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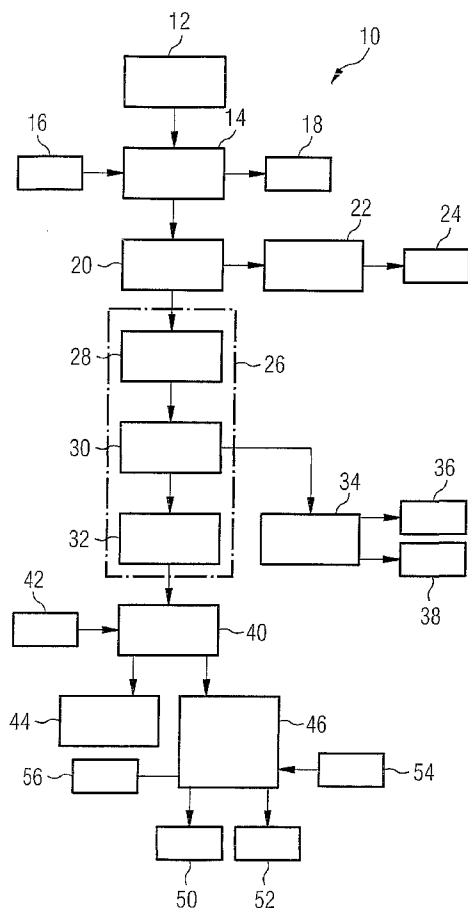
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(54) Title: PROCESS AND DEVICE FOR PRODUCING PALM OIL OR VEGETABLE OIL



(57) Abstract: A process (10) of and device (100) for producing palm oil or vegetable edible oil from fresh fruits contain the steps of extracting (26) crude oil from the fruits, clarifying (40) the crude oil in a two-phase decanter (116) and divide it into sludge and oil, and mechanically separating (46) sludge water (134) from the sludge of the two-phase clarification (40).

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Description

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PROCESS AND DEVICE FOR PRODUCING PALM OIL OR VEGETABLE OIL

10 Field of the Invention

The present invention relates to a process of and a device for producing palm oil or vegetable edible oil from fresh fruits. In particular, the invention relates to a process of and a device for separating palm oil or vegetable edible oil from crude oil in an oil mill.

15

Description of Prior Art

In an oil mill, in particular a palm oil mill, fresh fruit bunches are sterilised to deactivate the enzymes and threshed in order to separate the empty bunches. The fruits are digested thereafter and pressed to extract crude oil from a pericarp of the fruits (i.e., fibres and nuts). The crude oil is screened to remove large fibrous matter. The resulting screened crude oil contains about 50 % by weight pure oil, dispersed in water containing solids. Such solids are organelles and short fibres, sand, cell walls, carbohydrates in a range of hemicelluloses to simple sugars, all other major and minor components constituting normal plant cells, and matter adhered to the surface of the fruits. In appearance the water containing solids is viscous brownish-grey slurry.

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To separate the pure oil from the crude oil, the viscosity is lowered by adding hot water or steam and by heating the mixture. The mixture is flowing into a separator,

in which an oil phase separates and floats on a remaining slurry. The oil is continuously removed over an overflow weir, and also the slurry is continuously removed, and is, then, centrifuged in order to remove the pure oil present therein as much as possible. The separation in such a separator is a consequence of the differences in specific weight, and depends on the viscosity, the drop size, the residence time, etc. Moreover the size of the horizontal surface of a vessel of the separator is a determining factor for the upward velocity of the oil drops which, at a given quantity of crude oil to be handled per unit of time, can just reach the free surface. As the surface is made smaller, this boundary velocity will be higher, and the proportion of not separated oil will be higher accordingly.

It is known to improve the separation by rising the temperature so as to reduce the viscosity, which also requires additional energy, and, on the other hand, the oxidation risk at the free surface will also increase with the rising temperature. This is also the case when increasing the cross-section of the separation vessel and, thus, the surface, and, of course, the installation cost and the required space will increase too.

