, dadurch gekenn-

zeichnet, dass die Temperatur der sekundären Trockenluft dadurch erhöht wird, dass Luft mehrere den Trockner (2) umgebende, gerippte Rohre (7) passiert, worin Heisswasser oder ein anderes vergleichbares Medium zirkuliert wird.

3. Verfharen nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass die Teilchen zersprengt werden, wenn Torfteilchen oder andere Teilchen mit gebundenem Wasser getrocknet werden.

4. Verfahren nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Dehydratisierung der Trockenluft in einem Wärmetauscher oder Kondensor erfolgt.

5. Anordnung zum Trocknen von Faser- oder Teilchenmaterialien, vorzugsweise Torf, welche Anordnung einen rotierenden Trockner (2) umfasst, der an seinen Enden mit Einlass- und Auslassöffnungen (5 bzw. 6) für primäre Trockenluft versehen ist, dadurch gekennzeichnet, dass die Anordnung Mittel zur Zuführung von primärer Trockenluft axial zum rotierenden Trockner hat, dass der Mantel des rotierenden Trockners (2) eine grosse Anzahl von Löchern (4) von verhältnismässig kleinem Durchmesser hat, wobei die Anordnung Mittel (9, 10) zur Zuführung von sekundärer Trockenluft radial durch die Löcher sowie Mittel (7) zur Erhöhung der Temperatur der sekundären Trockenluft hat, ehe sie die Löcher (4) durchgeht.

6. Anordnung nach Anspruch 5, dadurch gekennzeichnet, dass gerippte Rohre (7), worin Heisswasser oder ein anderes vergleichbares Medium zirkulieren kann, rings um den Trockner (2) in einiger Entfernung davon angeordnet sind.

7. Anordnung nach Anspruch 5, dadurch gekennzeichnet, dass die Zufuhrmittel der sekundären Trockenluft aus einem Mantel (9) bestehen, der sich wesentlich längs des ganzen Trockners (2) erstreckt, wobei der Mantel mit einer Einlassöffnung (10) versehen ist, die im Bereiche der halben Länge des Trockners (2) gelegen ist.

Revendications

1. Procédé pour sécher un matériau fibreux ou granulaire, de préférence de la tourbe, dans un sécheur rotatif (2), l'air préchauffé de séchage primaire alimentant le sécheur rotatif (2) axialement à une température de l'ordre de 100 à 200°C, de préférence d'environ 140°C, et se saturant sensiblement d'humidité au cours de son passage par le tambour de séchage (2) en absorbant de l'eau du matériau à sécher, caractérisé en ce que ledit air de séchage primaire saturé d'humidité est déshydraté à sa sortie du sécheur rotatif (2) pour venir ensuite alimenter le tambour (2) radialement, en tant qu'air de séchage secondaire, par des trous (4) prévus dans l'enveloppe du sécher rotatif, la température dudit air de séchage secondaire étant élevée, avant son introduction dans le sécheur rotatif (2), jusqu'à une température de l'ordre de 100 à 200°C, de préférence d'environ 140°C.

2. Procédé selon la revendication 1, caractérisé en ce que la température de l'air de séchage secondaire est élevée du fait que ledit air passe par un nombre de tubes (7) à ailettes disposés autour du tambour (2) et dans lesquels on fait circuler de l'eau chaude ou tout autre fluide comparable.

3. Procédé selon l'une des revendications 1 et 2, caractérisé en ce que, lors du séchage de particules de tourbe ou d'autres particules contenant de l'eau liée, les particules éclatent.

4. Procédé selon une quelconque des revendications précéndentes, caractérisé en ce que la déshydration de l'air de séchage se produit dans un échangeur thermique ou dans un condenseur.

5. Dispositif pour sécher un matériau fibreux ou granulaire, de préférence de la tourbe, dispositif comprenant un sécheur rotatif (2) comportant, à ses extrémités, des ouvertures d'entrée et de sortie (5; 6) d'air de séchage primaire, caractérisé en ce qu'il comprend des moyens pour alimenter axialement le sécheur rotatif (2) en air de séchage primaire et que l'enveloppe du sécheur rotatif (2) est percée d'un grand nombre de trous (4) de diamètre relativement faible, le dispositif comprenant en outre des moyens (9, 10) d'alimentation en air de séchage secondaire radialement par les trous (4), ainsi que des moyens (7) de montée en température de l'air de séchage secondaire avant son passage par les trous (4).

6. Dispositif selon la revendication 5, caractérisé en ce qu'il est prévu, autour du tambour (2) et à une certaine distance de celui-ci, des tubes (7) à ailettes dans lesquels on peut faire circuler de l'eau chaude ou tout autre fluide comparable.

7. Dispositif selon la revendication 5, caractérisé en ce que le moyens d'alimentation en air de séchage secondaire sont constitués par une enveloppe (9) s'étendant sensiblement tout le long du tambour (2) et pourvue d'une ouverture d'entrée (10) située sensiblement à mi-longueur du tambour (2).

FIG.1

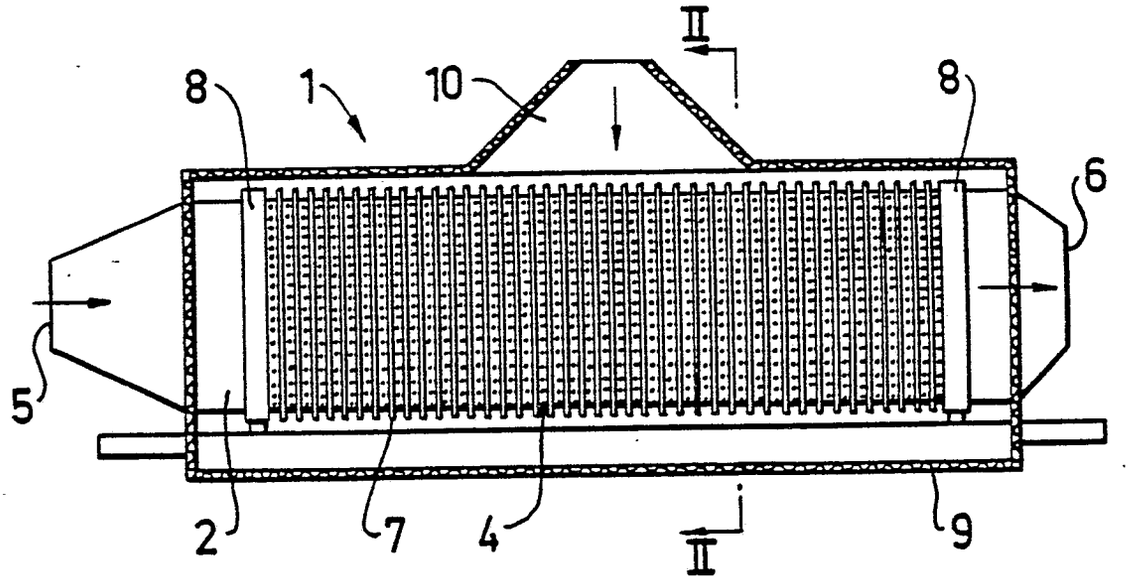

FIG.2