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(72) Inventor; and

(71) Applicant: YAP, Yin Foo [MY/MY]; No. 50, Jalan Wawasan 3/4, Pusat Bandar Puchong, 47160 Puchong, Selangor (MY).

(72) Inventor: LAI, Tung Loy; No. 50, Jalan Wawasan 3/4, Pusat Bandar Puchong, 47160 Puchong, Selangor (MY).

(74) Agent: LOK, Choon Hong; c/o Pintas Consulting Group Sdn Bhd, No. 19, Jalan SS 1/36, 47300 Petaling Jaya, Selangor (MY).

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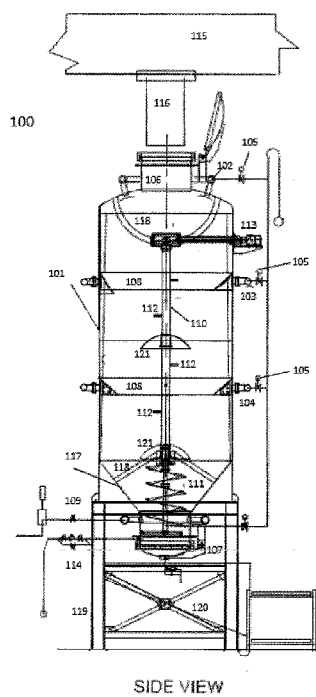
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(54) Title: PROCESS AND APPARATUS FOR STERILIZING OIL PALM FRUIT



SIDE VIEW

Figure 1

(57) Abstract: The present invention relates to a process for treating oil palm fruit bunches comprising the steps of introducing the oil palm fruit bunches to be treated into a treatment vessel (101) for gravity feed through the vessel (101); retarding the free fall flow of the oil palm fruit bunches during its passage through the vessel (101) to mitigate the compaction of the fruit bunches within the vessel (101); and discharging the sterilized oil palm fruit bunches from the treatment vessel (101).



PROCESS AND APPARATUS FOR STERILIZING OIL PALM FRUIT

FIELD OF INVENTION

5 The present invention relates to a process and an apparatus for sterilizing oil palm fruits. More particularly, the invention relates to an apparatus having a treatment vessel equipped with a means to retards free fall flow of the oil palm fruit bunches and to segregate the oil palm fruit bunches loaded therein to several partitions in order to minimize vertical pressure load on the oil palm fruits.

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BACKGROUND OF THE INVENTION

Sterilization process in palm oil mill operation is the first step in the sequence of processes to extract the oil. It is typically a batch process using steam for heating or
15 cooking the oil palm fruits. While the main function of the fruit sterilization is to deactivate enzymes in the fruits which may cause fermentation thereto, the sterilization process is also intended for loosening the fruits from the fruit bunches.

Vertical sterilizer is one of the common types of oil palm fruit sterilizer used in the
20 palm oil mill operation for sterilizing the harvested fruits.

Prior art GB 2421169 A discloses a vertical sterilizer that sterilizes fruit with steam and water. The water is introduced into the sterilizer for displacing air, washing the fruits, and damping the impact on the fruit during movement in the sterilizer.

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Prior art MY 164435 A reveals a system for sterilization of oil palm fruit comprising a sterilizer equipped with a damping member for reducing gravitational impact of the received fruit bunches prior to settling in the sterilizer. Pressurized steam is distributed into the sterilizer through a plurality of vertical conduits spaced apart to

each other on inner surface of the sterilizer.

There are several shortcomings identified for using the vertical sterilizers
aforementioned. When water is used in the sterilizer for cushioning the dropping
5 impact of the receiving fruits, a large volume of water is required to fill up at least
half portion of the sterilizer. The presence of large volume of water will subsequently
increases energy consumption and time duration required to heat up the sterilizing
chamber. As oil released from the fruits as a result of impact between the fruits during
movement in the water is inevitable, the released oil will subsequently mix with the
10 water, causing a further step of oil recovery from the water to be needed. Even though
the oil can be recovered, the quality thereof is often low and unacceptable.

Further, when the fruits are piling up in the vertical sterilizer, high vertical pressure
load is imposed on the fruits at the bottom portion of the sterilizer by the weight of
15 overlying fruits. The high vertical pressure load often damages the fruit and squeezes
oil therefrom, inducing undesirable oil loss during the sterilization process.
Nevertheless, the existing vertical sterilizers aforementioned do not provide a solution
to overcome such shortcomings.

20 SUMMARY OF INVENTION

The main aspect of the present invention is to provide a process for sterilizing oil
palm fruit bunches that is improved in terms of shorter sterilization cycle. This object
can be achieved by introducing pressurized steam starting from top to bottom portion
25 of a treatment vessel to remove cold air trapped therein. In the absence of the cold air,
desirable temperature can be easily reached within short duration of time for
sterilization process.

Another aspect of the present invention is to provide an apparatus for sterilizing oil

palm fruit bunches that can minimize vertical pressure load on the fruits, especially those that settle at the bottom portion of the treatment vessel. By mitigating compaction of the oil palm fruit in the vessel, substantial loss of palm oil and subsequent mixing of the palm oil with the condensate during the sterilization process
5 can be prevented.