Accordingly, a further method for separating pure oil from crude oil was developed in prior art. This method uses a three-phase decanter in which crude palm oil is split in the three phases of oil, sludge and waste water right after a thermo-screw pressing process. The separation in such a three-phase decanter provides sludge having a solids content or proportion of about 20 to 24 % by weight. This sludge is still easily flowing and has to be processed further into a sludge basin, a thermo dryer or by composting along with the fruit bunches.

It is an object of the present invention to provide an improved oil milling process and device for continuously processing crude oil and its components, and for minimizing the loss of pure oil experienced in the separation process of the prior art.

Summary of the invention

This problem is solved according to the invention by a process according to claim
5 1 and a device according to claim 8. Further improvements of the invention are described in the dependent claims.

The process of the invention contains the steps of extracting crude oil from the
fruits, clarifying the crude oil in a two-phase decanter and divide it into sludge and
10 oil, and mechanically separating sludge water from the sludge of the two-phase clarification. The device of the invention includes an extractor for extracting crude oil from the fruits, a two-phase decanter for clarifying the crude oil and separating it in sludge and oil, and a mechanical separator for mechanically separating
sludge water from the sludge of the two-phase decanter.

15 According to the invention in an oil mill, in particular a palm oil mill, a centrifuge in the form of a two-phase decanter is used for deviding crude oil into sludge and oil. The treatment of this separation can be kept simple and effective because of a further step of mechanical separation which is performed with the sludge of the
20 two-phase decanter. In this further step of mechanical separating sludge water is separated from the sludge, i.e., the sludge is dewatered by a mechanical treatment. Such mechanical treatment, e.g., can be a pressing process or a centrifugation process.

25 The step of mechanically dewatering the sludge after the two-phase centrifugation reduces the content or proportion of liquid components in the sludge and makes it spadeable. The arising cake is rather solid and can be transported and stored outside of sludge basins. Accordingly, the invention reduces the amount of sludge burdening the sludge basins of existing oil mills.

Further, the step of mechanically dewatering the sludge after a previous two-phase decanter separation requires less mechanical energy than a dryer needs thermal energy for dehydrating the same amount of water.

5 In a preferred embodiment of the invention a belt press is used for mechanically separating sludge water from the sludge of the two-phase clarification. A belt press is exceptionally advantageous for dewatering sludge including a rather low portion of water. The portion of water can then be further reduced by the belt press. For example, a belt press can be used for dewatering sludge including
10 about 84 % by weight or less water which is reduced to approximately 76 % by weight or less.

Alternatively, a two-phase decanter is preferably used for mechanically separating sludge water from the sludge of the two-phase clarification.

15 Accordingly, at the device of the invention the separator is advantageously a belt press or a two-phase decanter.

Following the step of mechanically separating sludge water from the sludge of the two-phase clarification, the sludge water of the mechanical separation is advantageously conducted into a basin or a treatment plant for further anaerobic digestion or dehumidifying the sludge water. As mentioned above, according to the invention this step of dehumidifying sludge water in basins or a treatment plant requires much less space and energy because of the reduced amount of sludge water and
20 the reduced amount of sludge contained in the sludge water.
25

In an alternative preferred embodiment of the invention a three-phase decanter is used for mechanically separating sludge water from the sludge of the two-phase clarification. The three-phase decanter provides an opportunity of reducing the amount of water in the sludge and, furthermore, to gain further pure oil from the
30 sludge of the previous two-phase decanter process.

The preferred use of a three-phase decanter for separating sludge water from sludge in a clarification process of an oil mill further can be integrated into the entire production process in the following manner: the fruits bunches can be sterilized before extraction of crude oil from the fruits and a condensate of the sterilisation can be conducted into the three-phase decanter along with the sludge of the two-phase clarification. The condensate of the sterilisation contains a remaining quantity of pure oil which is usually lost within the production process. By conducting the condensate into the three-phase decanter in combination with the sludge of the previous two-phase decanter process the remaining pure oil can be extracted from the condensate and can be supplied to further steps of oil purification.

The cake of the mechanical separation can be easily stored for further anaerobic digestion, can be transported to fields or can be composted without the need of further feeding to storage basins or handling in a treatment plant.

