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(72) Inventor: **Vitale, Michele**
25036 Palazzolo Sull'Oglio
(Brescia) (IT)

(71) Applicant: **P System S.r.l.**
25036 Palazzolo Sull'Oglio (Brescia) (IT)

(74) Representative: **Sangiaco, Fulvia**
C/o Biesse S.r.l.
Corso Matteotti, 42
25122 Brescia (IT)

(54) **System for drying biomass**

(57) The invention concerns a system for drying biomasses, in particular wooden chips, sawdust, shavings and the like. It comprises an open system, starting from a first silo (11) containing an initial humid material, means for a circulation of the material to be progressively dried (21,22,15,24,12), means for shredding-refining of the material in circulation (22), means for air heating of the material (14), means for in line detection of the level of

humidity (31) of the material in circulation, and means for collecting the material when it has reached a required degree of dryness(16,27-30). Means for detecting the level of humidity (31) being set up to give signals used to manage both the means for adjusting the quantity of material from time to time in circulation and the means for adjusting the energy flow (14) to heat the material depending on its level of dryness.

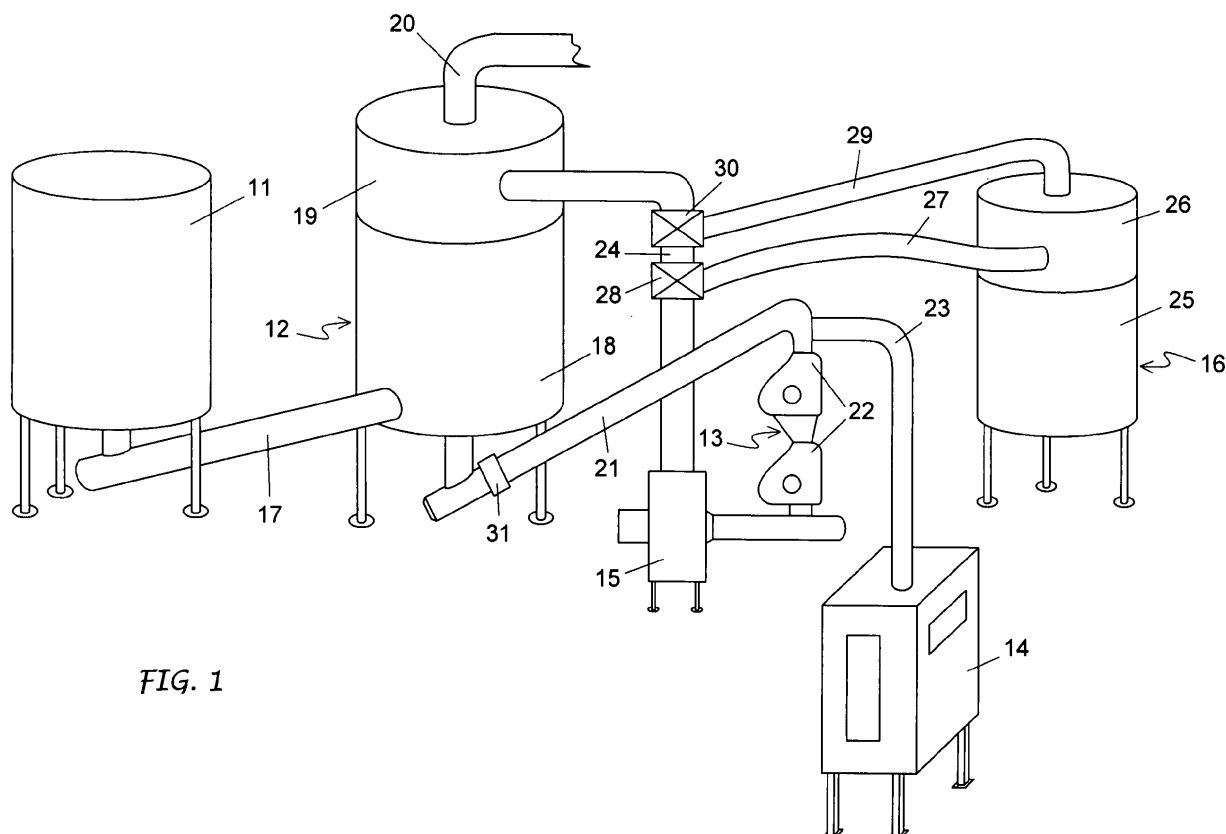


FIG. 1

Description

Field of the Invention

[0001] This invention concerns a system for drying biomass, in particular wooden chips, sawdust, shavings and the like, for the production then of pellets or briquettes using specific equipment.

