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(54) **Device for mixing energetic raw materials comprising in particular biomass, plant waste materials, coal dust, and optionally binders**

(57) The invention relates to a device for mixing fragmented energy raw materials, in particular biomass and/or plant waste materials and/or coal, optionally with addition of fillers and/or binders, characterized in that it comprises a mixing chamber (1) provided with at least

two rotating stirrers (2), comprising sweeping paddles (3), having axes parallel to each other and horizontal in relation to the base, the stirrers being connected to a drive propelling them into a rotational movement in the same direction.

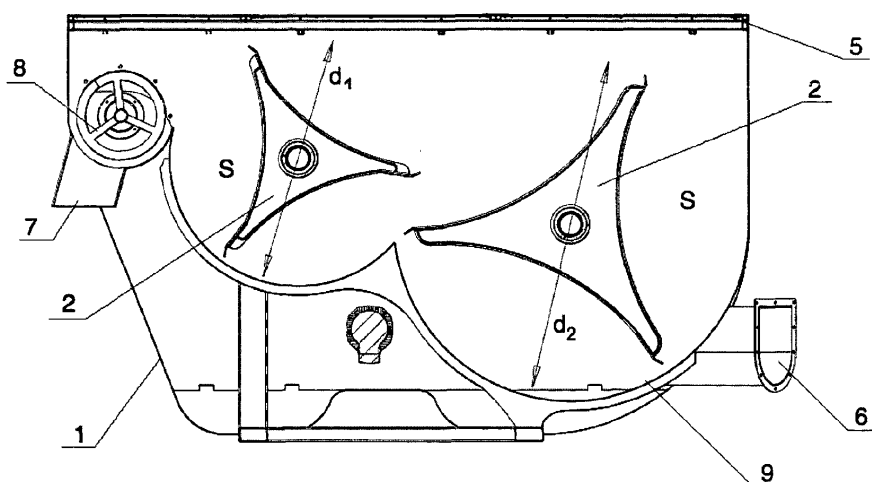


Fig. 1

Description

[0001] An object of the invention is a device for mixing energy raw materials, comprising in particular biomass, plant waste materials, coal dust, and optionally binders. The invention relates to the field of treatment and processing of fine-grained, often waste, solid fuels, such as plant materials, wood waste and coal or other materials constituting the residue of energy fuels of reduced utility. In the solid fuel processing, e.g. through the production of briquettes, pellets or granulates, optionally fillers and binders are also used. The said materials, before being subjected to the substantial step of pressing and forming into briquettes or pellets, have to be closely connected to each other and to exhibit homogeneity. The invention relates to a device providing the initial stage of homogenization of raw materials, which are subsequently subjected to formation into various types of shapes. This further step of the process and devices used for this purpose are known to those skilled in the art and can be used in combination with the mixing device described below.

[0002] The object of the invention is the device for mixing fragmented energy raw materials, in particular biomass and/or plant waste materials and/or coal, optionally with addition of fillers and/or binders, comprising a mixing chamber provided with at least two rotating stirrers, comprising sweeping paddles, having axes parallel to each other and horizontal in relation to the base, the stirrers being connected to a drive propelling them into a rotational movement in the same direction.

[0003] The chamber is provided with a dust filter, preferably from fabric, at least partially isolating the chamber area from the environment.

[0004] The stirrer taking up the raw materials from the side of the raw material supplying channel has its diameter larger than the diameter of the stirrer carrying off the homogenized mixture to the receiving channel.

[0005] Before the receiving channel, there is at least one feeding screw.

[0006] The object of the invention is depicted in the exemplary embodiment in the drawing, in which Figure 1 schematically shows a cross-sectional view of the device, Figure 2 shows a general view of the device, Figure 3 shows a top view, and Figure 4 shows in detail an exemplary rotating stirrer with sweeping paddles. In Figure 3, the axis from the longitudinal section, which was shown in Figure 1, is marked.

[0007] The device according to the invention is primarily designed for mixing chopped straw or other plant waste, wood shavings and pomaces, etc., and biomass with coal dust, as the initial step before briquetting or pelletising these raw materials.

