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(54) Benævnelse: **Valsepresse**

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US-A- 3 220 340

Description

[0001] The invention relates to a roller press with a rotatable outer drum, a rotatable press roll eccentrically positioned in the outer drum, a press nip formed by the drum and press roll, pressed product supplying feeding device and a pressed product purging discharge unit, whereby the axis of the press roll is arranged in the lower area of the drum in a sector deviating from the vertical in the direction of the discharge unit in relation to the rotation axis of the drum.

[0002] A roller press designed in this way already follows from DE 32 18 634 A1. Other fixtures for squeezing liquid from solid matter are known from 7 25 031 A, DE 34 17 966 A1 and AT 20 00 03 B. Other roller presses are known from WO 2011/035762 A1, which reveals the topic of claim 1, and US 3 220 340 A.

[0003] For energy recycling of Biomass, various interrelated processes are known, e.g. silaging by airtight storage, conservation through the forming lactic acid, separation of silage in a press juice and a pressed product through mechanical dewatering of the silage, fermentation of the press juice obtained in this manner in a biogas plant and drying the press product with the waste heat from the biogas plant for producing a fuel.

[0004] The transfer of a large part of the easily fermentable plant substances found in plants into the press juice is important in these procedures. On the one hand, these are dissolved substances like glucose, and on the other hand undissolved substances like starch. Considering the combustion properties of the fuel produced, an attempt is made to reduce the content of the mineral plant substances in the pressed product to a great extent.

[0005] Generally, the transfer of the undissolved as well as the dissolved plant substances in the press juice is difficult because these are embedded in the cellular structure in lignocellulose plants.

[0006] Therefore it is necessary to unlock the cellular structure of the ensiled plants with mechanical influence, to drain it extensively and discharge organic and inorganic plant substances, whereby in principle different fixtures must be available for mechanical dewatering.

[0007] For example, belt filter presses are suitable for the separation of surface water, however not for the separation of water from the cellular structure of biomass because the pressure required for this cannot be achieved with a belt filter press.

[0008] Furthermore, screw extrusion presses are suitable, either with a conical screw in a conical sieve bend screen or a cylindrical screw with conical core and/or decreasing slope in a

cylindrical sieve bend screen. If there are low requirements for the degree of dewatering and the low pressing power needed for it, mostly perforated sheets or slotted screens are used for the sieve bend screens.

[0009] The pressing power causes the solid material to clog the holes in the sieve bend screen. The shearing forces generated from the compressed solid materials are transferred from the parts protruding inwards from the holes to the solids particles clogging it. Through this a self-cleaning effect is produced which is improved many times by the use of perforated sheets with drilled holes extending in the flow direction.

[0010] However, screw extrusion presses also have the disadvantage that they lead to relatively greater layer thickness for the biomass independent of the design. With increasing thickness of the layer and increased compression of the biomass in the screw the outflow of water is prevented. In addition, the biomass compressed in the screw acts as a filter for undissolved plant substances e.g. starch, and prevents its transfer in the press juice for substances important for the energy recycling of the press juice.

[0011] The disadvantages of screw extrusion presses are the high level of wear and a high energy requirement due to friction of the compacted material at the sieve bend screen. In turn this results in a limitation of the pressing power.

[0012] For the solid/liquid separation, additionally roller presses with inner and/or outward nip rolls, with smooth and perforated roller surfaces are known. The advantage of roller presses is the fact that the high pressures can be produced which are required for disruption of the cellular structure of the herbaceous biomass. However, the conventional perforated roller surfaces made from perforated sheets or slotted screens are not suitable for it. For this purpose rollers with larger wall thickness are required, the perforation of which can only be produced by drilling, which is a very elaborate and costly process for the bore diameters of 2 to 3 mm required for herbaceous biomass.

[0013] As a rule, roller presses have a narrow press nip whereby a good removal of press juice results due to the low layer thickness of the solid material in connection with the perforation of the rollers. In case of herbaceous biomass, the fibres form a layer on the roller surfaces which closes the holes or slots with increasing pressure. Since there are no relative movements between the biomass and the perforated surfaces as in case of screw extrusion presses, the self-cleaning effect does not apply. Thus the beneficial effect of the perforation of roller surfaces is severely limited, if not completely lost.

[0014] Finally, the degree of dewatering achieved through roller presses essentially depends on the even distribution of the material on the roller width. One sided feeding for example,

leads to the fact that the pressing power required on the other side is not achieved. Herbaceous biomass is particularly an extraordinarily poorly flowing bulk material. For achieving a high degree of dewatering, an appropriate dosing system is required.