Yet another aspect of the present invention is to provide an apparatus for sterilizing oil palm fruit bunches that is able to retard free fall flow of the oil palm fruit bunches which are gravity fed through the treatment vessel, thereby avoiding impact damage
10 to the outer layer of the oil palm fruit.

At least one of the preceding aspects is met, in whole or in part, by the present invention, in which the embodiment of the present invention describes a process for treating oil palm fruit bunches comprising the steps of introducing the oil palm fruit
15 bunches to be treated into a treatment vessel (101) for gravity feed through the vessel (101); retarding the free fall flow of the oil palm fruit bunches during its passage through the vessel (101) to mitigate the compaction of the fruit bunches within the vessel (101); and discharging the sterilized oil palm fruit bunches from the treatment vessel (101).

20

According to a preferred embodiment, the oil palm fruit bunches loaded in the treatment vessel (101) is segregated into several partitions to reduce vertical pressure load on the oil palm fruit bunches which settle at the bottom portion of the vessel (101).

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In another preferred embodiment, the process aforementioned further comprising a step of feeding pressurized steam into the treatment vessel (101), starting from top to bottom portion of the vessel (101) through a first steam distributing unit (102), followed by a second steam distributing unit (103) that is installed below the first

steam distributing unit (102), for facilitating removal of cold air trapped in the vessel (101) and for sterilizing the oil palm fruit bunches.

Preferably, the steam is fed into the treatment vessel (101) at a pressure of about 20-
5 40 psi.

In another preferred embodiment, the process aforementioned facilitates the detachment of the oil palm fruits from the bunches.

10 The present invention also discloses an apparatus (100) for treating oil palm fruit bunches comprising a vertical treatment vessel (101) in which the oil palm fruit bunches to be treated is gravity fed therethrough; a fruit bunch inlet for introducing the oil palm fruit bunches to sterilized into the vessel (101); a fruit bunch outlet for discharging the treated oil palm fruit bunches from the vessel (101); and a means
15 (108) to retard the free fall flow of the oil palm fruit bunches through the vessel (101) to mitigate compaction of the fruit within the vessel (101).

In accordance with a preferred embodiment, the means (108) to retard the free fall of the oil palm fruit bunches comprises a restriction in the internal cross section of the
20 treatment vessel. It is preferable that the restriction comprises at least one partition having a passageway through which the oil palm fruit bunches pass. Preferably, each partition has an inverted frusto-conical configuration.

Pursuant to a preferred embodiment of the present invention, the apparatus (100)
25 aforementioned further comprising a first steam distributing unit (102) installed at the top portion of the vessel (101), wherein, when in use, steam is introduced into the vessel (101) through the first steam distributing unit (102) so that cold air trapped therein can be removed from top to bottom portion of the vessel (101) and exit through a steam discharging outlet (109).

In another preferred embodiment, the apparatus (100) aforementioned further comprising one or more steam distributing units (103, 104) that are vertically spaced apart to each other.

5

In still another embodiment of the present invention, the apparatus (100) aforementioned further comprising a vertical spindle (110) positioned within the vessel (101), equipped with a vertical screw conveyor (111) at the bottom thereof for facilitating the discharging of the fruit from the fruit bunch outlet (107). It is
10 preferable that the upper and middle portion of the vertical spindle (110) are fitted with a plurality of flexible blades (112) for breaking arch formed by the fruit bunches.

Yet another preferred embodiment is an apparatus (100) aforementioned further comprising a hydraulic motor (113) for powering the rotation of the vertical spindle
15 (110).

A further preferred embodiment describes an apparatus (100) aforementioned further comprising an outlet (114) at the bottommost of the vessel (101) for discharging condensate therefrom.

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The present preferred embodiment of the invention consists of novel features and a combination of parts hereinafter fully described and illustrated in the accompanying drawings and particularly pointed out in the appended claims; it being understood that various changes in the details may be effected by those skilled in the arts but without
25 departing from the scope of the invention or sacrificing any of the advantages of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

For the purpose of facilitating an understanding of the invention, there is illustrated in the accompanying drawing the preferred embodiments from an inspection of which when considered in connection with the following description, the invention, its construction and operation and many of its advantages would be readily understood
5 and appreciated.

Figure 1 shows a side view of an apparatus (100) according to one preferred embodiment of the present invention.

10 Figure 2 shows a means (8) to retard the free fall of the oil palm fruit bunches in the treatment vessel (101) of an apparatus (100) according to one preferred embodiment of the present invention.

Figure 3 shows a side view of an apparatus (100) having segregated zones loaded with
15 the oil palm fruit bunches in the treatment vessel (101) according to one preferred embodiment of the present invention.

Figure 4 shows introduction of steam into the treatment vessel (101), beginning from the top portion (zone A), followed by middle portion (zone B) and lower portion
20 (zone C) thereof.

Figure 5 shows introduction of the oil palm fruit bunches to be treated into the treatment vessel (101) through the fruit bunch inlet (106).

25 Figure 6 shows oil palm fruit bunches bounce off the damping unit (121) according to one preferred embodiment.

Figure 7 shows discharging of the treated oil palm fruit bunches through the fruit bunch outlet (107).