Description of the Drawings

Having thus generally described the invention, reference will now be made to the accompanying schematic drawings, illustrating a preferred embodiment of the invention.

Fig. 1 is a flow diagram showing an embodiment of the process of producing palm oil according to the invention.

Fig. 2 is a rather schematic view of a first embodiment of a device for producing palm oil or vegetable edible oil from fresh fruits according to the invention.

Fig. 3 is a rather schematic view of a second embodiment of a device for producing palm oil or vegetable edible oil from fresh fruits according to the invention.

Fig. 4 is a rather schematic view of a third embodiment of a device for producing palm oil or vegetable edible oil from fresh fruits according to the invention.

- 5 Referring to Fig. 1 a process 10 for producing palm oil or vegetable edible oil from fresh fruits is depicted starting with a step 12 of storing fresh fruits bunches in a storage. Thereafter, the fresh fruits bunches are sterilized in a sterilisation step 14 by adding of steam 16 and discharging condensate 18 from the sterilizer.
- 10 Following, the sterilized bunches are threshed in a threshing step 20 and the empty bunches are composted in a step 22 to fertilizer 24. The fruits are further processed by an extraction process 26 including the steps of digestion 28, pressing 30 and screening 32. In the step of screening 32 fibres and nuts are forwarded to a depericarping process 34 in which fibres 36 are separated from kernels 38 to
- 15 be recovered.

- By pressing 30 and screening 32 in the extraction process 26 crude oil is separated from the fibres and nuts and is delivered to a clarification step 40 in which the crude oil is separated in a two-phase decanter in pure oil and sludge by adding of steam 42. The pure oil is further purified in a purification step 44.
- 20

- The sludge is processed in a mechanical separation step 46. Thus, the sludge is divided into waste water 50 to be conducted to a treatment plant, and cake 52 including about 22 % by weight of solid components and being transported to fields or being composted.
- 25

- The step of mechanical separation 46 provides the further opportunity to add condensate 54 from the discharging step 18 of the sterilizer to the sludge to be separated and to extract further oil 56 from the sludge and the condensate. The thus extracted oil can be purified for further use as for fuel, biodiesel or soap production.
- 30

Fig. 2 to 4 show three embodiments of devices 100 for processing the above mentioned steps of pressing 30 and screening 32, and for clarifying and purifying of the oil as described in steps 40, 44 and 46.

5

In detail all devices 100 include a screw press 102 in which the digested fruits are pressed and from which oil is delivered to a vibrato screen 104 for screening. The crude oil derived from this process is stored in a tank 106 and conducted by a pump 108 to a heat exchanger 110. At the heat exchanger 110 the crude oil is heated by a steam inlet 112 and a free overflow 114 is provided for conducting excessive oil back to the tank 106.

10

The heated crude oil is then delivered into a two-phase decanter 116 in which the crude oil is separated in pure oil and sludge.

15

The pure oil is first stored in a tank 118, subsequently it is forwarded by a pump 120 to an oil purifier 122, in which it is further purified by extracting waste water 124 and cake 126 from the pure oil 128.

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The sludge separated in the two-phase decanter 116 is delivered to the further step of mechanical separation.

25

In the embodiment of the device of Fig. 2 this step of mechanical separation is realized by way of a belt press 130. The belt press 130 reduces the amount of water within the sludge and thus increases the amount of solid components in the sludge from about 14 to 16 % by weight to about 22 % by weight. Accordingly, a cake 132 derived from the belt press is spadeable and can be transported by way of front-end loaders and lorries or trucks. Further, the amount of sludge is reduced by separating sludge water 134 in this mechanical separation process (see step 46 in Fig. 1).

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Fig. 3 shows an embodiment of device 100 in which the mechanical separation step of the sludge derived from the two-phase decanter 116 is provided by a second two-phase decanter 136 at which the sludge is also separated in cake 132 and sludge water 134.