[0015] Therefore, the purpose of the invention is to create a roller press with which biomass can be dewatered in great quantity in a single step with cell disruption and simultaneous discharge of plant substances.

[0016] This purpose is accomplished according to the present invention by the roller press with the properties of claim 1. The dependent claims describe the beneficial arrangements of the invention.

[0017] According to a particularly preferred arrangement, a conventional roller press is designed in such a way that a press roll in a drum is arranged with a closed i.e. non perforated roller surface in the roller drum in such a way that the squeezed liquid flows against the material flow through the loosely compacted and sparse biomass and it is discharged in a largely solid-free zone at the bottom of the drum (drum bed) under the guide plate of the dosing system through preferably designed openings in side discs of the drum.

[0018] The diameter ratio of the drum and the press roll is selected in such a way that on the one hand the entry of biomass in the pressing zone is ensured and on the other hand the length of the pressing zone is kept as short as possible considering the flow of liquid. The press roll preferably has a diameter of 25 % to 50 % of the diameter of the outer drum depending on the properties of the biomass. The press roll is preferably arranged in an angle between 30° and 60° from the lower point of the drum.

[0019] To ensure the entry of the material, optionally the surfaces of the drum and the press roll can be profiled and they can especially have an interlocking profile.

[0020] Uniform feed of the biomass over the entire press width to the pressing zone is important for a good dewatering result. For this the press is preferably fed with a screw conveyor in a form such that controlled with a proper level indicator, a demarcated product space is filled within the press on the entire press width till a specified height is filled.

[0021] At the lower end of the product room, the biomass is conveyed by the dosing system, based on this invention, evenly on the whole width through a guide plate of the pressing zone. This can consist of circulating attachments or a drawer element for example.

[0022] The dosing system can also be used to build primary pressure in the pressing zone.

[0023] The invention is described in detail based on a particularly well-designed exemplary embodiment illustrated in the drawings. It shows:

Fig. 1 a cross-section through a roller press according to the invention;

Fig. 2 a horizontal cut through the roller press from Fig. 1; and

Fig. 3 a perspective view of the roller press according to the invention.

[0024] The exemplary embodiment illustrated in Fig. 1, Fig. 2 and Fig. 3 shows an especially preferred arrangement of the roller press according to the invention. The roller press consists of an outer drum 1 mounted in a rotatable manner in the frame 3 using rotary joints 5 and a pivoted press roll 2 which is eccentrically mounted to the axis of the drum 1. The drum 1 is driven using the toothing at the outer rings of the rotary joints 4 through the sprocket 5. The press roll 2 is mounted in the swing arm 6 rotatably supported with the frame 3. The press roll is pressured using hydraulic cylinder 7 with constant preselected pressure at drum 1, independent of the quantity of the biomass fed and the resulting layer thickness in the pressing zone 8.

[0025] The biomass is fed with the screw conveyor 9 to the product space 12 formed through drum 1, laterally limited walls 10 and the partition wall 11. It is then fed in a controlled manner preferably by the attachments 13 of the rotating metering shaft 14 through the gap 17 between the guide plate 15 and the press roll 2 of the pressing zone 8. The guide plate 15 is provided with slots 16, through which the attachments 13, seen relative to guide plate 15, appear at the side of drum 1 and disappear again on the opposite side. The attachments 13 are designed in such a way that clinging biomass is peeled off by plunging in the guide plate 15 on the upper side of the guide plate 15.

[0026] After passing through the pressing zone 8, the biomass is detached by scrapers 18 from the surfaces of the drum 1 and the press roll 2. The scrapers are rotatably mounted using the axis 19 in the lateral limits 10 and are pressed preferably through springs outside the pressing chamber at the surfaces of drum 1 and press roll 2. As the product space 20 fills up, the biomass is discharged through the discharge screw 21. The squeezed liquid is discharged through the side openings 22 in side discs arranged at both sides of drum 1, which limit the drum 1 as a flange at the front faces of drum 1 in a circular form.