Figure 8 shows removal of steam and condensate comprising palm oil through a steam discharging outlet (109) and outlet (114) for discharging condensate respectively.

5

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, the invention shall be described according to the preferred embodiments of the present invention and by referring to the accompanying description and drawings. However, it is to be understood that limiting the description to the preferred
10 embodiments of the invention and to the drawings is merely to facilitate discussion of the present invention and it is envisioned that those skilled in the art may devise various modifications without departing from the scope of the appended claim.

15 The present invention relates to a process for treating oil palm fruit bunches comprising the steps of introducing the oil palm fruit bunches to be treated into a treatment vessel (101) for gravity feed through the vessel (101); retarding the free fall flow of the oil palm fruit bunches during its passage through the vessel (101) to mitigate the compaction of the fruit bunches within the vessel (101); and discharging
20 the sterilized oil palm fruit bunches from the treatment vessel (101).

In one embodiment, the treatment vessel (101) described herein can be referred as a sterilizing chamber. Preferably, the treatment process described herein refers to an oil palm fruit bunches sterilization process.

25

In a preferred embodiment, the oil palm fruit bunches loaded in the treatment vessel (101) is segregated into several partitions to reduce vertical pressure load on the oil palm fruit bunches which settle at the bottom portion of the vessel (101). The segregation of the oil palm fruit bunches load into partitions can mitigate the

compaction of fruit in the vessel (101), thereby minimizing the amount of oil squeezed out from the oil palm fruit.

5 In another preferred embodiment, the process aforementioned further comprising a step of feeding pressurized steam into the treatment vessel (101), starting from top to bottom portion of the vessel through a first steam distributing unit (102), followed by a second steam distributing unit (103) that is installed below the first steam distributing unit (102), for facilitating removal of cold air trapped in the vessel (101) and for sterilizing the oil palm fruit bunches.

10

A suitable steam pressure is preferably used for sterilization. The heat from the pressurized steam is important to cause the moisture in the nuts to expand. When the pressure is reduced the contraction of the nut leads to the detachment of the kernel from the shell wall, thus loosening the kernels within their shells. The detachment of
15 the kernel from the shell wall greatly facilitates later nut cracking operations. In the present invention, the steam is preferably fed into the treatment vessel (101) at a pressure of about 20-40 psi.

According to the present invention, the sterilization process aforementioned is able to
20 weaken the pulp structure of the oil palm fruit, softening it and making it easier to detach from the bunches.

The present invention also relates to an apparatus (100) for treating oil palm fruit bunches comprising a vertical treatment vessel (101) in which the oil palm fruit
25 bunches to be treated is gravity fed therethrough; a fruit bunch inlet (106) for introducing the oil palm fruit bunches to be sterilized into the vessel; a fruit bunch outlet (107) for discharging the treated oil palm fruit bunches from the vessel (101); and a means (108) to retard the free fall flow of the oil palm fruit bunches through the vessel to mitigate compaction of the fruit within the vessel. The apparatus (100)

according to one preferred embodiment is illustrated in Figure 1.

Preferably, the oil palm fruit bunches to be treated are transferred from a source to the apparatus (100) via a conveyor system (115), and loaded into the vessel (101) through
5 a chute (116), followed by the fruit bunch inlet (106). As depicted in Figure 5, the oil palm fruit bunches are gravity fed into the vessel (101) through the fruit bunch inlet (106).

According to a preferred embodiment, the means (108) to retard the free fall of the oil
10 palm fruit bunches comprises a restriction in the internal cross section of the treatment vessel (101). It is preferable that the restriction comprises at least one partition having a passageway through which the oil palm fruit bunches pass. Preferably, each partition has an inverted frusto-conical configuration as shown in Figure 2. In an exemplary embodiment as shown in Figure 3, the apparatus (100) of the present invention
15 comprises 2 inverted frusto-conical partitions (108) that restricts the passthrough of the oil palm fruit bunches through the vessel (101). Preferably, the inverted frusto-conical partitions (108) are vertically spaced apart from each other, thereby enabling the fruit bunches loaded in the vessel (101) to be separated into zone A, B and C. The presence of the inverted frusto-conical partitions (108) can minimize the palm oil
20 from squeezing out from stressed oil palm fruits as a result of high vertical pressure load exerted thereon.

In addition, to further retard the movement of the oil fruit palm bunches through the treatment vessel (101), one or more damping units (121) are therefore included in the
25 apparatus (100) of the present invention. As illustrated in Figure 6, the damping unit (121) preferably has a bulging surface on top thereof to bounce the oil palm fruit bunches to the side wall (122) instead of allowing the fruit bunches to directly free fall through the vessel (101).

Pursuant to a preferred embodiment of the present invention, the apparatus (100) aforementioned further comprising a first steam distributing unit (102) installed at the top portion of the vessel (101), wherein, when in use, steam is introduced into the vessel (101) through the first steam distributing unit (102) so that cold air trapped
5 therein can be removed from top to bottom portion of the vessel (101) and exit through a steam discharging outlet (109).