State of the Technique

[0002] Already well known are the rotative and transverse drying biomass systems, but they are not without drawbacks and problems. Such drying systems are usually open system and require relatively high treatment temperatures which, besides having need of considerable energy consumption, can lead to an unwanted "toasting" of the material. Furthermore there is not the possibility of using an effective constant control of the dehumidification of the material and to be able to vary the feed of internal energy in relation to the material being treated or the level of dryness little by little reached.

Objectives and Summary of the Invention

[0003] One objective of this invention is to avoid the drawbacks and problems of the known technique and for that purpose to propose a system for drying biomass designed and operating using an open system with relatively low temperatures, ranging from 120- 180°C.

[0004] A further objective of the invention is to propose a system for drying biomass material such as wooden chips, sawdust, shavings and the like carried out by means of an innovative combination of components, normally not compatible between them but which enables the variation and absorption of energy fed to be carried out in relation to the load, the level of humidity and granulometry of the material being used in the treatment phase.

[0005] Said objectives are reached with a system for drying biomass that comprises, in a closed cycle combination, starting from a first silo containing an initial humid material, means for progressively turning the material to be dried, means for a breaking up-refining of the circulating material, means for heating the material using air, basically in the ambient of the breaking up-refining means, means at least for a monitoring in line with the humidity level of the material in circulation, and means for collecting the when it has reached the intended drying level. The means for monitoring the level of humidity are set up to supply signals used to conduct both the means for adjusting the quantity of material from time to time in circulation and the means for monitoring the feed of energy for heating the material depending on its drying level.

Detailed Description of the Invention

[0006] The invention will however be illustrated in

greater detail in the following description made in reference to the enclosed drawing in which the figure shows an outline of the drying system herein proposed.

[0007] As shown, the system comprises in combination a first silo 11 for the initial humid material, a second silo 12 for an intermediate collection and a recycling of the material during treatment, a refiner group 13, a boiler 14 for providing hot air for drying the material, at least one fan 15 for the circulation of the material and at least one final container 16 for collecting the dry material on finishing the treatment.

[0008] The first silo 11 is designed to receive the initial material with a humid content usually higher than 15%. This silo has an internal mixer for the material and has a bottom outlet from which extends a first conveyor 17, for example the auger type, set up for a progressive transfer of the initial material to the second silo 12.

[0009] This second silo 12 has a lower acceptance section 18 for the material and provided with an internal stirrer, and an upper section 19 configured as a cyclone designed to separate the aeriform substances from the solid material. The aeriform substances are discharged externally by means of a summit duct 20, whereas the solid material accumulates in the bottom section 18. The second silo 12 also has at least one bottom discharge and from this extends a second conveyor 21, also an auger, designed to convey the material to the entrance of the refiner group 13.

[0010] Preferably, this refiner group 13 comprises two or more cascading hammer mills 22, designed to conveniently crush the material and to amalgamate it with the hot air coming from the boiler 14 through a conduit 23 connected to the input of said refiner group. The outlet of the refiner group 13 is connected to the input of the ventilator 15, the outlet of which is connected by a conduit 24 to the upper section 19, or cyclone, of the second silo 12. Practically, the ventilator 15 is provided to convey the material amalgamated by air from the refiner group 13 to the second silo 12 in which the aeriform substances then separate from the solid material.

[0011] As regards to the boiler 14, it can be fed by gas or by some other fuel and however provided to produce hot air at a temperature of about 120-180°C, which is made to circulate in and with the material both in the refiner group 13 and in the second silo 12 so as to gradually remove humidity from the material.

[0012] Also the final container 16 has a lower acceptance section 25 for collecting the dry material and a cyclone 26 in its upper part.