5

Finally, in Fig. 4 a third embodiment of device 100 is depicted including a three-phase decanter 138 for mechanically separating the sludge derived from the first step of clarification in the two-phase decanter 116. The thus installed three-phase decanter 138 provides the opportunity not only to separate sludge water 134 (for
10 anaerobic digestion) and cake 132 (for fertilization of fields) from the sludge but also to extract from the sludge processed therein further (secondary) oil and to deliver it through an oil outlet 140. Accordingly, the rate of yield of oil can be increased by this step of mechanical separation in a three-phase decanter.

15

In addition, the further extraction of oil can be used in order to gain oil out of the condensate separated in a previous sterilizing process (as shown in step 14 in Fig. 1). Therefore, a conduction line 142 is provided for delivering such condensate to the three-phase decanter 138.

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As the mechanical separation (see belt press 130, second two-phase decanter 136, three-phase decanter 138, and step 46) of sludge derived out of the two-phase decanter provides an easy and effective way for separating waste water from the sludge, it is further possible to add (even a larger) amount of dilution water 144 into the two-phase decanter 116 and to thereby adjust and optimize the
25 process of clarification of crude oil provided in this two-phase decanter 116.

Reference Signs

5	10	process of producing oil
	12	storing of fresh fruits bunches
	14	sterilizing of fruits bunches
	16	adding of steam
	18	discharging of condensate
10	20	threshing of fruits bunches
	22	composting of empty bunches
	24	discharging of fertilizer
	26	extraction process
	28	digestion
15	30	pressing
	32	screening
	34	depericarping
	36	separating of fibres
	38	recovering of kernels
20	40	two-phase clarification
	42	adding of steam
	44	purification of oil
	46	mechanical separation
	50	conducting of waste water
25	52	transporting cake to fields
	54	adding condensate
	56	extracting further oil
	100	device
	102	screw press
30	104	vibrato press
	106	tank

	108	pump
	110	heat exchanger
	112	stream inlet
	114	free overflow
5	116	two-phase decanter
	118	tank
	120	pump
	122	oil purifier
	124	waste water
10	126	cake
	128	pure oil
	130	belt press
	132	cake
	134	sludge water
15	136	second two-phase decanter
	138	three-phase decanter
	140	oil outlet
	142	conduction line
	144	dilution water

Claims

- 5 1. Process (10) of producing palm oil or vegetable edible oil from fresh fruits containing the steps of extracting (26) crude oil from the fruits, clarifying (40) the crude oil in a two-phase decanter (116) and divide it into sludge and oil, and
- 10 mechanically separating (46) sludge water (134) from the sludge of the two-phase clarification (40).
- 15 2. Process according to claim 1, wherein a belt press (130) is used for mechanically separating (46) sludge water (134) from the sludge of the two-phase clarification (40).
- 20 3. Process according to claim 1, wherein a two-phase decanter (136) is used for mechanically separating (46) sludge water (134) from the sludge of the two-phase clarification (40).
- 25 4. Process according to claim 1, wherein a three-phase decanter (138) is used for mechanically separating (46) sludge water (134) from the sludge of the two-phase clarification (40).
- 30 5. Process according to claim 4, wherein fruits bunches are sterilized (14) before extraction of crude oil from the fruits and a condensate (18) of the sterilisation is conducted into the three-phase decanter (138) along with the sludge of the two-phase clarification (40).
6. Process according to one of claims 2 or 5,

wherein the sludge water (134) of the mechanical separation (46) is stored for further anaerobic digestion.

7. Process according to one of claims 1 to 6,

5 wherein the cake (132) of the mechanical separation (46) is stored for further anaerobic digestion or direct use in fields.

8. Device (100) for producing palm oil or vegetable edible oil from fresh fruits including

10 an extractor for extracting (26) crude oil from the fruits,
a two-phase decanter (116) for clarifying the crude oil and dividing it into sludge and oil, and
a mechanical separator (130; 136; 138) for mechanically separating sludge water (134) from the sludge of the two-phase clarification (40).

15

9. Device according to claim 8,
wherein the mechanical separator is a belt press (130).

10. Device according to claim 8,

20 wherein the mechanical separator is a two-phase decanter (136).

11. Device according to claim 8,

wherein the mechanical separator is a three-phase decanter (138).