In another preferred embodiment, the apparatus (100) comprising one or more steam distributing units (103, 104) that are vertically spaced apart to each other. It is
10 preferable that the additional steam distributing units (103, 104) are installed beneath the means (108) to retard the free of the oil palm fruit bunches. Preferably, the first steam distributing unit (102) is installed near the fruit bunch inlet (106). When the steam is introduced into the treatment vessel (101), the cold air therein can be flushed out from top to the bottom thereof and discharged through the steam discharging
15 outlet (109). Preferably, the steam provided is pressurized and the steam pressure in the treatment vessel (101) is controlled by one or more steam inlet valves (105). In a preferred embodiment, the steam pressure is maintained at between about 20-40 psi.

To effectively flush the cold air out of the treatment vessel (101), the apparatus (100)
20 preferably comprises a plurality of steam distributing units (102, 103, 104) that are vertically spaced apart to each other in the vessel. In one embodiment as shown in FIGURE 4, besides the first steam distributing unit (102) disposed at the top portion of the vessel, a second (103) and third (104) steam distributing units are placed somewhere below the means (108) to retard the free fall of the oil palm fruit. When in
25 operation, the steam is initially introduced into the vessel (101) through the first steam distributing unit (102). As steam almost fills up the space in zone A, the second steam distributing unit (103) disposed below a first inverted frusto-conical partitions (108a) will be activated to feed steam into zone B of the vessel (101). Thereafter, when zone A and B are saturated with steam, the third steam distributing unit installed below a

second inverted frusto-conical partitions (108b), will be activated to supply steam into the zone C of the vessel (101). As the hot steam rises up in the vessel (101), the cold air therein will be forced towards the bottom thereof and exits through the steam discharging outlet (109) located somewhere below the tapered bottom portion (117) of the vessel.

Advantageously, the vertical spindle (110) is positioned vertically somewhere in the middle within the treatment vessel (101) and a vertical screw conveyor (111) is attached at the bottom thereof. As illustrated in Figure 7, it is preferable that the vessel (101) has a tapered bottom (117) to concentrate the oil palm fruit towards the vertical screw conveyor (111). Preferably, on top of the vertical screw conveyor (111), the vertical spindle (110) is provided with a plurality of flexible blades (112). It is preferable that the rotation of the vertical spindle (110) is powered by a hydraulic motor unit (113). When in use, the rotation of the vertical spindle (110) drives the movement of the vertical screw conveyor (111) and the flexible blades (112) in a clockwise manner. The vertical screw conveyor (111) moves the fruit load downwards towards the fruit discharging outlet (107) while the flexible blades (112) break the arch formed by the fruit bunches. According to a preferred embodiment, the vertical spindle (110) is supported and maintained by a plurality of steel bars (118) connecting the inner surface of the vessel (101) thereto.

In one embodiment, the treatment vessel (101) is disposed on top of a supporting stand (119). It is preferable that a conveyor system (120) is placed underneath the vessel (101) and the fruit bunch discharging outlet (107) for transferring the sterilized fruit bunches to subsequent treatment process.

Advantageously, the apparatus (100) as set forth in the preceding description further comprising an outlet (114) at the bottommost of the treatment vessel (101) for discharging condensate therefrom. The “condensate” used herein refers to the liquid

phase produced by the condensation of steam. As shown in the Figure 8, the condensate may partially mixed with the palm oil, the collected condensate from the outlet (114) is thus preferably processed for oil extraction.

5 EXAMPLES

The present invention can be further understood through consideration of the following non-limiting Example.

Example 1

- 10 After feeding the fresh fruit bunches into the treatment vessel, the fruit bunch inlet is closed. Pressurized steam at about 20 psi is supplied into the zone A of the vessel through the first steam distributing unit, followed by steam introduction into the zone B and C through the second and third steam distributing units. By supplying the pressurized steam at all 3 zones, the cold air contained inside the vessel will be forced
15 out through the air inlet.

- After 10 minutes preheating of the oil palm fruits with the pressurized steam, the steam pressure is increased gradually to about 40 psi from about 20 psi within about 30 minutes to complete the first cooking cycle. Next, the cooking is further cooked for
20 about 40 minutes to complete the first sterilization process. After the completion of first sterilization process, the steam contained within the treatment vessel will be removed through the steam discharging outlet. To facilitate the discharging of the steam from the vessel, the first steam distributing unit will be activated to introduce fresh steam at the pressure of about 40 psi. The steam pressure is later gradually
25 reduced from about 40 psi to about 20 psi for about 4-5 minutes. Thereafter, the steam distributing unit is deactivated and the apparatus is ready for 2nd sterilization cycle.

Although the invention has been described and illustrated in detail, it is to be understood that the same is by the way of illustration and example, and is not to be

taken by way of limitation. The spirit and scope of the present invention are to be limited only by the terms of the appended claims.