[0013] In an execution method such as the one represented in the drawing, the conduit 24 connecting the outlet of the ventilator to the second silo 12 is connected, by way of a first ramification 27 and a respective first valve 28, to the cyclone 26 in the upper part of the final container 16 and, by way of a second ramification 29 and a respective second valve 30, to the summit of said final container.

[0014] It should be noted that the system will be pro-

vided with instruments to control the operating parameters, in particular a humidity probe 31 of the capacitive type or the like, placed along the route of the material, for example along the conveyor 21 that extends from the bottom of the second silo 12, to read-out the humidity level and it is set up to provide signals able to manage on the one hand means for adjusting the quantity of material from time to time in circulation and on the other hand to adjust the feed of hot air from the boiler in regards to the variation in the progressive dry level of the material.

[0015] Basically, the initial humid material accumulated in the first silo 11 is conveyed to the second silo 12 from where it is moved on by the second conveyor 21 and sent to the refiner group 13. The material is then shredded according to needs and amalgamated by the hot air supplied by the boiler. It then moves on to the ventilator 14 to return to the second silo 12 where it is cycloned to separate the aeriforms and discharge them externally. The material will gradually be dried, by making it circulate in large quantities and for a period of time necessary for it to dry based on the signals sent by the humidity probe 31. When the material has reached the dry level required, usually a humidity level of less than 15%, it is pneumatically sent and collected in the final tank 16 through the valve 28 and the conduct 27, whereas the aeriforms deriving from the cycloning in said tank is discharged towards the second silo 12 through the conduct 29 and the valve 30.

[0016] In a different, but equivalent, method, not shown, once the material has reached the required humidity level it is transferred to the final collection container 16 not through pneumatic means, but by through an additional conveyor that extends from the bottom of the second silo 12 that provisionally accumulates the material until it is dry.

Claims

1. A system for drying biomasses, in particular wooden chips, sawdust, shavings and the like, **characterised in** comprising an open system combination, starting from a first silo containing an initial humid material, means for a circulation of the material to be progressively dried, means for shredding-refining of the material in circulation, means for air heating of the material, basically in the ambient of the breaking up-refining means, means at least for a gathering in line of the level of humidity of the material in circulation, and means for collecting the material when it has reached a required degree of dryness, said means for detecting the level of humidity being set up to supply signals used to manage both means for adjusting the quantity of material from time to time in circulation and means for adjusting the energy flow to heat the material depending on its level of dryness.

2. A system according to claim 1, **characterised by a**

first conveyor (17) to transfer the humid material from the bottom of said first silo (11) to a second silo (12) designed for an intermediate accumulation and a recycle of the material during the treatment process, a second conveyor (21) for the transfer of the material from the bottom of said second silo input of a shredding-refining group (13) of the material, a boiler (14) for the production of hot air to progressively dry the material, the hot air being preferably conveyed to said group (13), at least one fan (15) for a delivery of the material from the outlet of said group to the second silo, and valve means to deviate and pneumatically send the material once treated to one final container (16) for collection of the dried material.

3. A system according to claim 1, **characterised by a** first conveyor (17) to transfer the humid material from the bottom of said first silo (11) to a second silo (12) designed for an intermediate accumulation and a recycle of the material during the treatment process, a second conveyor (21) for transferring material from the bottom of said second silo to the entrance of a shredding-refining group (13) of the material, a boiler (14) for a production of hot air for the gradual drying of the material, the hot air being conveyed, preferably, in said group (13), at least one fan (15) for sending the material from the outlet of said group to the second silo, and an additional conveyor for the transfer of the material, once dried, from the bottom of said second silo (12) to one final collecting container (16) of the dry material.

4. A system according to claims 1, 2 or 3, **characterised in that** the means for detecting at least the degree of humidity of the material in circulation is a capacitive type humidity probe (31) inserted along the path of the material, preferably in the second conveyor connecting the second silo to the shredding-refining group (13).

5. A system according to any of the previous claims, **characterised by** the fact that said shredding-refining group (13) comprises one, two or more cascading hammer mills.

6. A system according to any of the previous claims, **characterised by** the fact that both the second silo (12) and the final container (16) contains a cyclone for the separation of the aeriforms from the solid material.