[0008] The purpose of the device according to the invention is to homogenize the raw materials, optionally to additionally fragment them and to average the humidity of the raw materials intended, in the next step, for granulation. The physical properties of the raw materials used

unified and stratification phenomenon of raw materials of different origins is reduced. Humidity averaging is necessary because, e.g. the biomass, used in the device, may exhibit high humidity, and other raw materials, e.g. coal dust may be dry. Humidity equalization of the mixture provides, in the further step, an effective formation of homogeneous shapes. Their homogeneity increases their durability (susceptibility to crushing and dusting).

[0009] The device according to the invention comprises the mixing chamber 1, in which preferably two stirrers 2 with axes 4 that are mutually parallel and horizontal in relation to the base are mounted. The chamber is provided with the supplying channel 6 and the receiving channel 7. Each stirrer 2 is provided with the sweeping paddles 3. The device can be provided with two or more stirrers arranged in series, one after another. The stirrers, during operation, perform consistent rotational movement in the same direction. This is also the direction of moving the raw materials from the tank towards the outlet (the receiving channel) discharging the homogeneous mixture of the raw materials.

[0010] The paddles 3 of the stirrer 2 are mounted symmetrically on the centrally located driven axle 4. In this way, the stirrer operates on the area indicated by the radius constituting the arms, on which the stirrer paddles are arranged. Preferably, each stirrer 2 comprises three stirring paddles 3 arranged symmetrically, i.e. every 120 degrees around the axle 4. However, the stirrer with two to four paddles can be used. The paddles 3 of the stirrer 2 provide, in addition to mixing, movement of the raw material towards the discharge (the reception). Diameter of the stirrer should be such as to provide effective movement of the raw materials in the mixing chamber, i.e. should reach (with some clearance) the chamber bottom 9, so that there was no deposition of the unmixed raw materials. Diameter d_2 of the stirrer 2 located in the chamber 1 from the side of the supplying channel 6 is larger than diameter d_1 of the stirrer located from the side of the receiving channel 7. In the mixing chamber, before the receiving channel 7, a feeding screw 8 supplying the homogeneous mixture of the raw materials, is mounted. The mixing chamber is provided with a dust filter 5 mounted on the edges of the lateral chamber walls (it covers the chamber).

[0011] In one exemplary embodiment, the device shown in the drawing is provided with the supplying channel located below the receiving channel, but position of these channels is arbitrary, and it is also desirable to have such an arrangement that the raw material supply is below the level of reception of the homogeneous mixture.

[0012] The dust filter depicted in Figure 2 covers only a part of the mixing chamber, but with pneumatic raw material feeding, it is preferable that the entire chamber is covered with a cover with dust filter. On the other hand, with mechanical raw material feeding, the filter is not necessary, or only a part of the chamber will be provided with filter.

[0013] In Figure 1, diameters of the stirrers, which can vary in size, but can also have the same size, are shown. In Figure 1, the consistent operational direction of the stirrers is shown with arrows S. The stirrers are driven e.g. via a chain drive. The stirrer with larger diameter and larger paddles sweeps the material, which is not yet mixed, directly from the tank. The smaller stirrer sweeps the mixture into the receiving channel.

[0014] The discharge (carrying off to the further treatment) of the raw material of an averaged humidity is realized by means of the feeding screws. The device can be provided with one discharge outlet or more, e.g. two. Thus the device can supply one granulator or two granulators operating in parallel, which increases the performance of the whole process.

[0015] Supplying the mixer with the raw material is arbitrary, and may be realized by means of mechanical conveyors or by pneumatic transportation. The device can be connected to a few tanks supplying various types of raw materials, or to one tank, to which various types of raw materials are supplied periodically. The process can be carried out continuously or in batches. The mixing chamber has preferably such a volume that it also serves as a buffer vessel and ensures e.g. at least two-hour operation of the granulators forming, in the further step, the homogeneous mixture obtained in the device according to the invention.

[0016] The device can be supplied with a raw material causing strong dusting, such as straw, coal dust, therefore, it is further provided with dust filter, preferably from fabric, which prevents from dusting both the environment, i.e. the production hall, and other devices connected to the mixer. The filter is made from an air-permeable fabric so that it allows equalizing the pressure in the chamber when the device is operating. The fabric filter does not allow for overpressure caused by the raw material feeding.

in that the stirrer (2) taking up the raw materials from the side of the raw material supplying channel (6) has its diameter larger than the diameter of the stirrer (2) carrying off the homogenized mixture to the receiving channel (7).