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CLAIMS

1. A process for treating oil palm fruit bunches comprising the steps of
introducing the oil palm fruit bunches to be treated into a treatment vessel
5 (101) for gravity feed through the vessel (101);
retarding the free fall flow of the oil palm fruit bunches during its passage
through the vessel (101) to mitigate the compaction of the fruit bunches within
the vessel (101); and
discharging the sterilized oil palm fruit bunches from the treatment vessel
10 (101).
2. A process according to claim 1, wherein the oil palm fruit bunches loaded in
the treatment vessel (101) is segregated into several partitions to reduce
vertical pressure load on the oil palm fruit bunches which settle at the bottom
15 portion of the vessel (101).
3. A process according to claim 1 or claim 2 further comprising a step of feeding
pressurized steam into the treatment vessel (101), starting from top to bottom
portion of the vessel (101) through a first steam distributing unit (102),
20 followed by a second steam distributing unit (103) that is installed below the
first steam distributing unit (102), for facilitating removal of cold air trapped
in the vessel (101) and for sterilizing the oil palm fruit bunches.
4. A process according to any one of claims 1 to 3 facilitates the detachment of
25 the oil palm fruits from the bunches.
5. An apparatus (100) for treating oil palm fruit bunches comprising
a vertical treatment vessel (101) in which the oil palm fruit bunches to be
treated is gravity fed therethrough;

a fruit bunch inlet (106) for introducing the oil palm fruit bunches to sterilized into the vessel (101);

a fruit bunch outlet (107) for discharging the treated oil palm fruit bunches from the vessel (101); and

5 a means (108) to retard the free fall flow of the oil palm fruit bunches through the vessel to mitigate compaction of the fruit within the vessel (101).

6. An apparatus (100) according to claim 5 further comprising a first steam distributing unit (102) installed at the top portion of the vessel (101), wherein,
10 when in use, steam is introduced into the vessel (101) through the first steam distributing unit (102) so that cold air trapped therein can be removed from top to bottom portion of the vessel (101) and exit through a steam discharging outlet (109).

15 7. An apparatus (100) according to claim 5 or claim 6, wherein the means (108) to retard the free fall of the oil palm fruit bunches comprises a restriction in the internal cross section of the vessel (101).

8. An apparatus (100) according to claim 7, wherein the restriction comprises at
20 least one partition having a passageway through which the oil palm fruit bunches pass.

9. An apparatus (100) according to claim 7 or claim 8, wherein each partition has
an inverted frusto-conical configuration.

25 10. An apparatus (100) according to any one of claims 5 to 9 further comprising one or more steam distributing units (103, 104) that are vertically spaced apart to each other.

11. An apparatus (100) according to any one of claims 5 to 10 further comprising a vertical spindle (110) positioned within the vessel (101), equipped with a vertical screw conveyor (111) at the bottom thereof for facilitating the discharging of the fruit from the fruit bunch outlet (107).
- 5
12. An apparatus (100) according to any one of claims 11, wherein the upper and middle portion of the vertical spindle (110) are fitted with a plurality of flexible blades (112) for breaking arch formed by the fruit bunches.
- 10
13. An apparatus according to claim 11 or 12 further comprising a hydraulic motor unit (113) for powering the rotation of the vertical spindle (110).
14. An apparatus according to any one of claims 5 to 13 further comprising an outlet (114) at the bottommost of the vessel (101) for discharging condensate therefrom.
- 15