7. A plant for drying biomass, as substantially above described, illustrated and claimed for the specified aims.

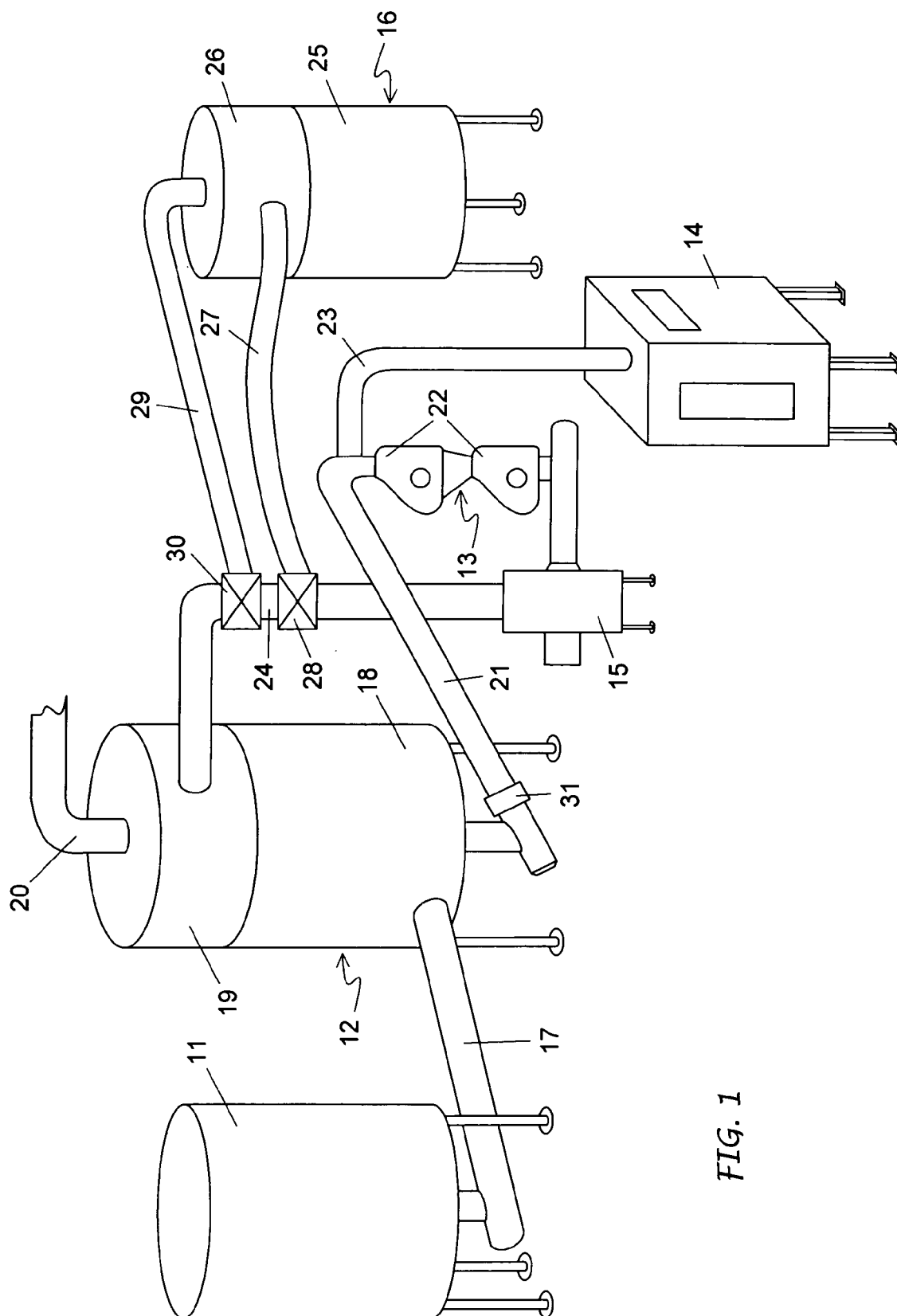


FIG. 1



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Application Number
EP 09 42 5502

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Place of search The Hague		Date of completion of the search 17 May 2010	Examiner Hauck, Gunther
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EUROPEAN SEARCH REPORT

Application Number
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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