12. Device according to claim 11,

25 wherein a sterilizer is provided for sterilising (14) fruits bunches before extraction (26) of crude oil from the fruits, and conducting means (18, 54) are provided for conducting a condensate of the sterilizer into the three-phase decanter (138) along with the sludge of the two-phase clarification (40).

30

13. Device according to one of claims 8 to 12,

wherein a basin is provided in which the sludge water (134) of the mechanical separation (46) is conducted for further anaerobic digestion.

14. Device according to one of claims 8 to 13,
5 wherein a storage for storing the cake (132) of the mechanical separation (46) and for further anaerobic digestion is provided.

FIG 1

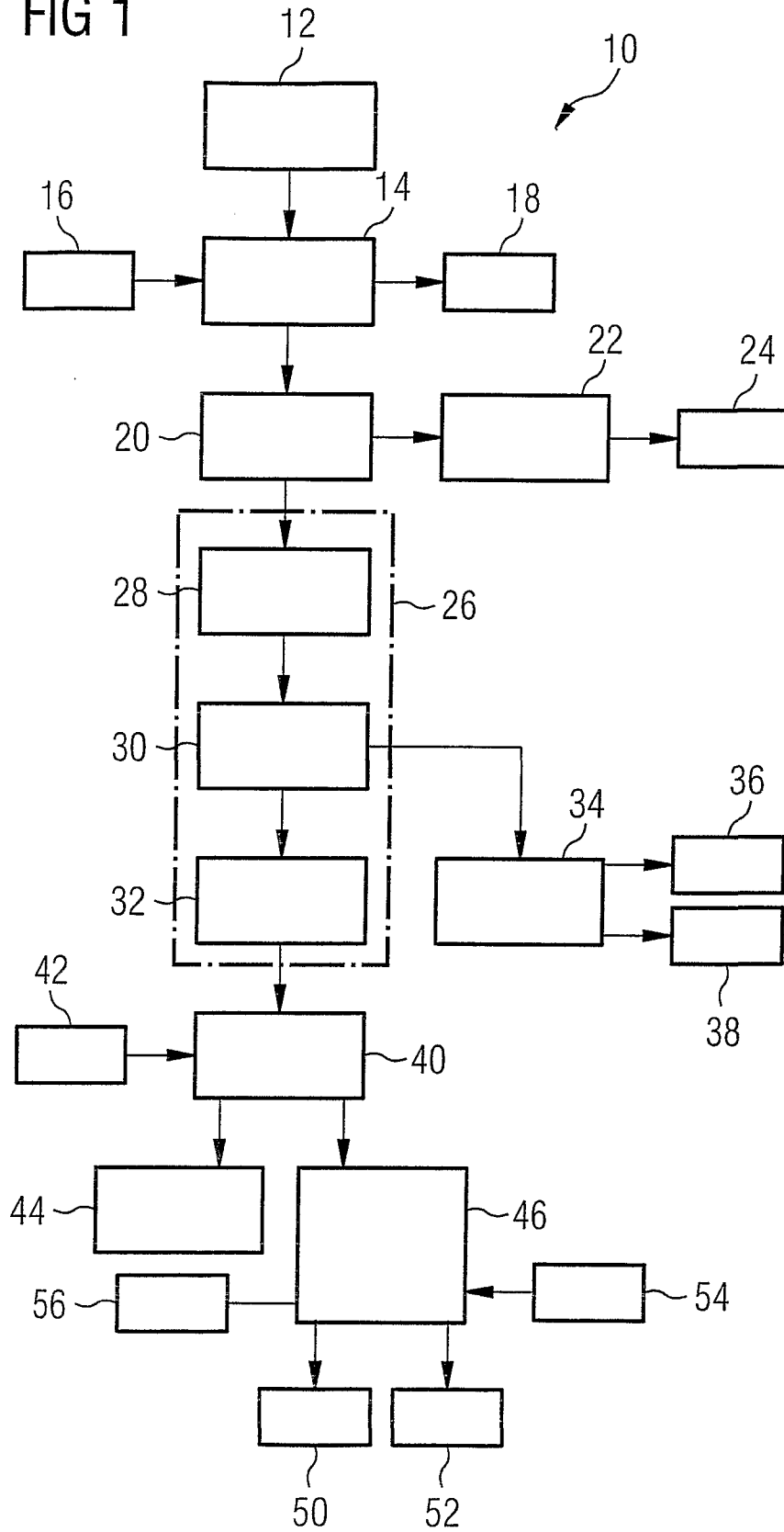


FIG 2

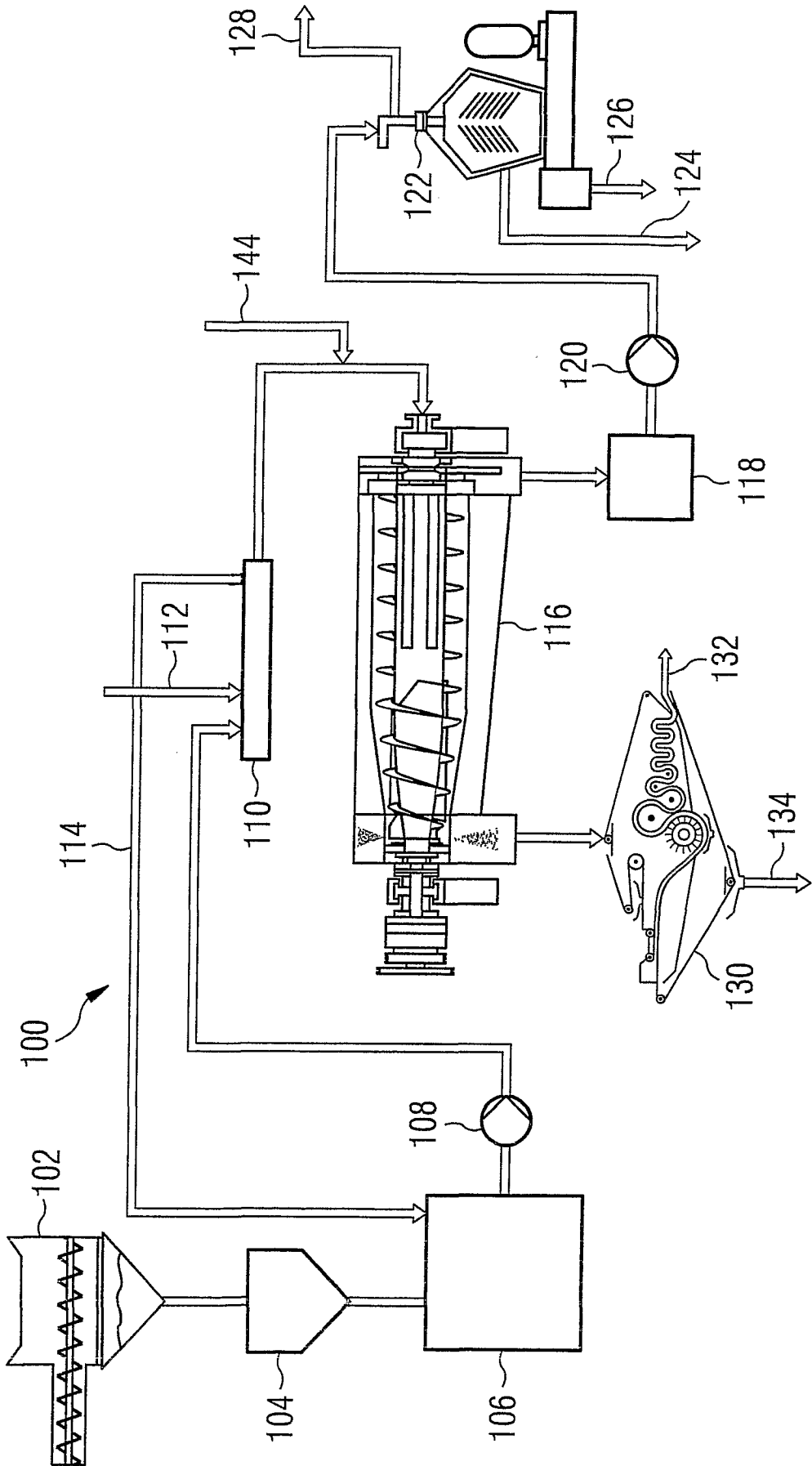


FIG 3

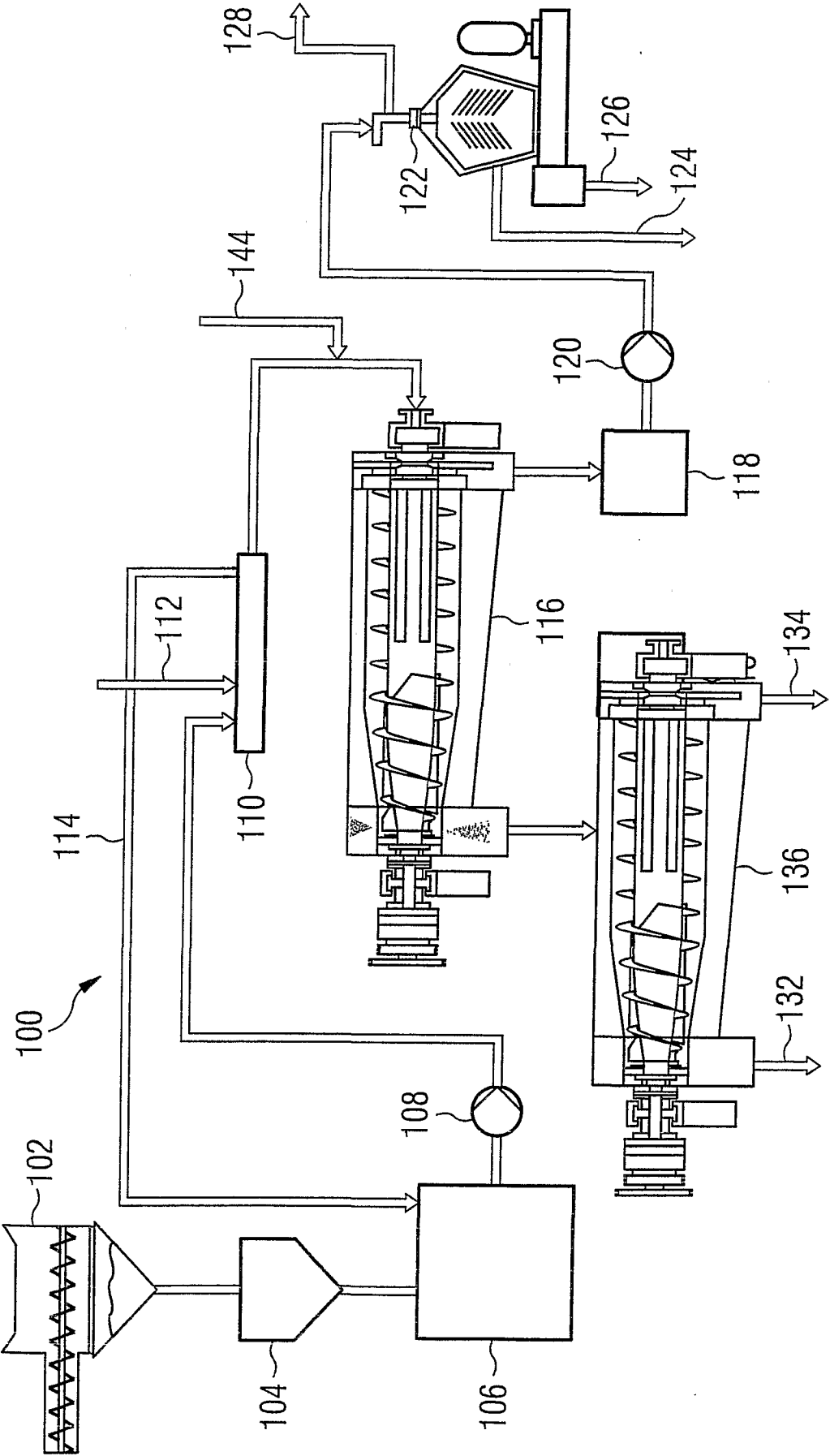
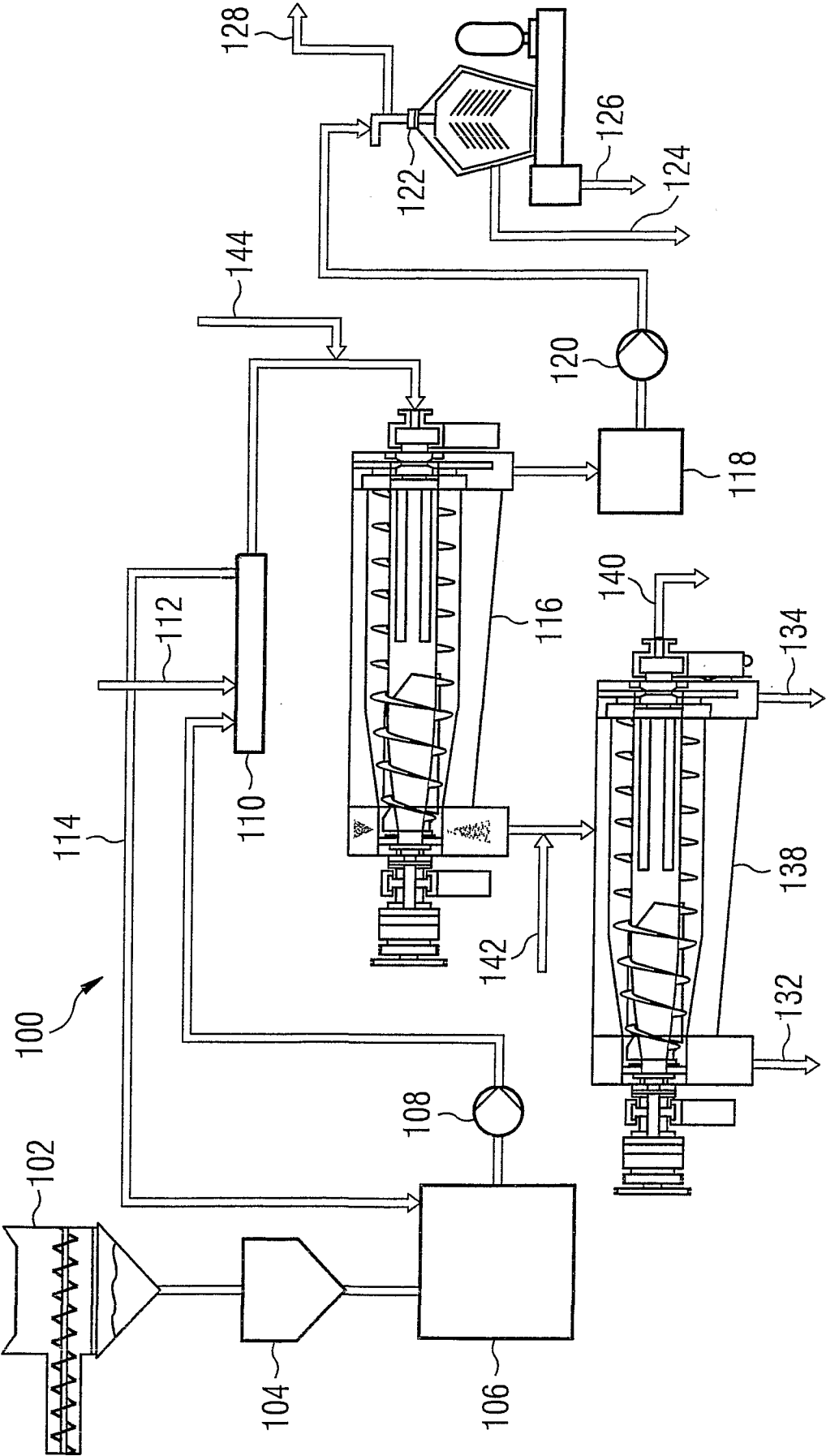


FIG 4



INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER
 INV. C11B1/02 C11B1/06 C11B1/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 C11B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, FSTA, BIOSIS, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.



See patent family annex.

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T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No
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International application No

PCT/EP2005/010726

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