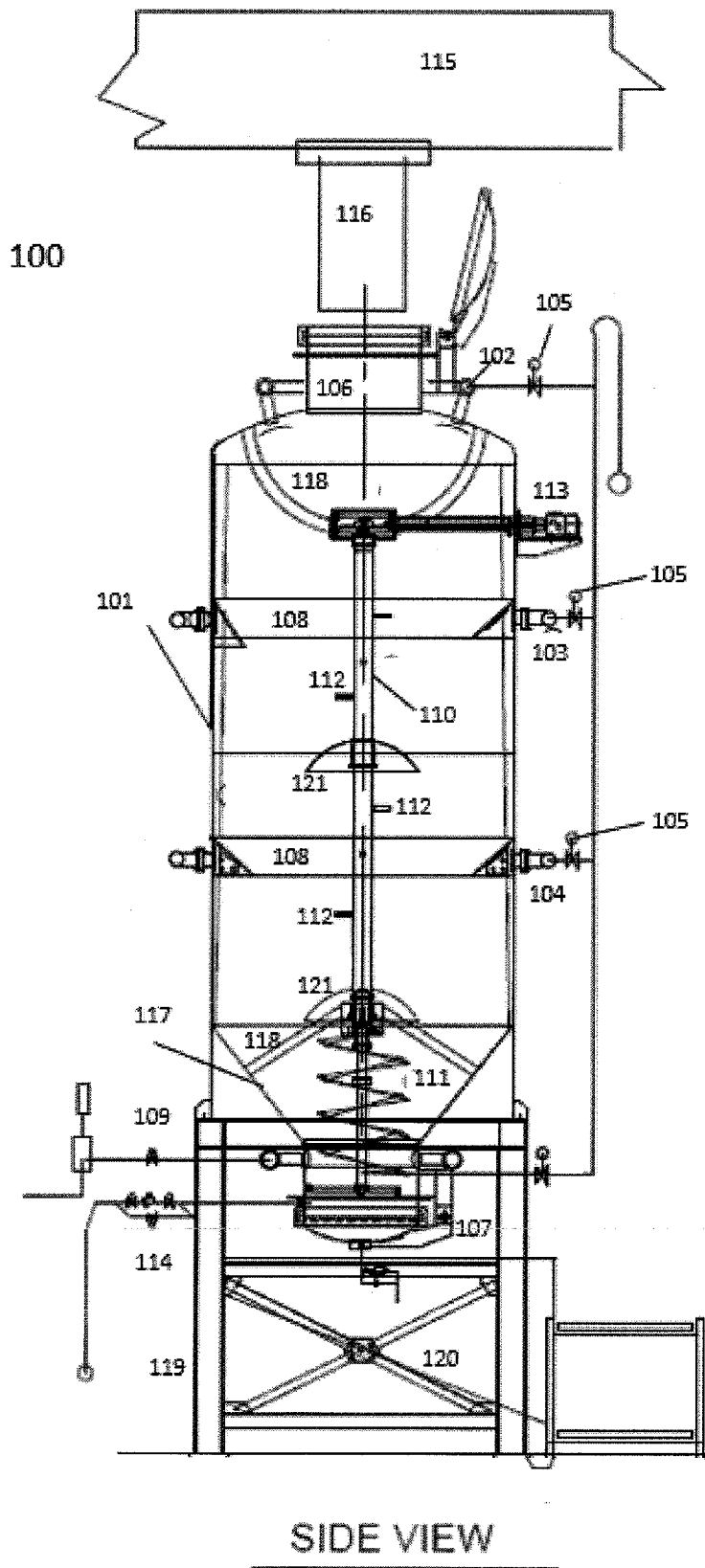


Figure 1

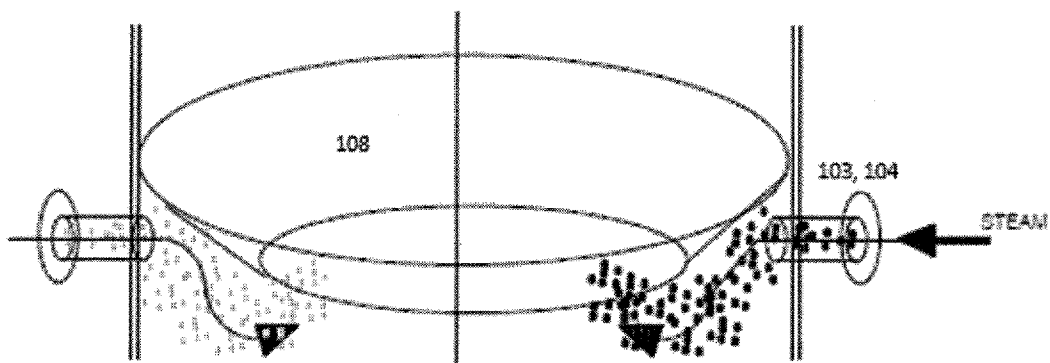
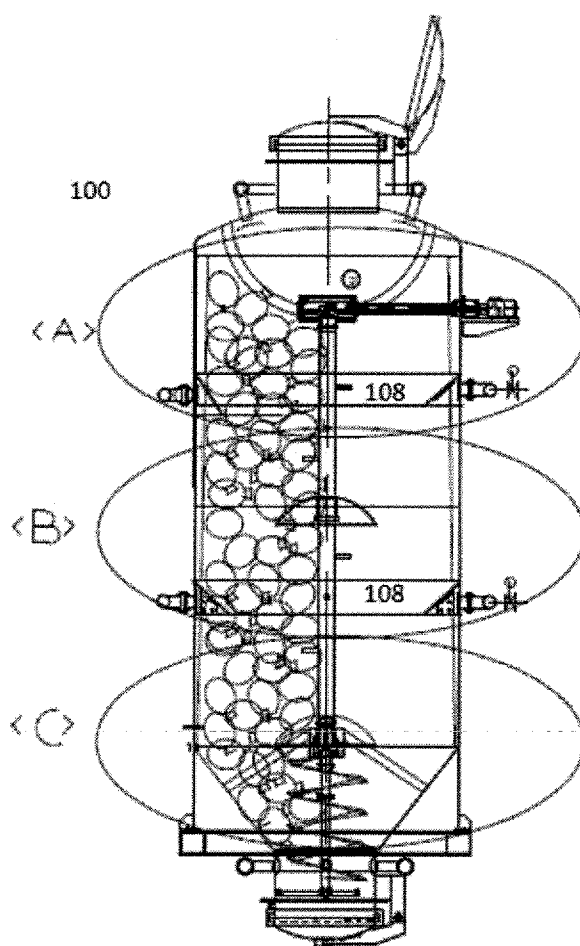