Claims

1. A device for mixing fragmented energy raw materials, in particular biomass and/or plant waste materials and/or coal, optionally with addition of fillers and/or binders, **characterized in that** it comprises a mixing chamber (1) provided with at least two rotating stirrers (2), comprising sweeping paddles (3), having axes parallel to each other and horizontal in relation to the base, the stirrers being connected to a drive propelling them into a rotational movement in the same direction.
2. The device according to claim 1, **characterized in that** the chamber is provided with a dust filter (5), preferably from fabric, at least partially isolating the chamber area from the environment.
3. The device according to claim 1 or 2, **characterized**

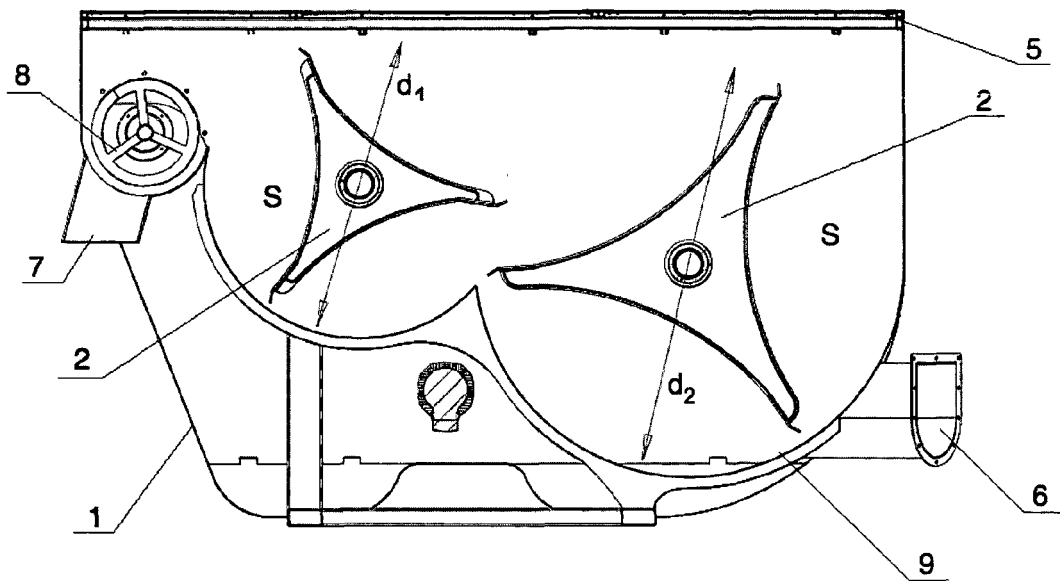


Fig. 1

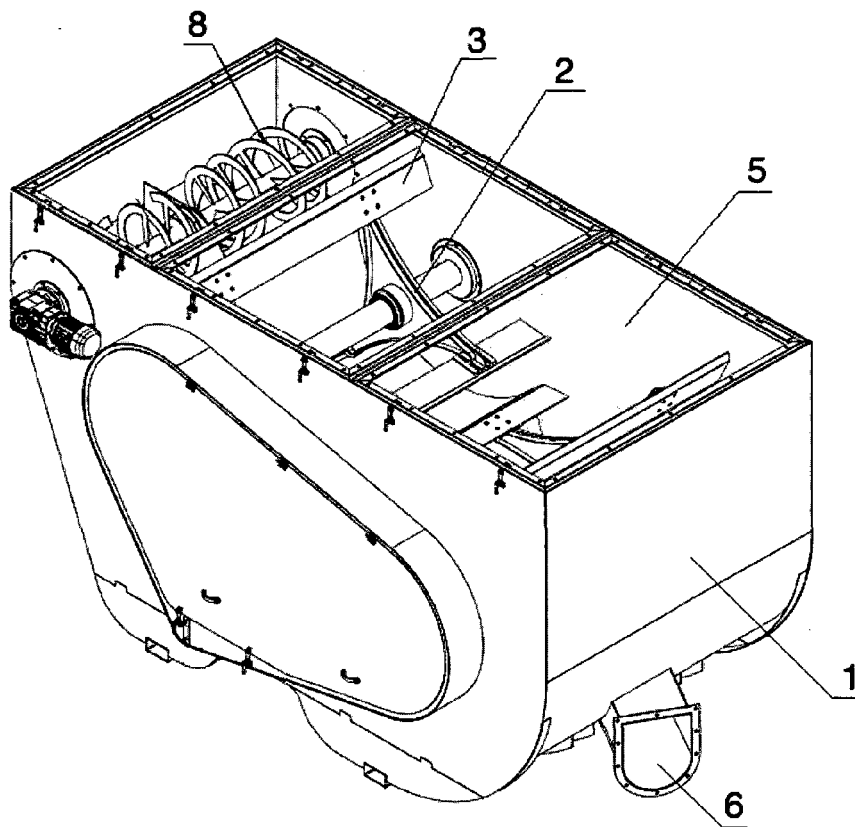


Fig. 2

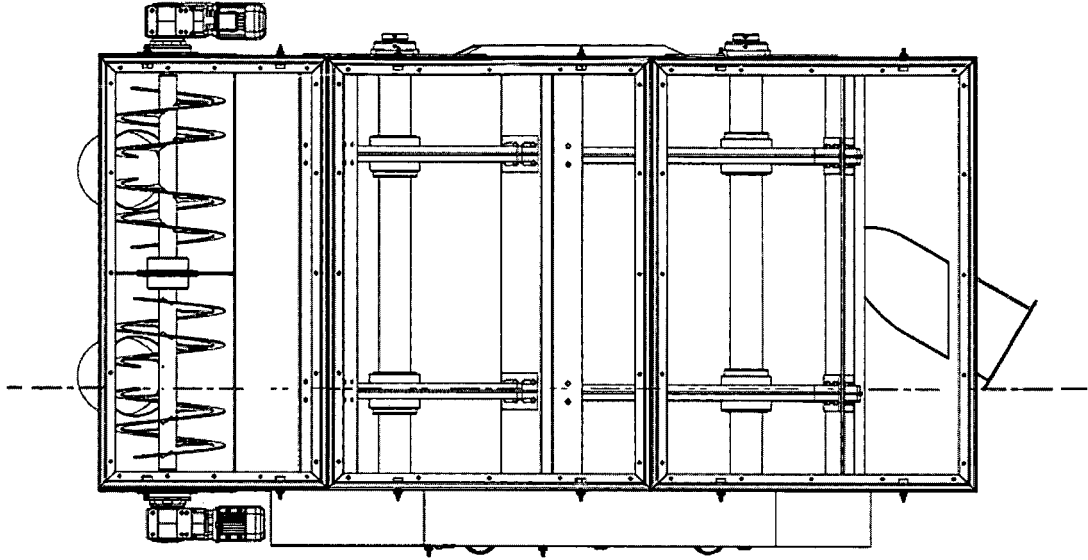


Fig. 3

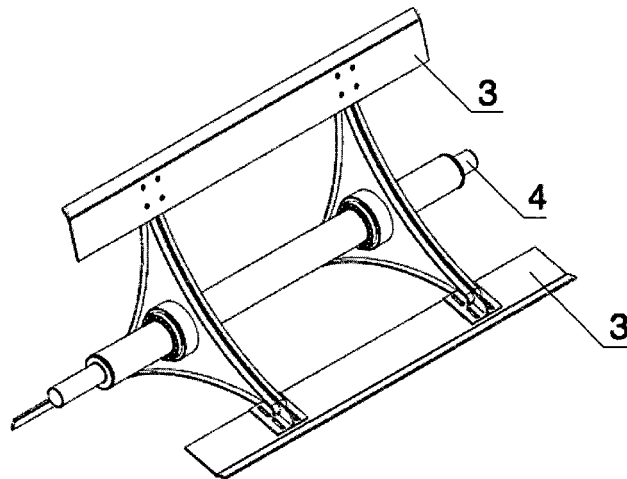


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 12 00 7257

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			B01F A01K
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 12 March 2013	Examiner Krasenbrink, B
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 12 00 7257

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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