Krav

1. Valsepresse, som har en drejeligt lejret ydre tromle (1), en drejeligt lejret pressevalse (2), som er excentrisk anbragt i den ydre tromle (1), en tilføringsindretning (9), der tilfører pressemateriale til en pressespalte, som er dannet af tromlen (1) og pressevalsen (2), og en udledningsindretning (21), der udleder presset pressemateriale, hvorved pressevalsens (2) akse er anbragt i tromlens (1) nedre område i en sektor, der afviger fra den vertikale i retning mod udledningsindretningen (21) i forhold til tromlens (1) omdrejningsakse,
kendetegnet ved,
en ledeplade (15), der dækker tromlens bund og fører pressemateriale fra tilføringsindretningen (9) til pressespalten,
hvorved ledepladen (15) har slidser (16), og til at drive biomassen frem har en doseringsaksel (14), som er anbragt under ledepladen (15), og som har et antal medbringere (13), hvorved medbringerne (13) griber igennem slidserne (16), når valsepressen er i drift.

2. Valsepresse ifølge krav 1, **kendetegnet** ved, at pressevalsens (2) akse er anbragt i tromlens (1) nedre område i en sektor, der afviger 30° til 60° fra den vertikale i retning mod udledningsindretningen (21) i forhold til tromlens (1) omdrejningsakse.

3. Valsepresse ifølge krav 1 eller 2, **kendetegnet** ved, at pressevalsens (2) diameter er 25% til 50% af den ydre tromles (1) diameter.

4. Valsepresse ifølge krav 1, 2 eller 3, **kendetegnet** ved en væg (10), der begrænser tromlens (1) indre rum.

5. Valsepresse ifølge ethvert af de foregående krav, **kendetegnet** ved, at tromlen (1) har en sideskive med et antal udløbsåbninger (22), der gennembryder væggen (10) på langs.

6. Valsepresse ifølge ethvert af de foregående krav, **kendetegnet** ved, at tromlens (1) indre cylinderflade og/eller pressevalsens (2) ydre cylinderflade er profileret.

7. Valsepresse ifølge ethvert af de foregående krav, **kendetegnet** ved, at tilføringsindretningen (9) og/eller udledningsindretningen (21) er udformet som en transportsnekke.