Figure 2



SIDE VIEW

ZONE: <A> <C>

Figure 3

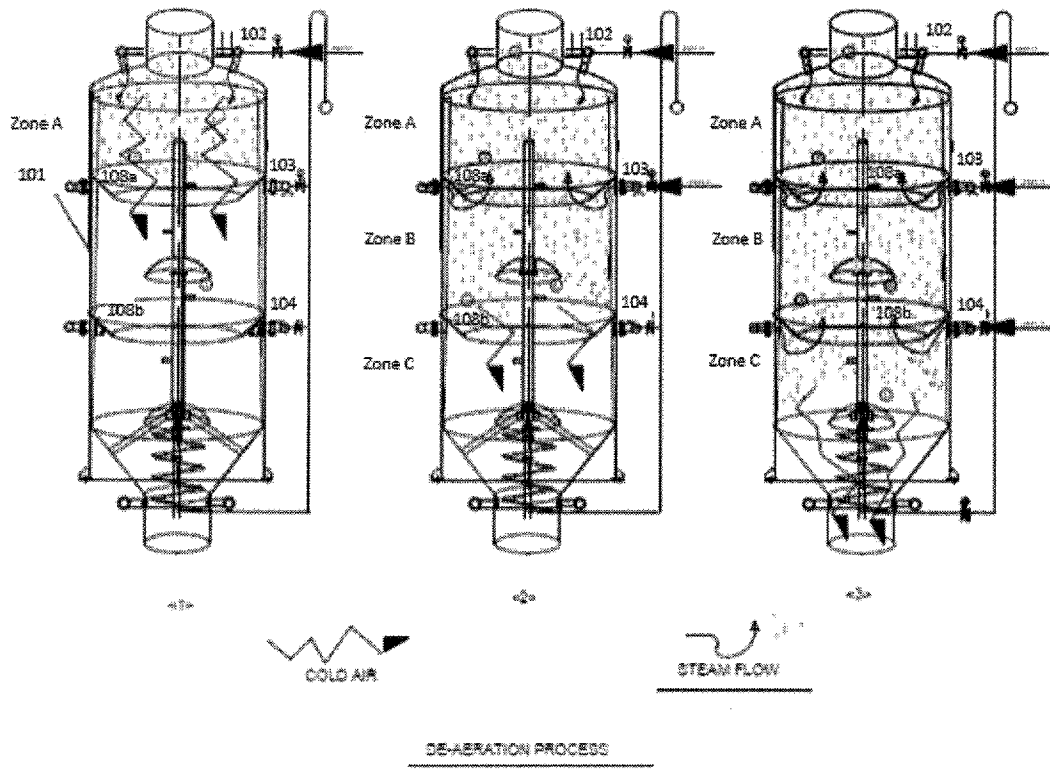


Figure 4

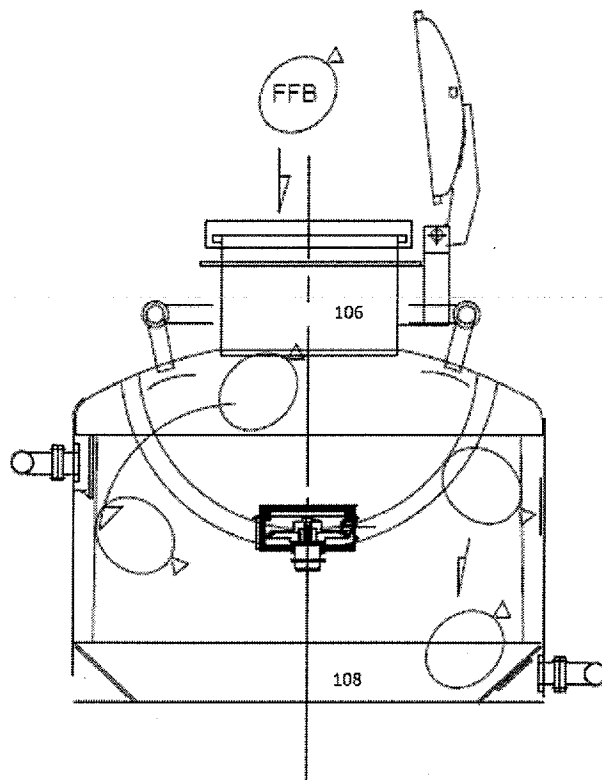


Figure 5

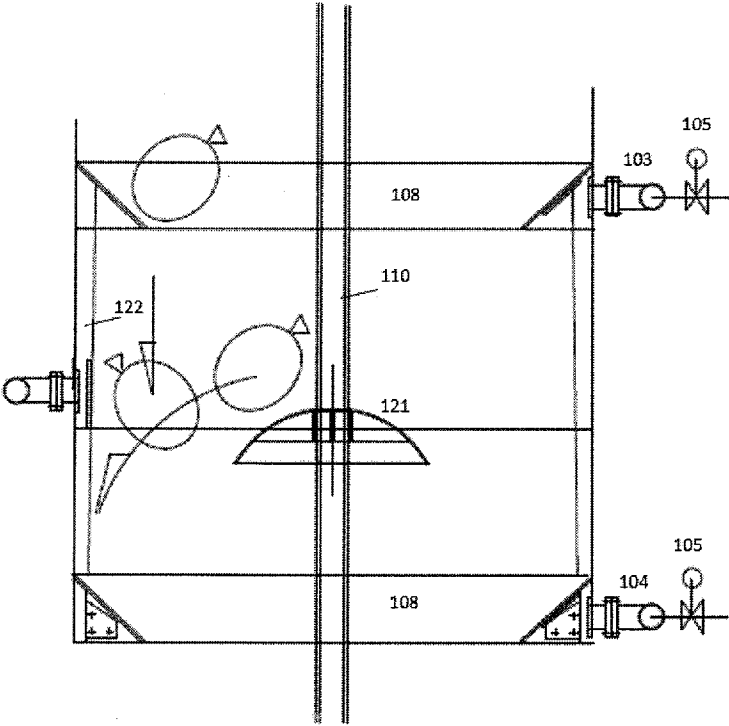


Figure 6

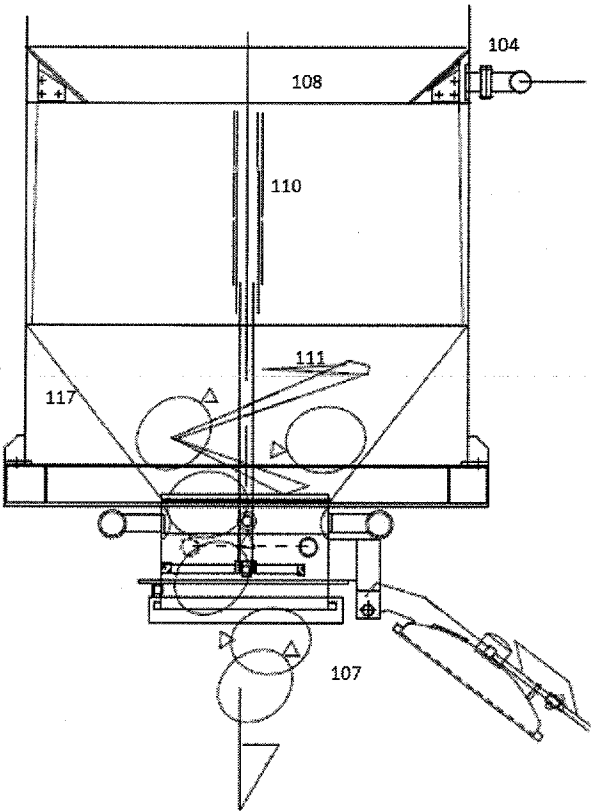


Figure 7

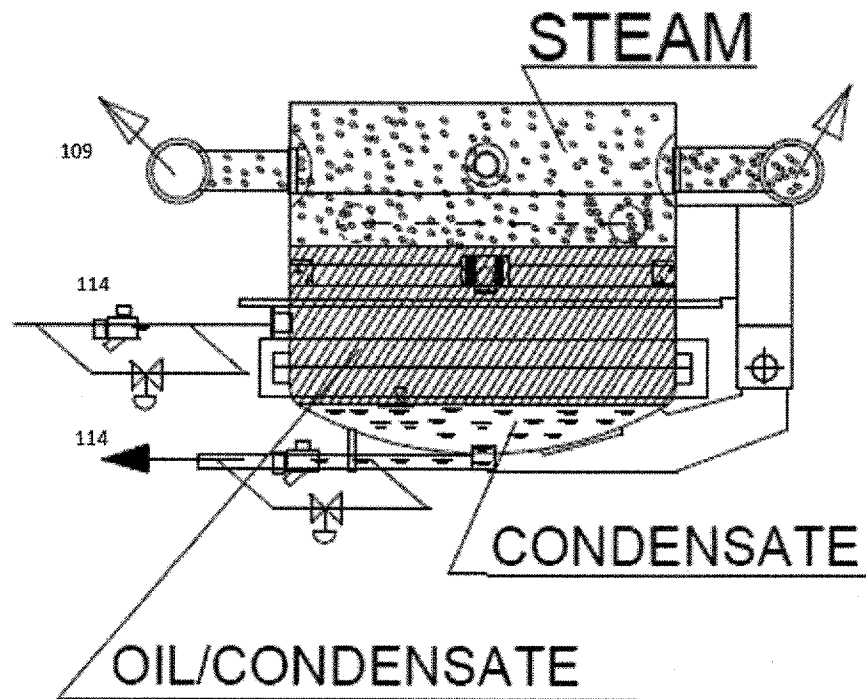


Figure 8

INTERNATIONAL SEARCH REPORT

 International application No.
PCT/MY2019/050018

A. CLASSIFICATION OF SUBJECT MATTER

A23L 3/16 (2006.01) A23D 9/02 (2006.01) C11B 1/04 (2006.01)

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)

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 practicable, search terms used)

A23L3/16PATENW: IPC/CPC Class marks A23D9/00, A23L3/00, A23B7/0053, A23L3/16, C11B1/00, C11B1/10, C11B1/04 and Keywords (pam oil, sterilize, treat, steam, kettle, vessel, container, settle, gravity, freefall, damp, retard, constrict, cone, conical, tapering, partition, baffle, compartment) & like terms: Google Patent Search, Esp@cenet with keywords: palm oil sterilizer, oil palm treatment with like terms: Esp@cenet & Auspat search using keywords (Yap YIn Foo, Lai Tung Loy, Lok Choon Hong and sterilizing oil palm): Applicant(s)/Inventor name searched in Esp@cenet and internal database provided by IP Australia

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	



Further documents are listed in the continuation of Box C



See patent family annex

* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"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 9 May 2019	Date of mailing of the international search report 09 May 2019
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaaustralia.gov.au	Authorised officer Asoka Dias-Abey AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. +61262832141

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This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.			
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