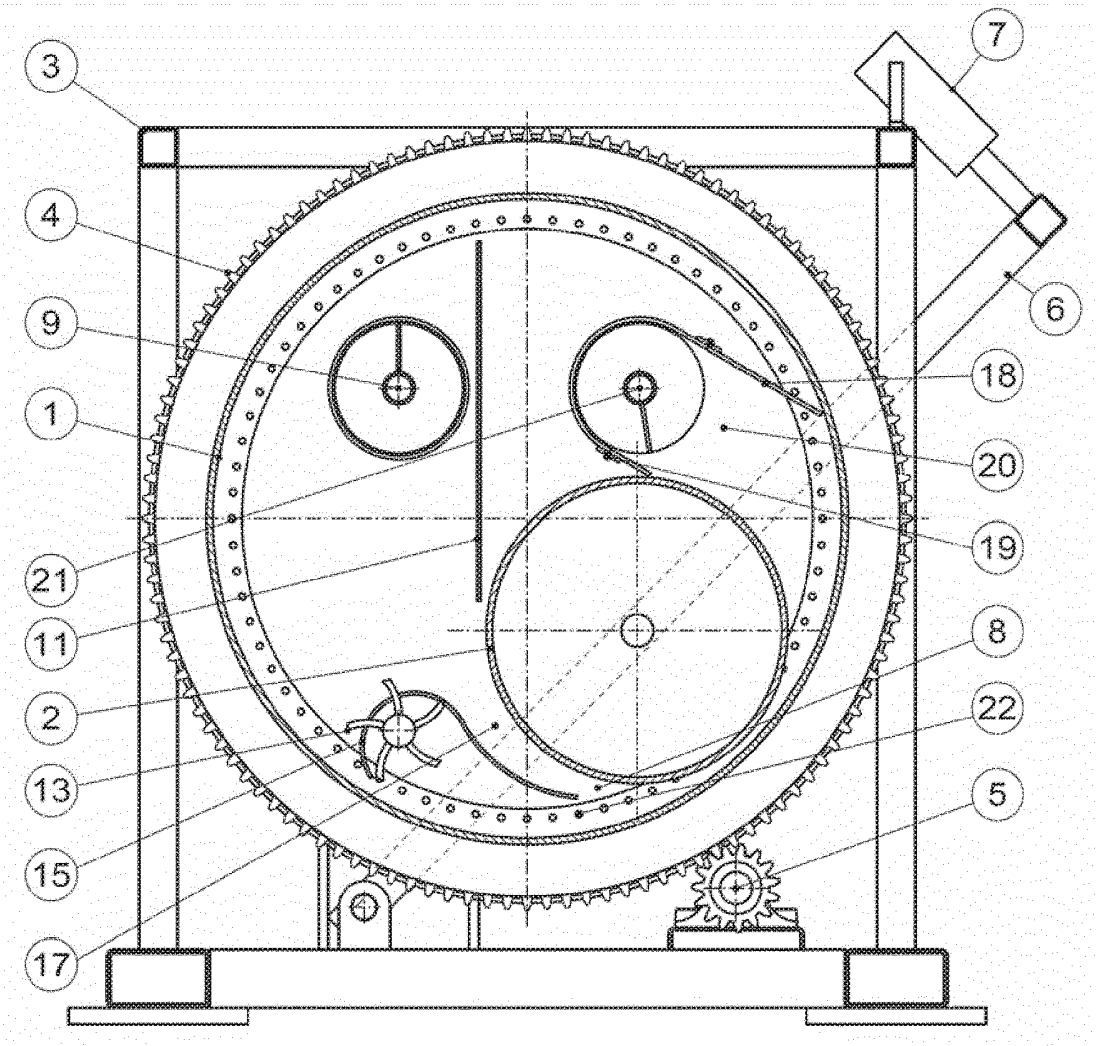

FIG. 1

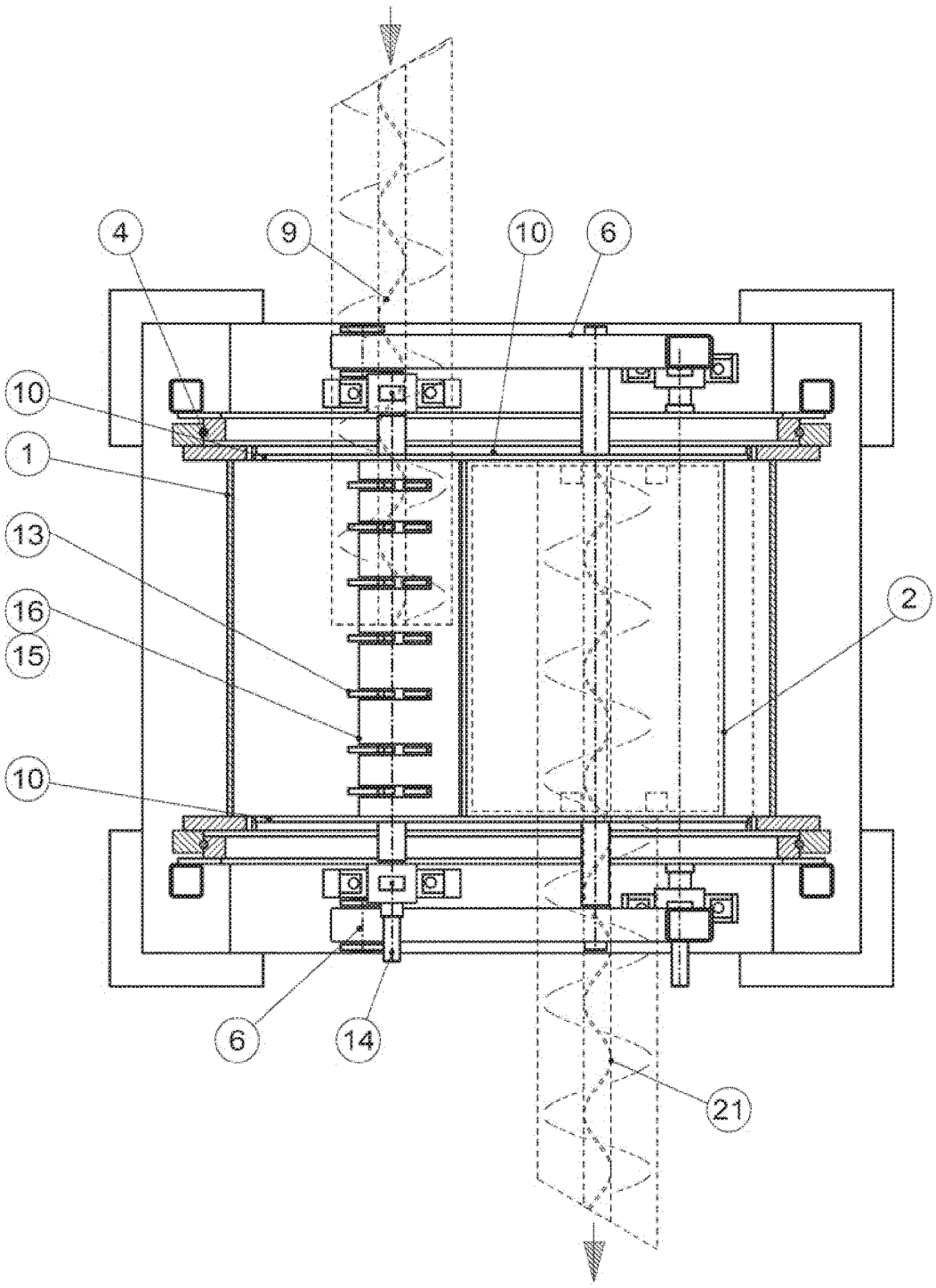

FIG. 2

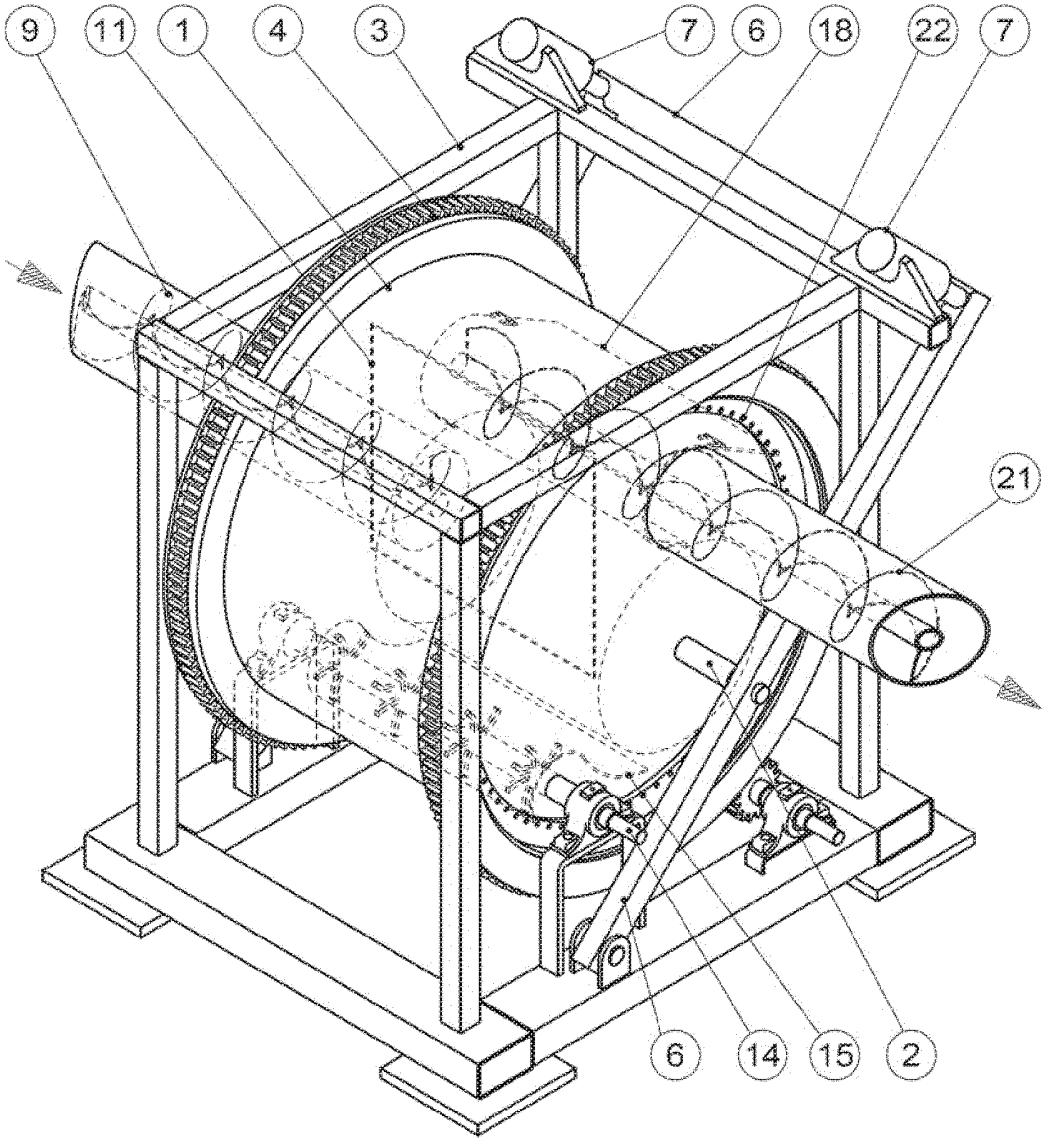

FIG. 3