

[Document Name] Description

[Title of Invention] METHOD AND APPARATUS FOR DIVIDING
PALM TRUNK

[Technical Field]

[0001]

The present invention relates to a method and apparatus for dividing a palm trunk. In particular, the present invention relates to, for example, a method for dividing a palm trunk that enables the total use of the palm trunk for mass production.

[Background Art]

[0002]

Palms, especially oil palms, are widely cultivated in countries near the equator, such as Indonesia and Malaysia, and in recent years, the expansion of oil palm farms has been a problem in the balance with the natural environment. By the way, the life of oil palms is generally about 25 years, and old oil palms are cut down. There have been several proposals for the reuse of trunks of such cut oil palms (for example, prior patent publication 2). For example, prior patent publication 1 below discloses continuous separation into a vascular bundle and a soft tissue constituting an oil palm trunk, enabling the total use of these for mass production.

[0003]

In the above patent literature publication 1, shredded pieces obtained by cutting off or shaving off an oil palm trunk are squeezed, and the sap is extracted. The residue obtained after the extraction of the sap is supplied to a separation chamber as a solid mixture. The above residue is conveyed while being stirred by the paddle of a paddle conveyor provided in the separation chamber, and a vascular bundle that is a low mobility solid in the solid mixture is recovered. Furthermore, an air flow is caused to flow in a direction opposite to the conveyance direction of the paddle conveyor, and by the air flow, a soft tissue that is a high mobility solid in the solid mixture is carried to be collected. At this time, compressed air is jetted toward the solid mixture conveyed by the paddle conveyor, promoting the separation of the high mobility solid from the solid mixture.

[Citation List]

[Patent Literature]

[0004]

[Patent Literature 1]

Japanese Patent Laid-Open No. 2013-34983

[Patent Literature 2]

International Publication No. WO 2018/216682

[Summary of Invention]

[Technical Problem]

[0005]

However, the above conventional dividing apparatus is intended for dividing the residue obtained after the extraction of the sap and does not divide the trunk directly into the vascular bundle and the soft tissue, which thus requires additional processing steps. Furthermore, such a dividing apparatus requires a relatively large-scale apparatus for connecting an air flow forming apparatus to the separation chamber including the paddle conveyor.

[0006]

Thus, the present invention has been made to solve such problems, and an object thereof is to provide a method and apparatus for dividing a palm trunk that, with a relatively simple configuration, divide the palm trunk into a vascular bundle and a soft tissue in a mass production manner, enabling the total use of the palm trunk.

[Solution to Problem]

[0007]

To achieve the above object, a method for dividing a palm trunk according to the first invention crushes a thin plate obtained by skiving the palm trunk, gravitationally classifies fragments, recovers a vascular bundle from gravitationally classified heavy objects, and

recovers a soft tissue from gravitationally classified light objects.

[0008]

The dividing method according to the first invention can be implemented by a simple apparatus and facilitate mass production, enabling the total use of the palm trunk including the vascular bundle and the soft tissue. In particular, the thin plate obtained by skiving the palm trunk is crushed. This allows an efficient gravitational classification at the subsequent stage.

[0009]

An apparatus for dividing a palm trunk according to the second invention includes: a crusher (4, 5) configured to crush a separated piece into fragments, the separated piece being separated from the palm trunk and having a predetermined size; and a gravitational classifier (7) configured to classify supplied fragments into heavy objects and light objects, wherein a vascular bundle of the trunk is recovered from heavy objects classified by the gravitational classifier (7), and a soft tissue of the trunk is recovered from light objects classified by the gravitational classifier (7).

[0010]

The dividing apparatus according to the second invention has a simple configuration. Furthermore, the gravitational classifier divides the fragments of the trunk into the vascular bundle and the soft tissue. This

facilitates mass production, enabling the total use of the palm trunk. The gravitational classifier here can use wind force. Then adjusting the wind force allows the gravitational classifier to perform classification into heavy objects and light objects with desired specifications as appropriate.

[0011]

The apparatus for dividing a palm trunk according to the third invention includes a rotary lathe (1) provided at a preceding stage of the crusher (4, 5), the rotary lathe (1) being configured to skive (slice into a thin long strip) the palm trunk.

[0012]

According to the third invention, the trunk is skived and crushed. This allows an efficient gravitational classification at the subsequent stage.

[0013]

In the apparatus for dividing a palm trunk according to the fourth invention, the crusher includes a preceding primary crusher (4) configured to perform coarse crushing and a subsequent secondary crusher (5) configured to perform fine crushing.

[0014]

According to the fourth invention, the secondary crusher performs fine crushing. This allows the gravitational classifier to perform an efficient classification.

[0015]

The apparatus for dividing a palm trunk according to the fifth invention includes a drier (2) provided at a subsequent stage of the rotary lathe (1) or at a subsequent stage of the primary crusher (4).

[0016]

According to the fifth invention, the trunk is crushed in a state of being dried to a desired extent. This allows an efficient crushing, and at the time of crushing, the separation into the vascular bundle and the soft tissue is performed in a more favorable manner.

[0017]

The apparatus for dividing a palm trunk according to the sixth invention further includes a separator (3) provided at the subsequent stage of the rotary lathe (1) or at a subsequent stage of the drier (2) provided at the subsequent stage of the rotary lathe (1), the separator (3) being configured to separate a skived thin plate.

[0018]

According to the sixth invention, the skived thin plate is separated. This allows an efficient crushing in the crusher at the subsequent stage.

[0019]

The apparatus for dividing a palm trunk according to the seventh invention further includes a sieve (8) configured to divide heavy objects output from the

gravitational classifier (7) and recover a vascular bundle.

[0020]

According to the seventh invention, the provision of the sieve allows recovery of a vascular bundle with desired specifications.

[0021]

In the apparatus for dividing a palm trunk according to the eighth invention, the sieve (8) includes a first sieve (85) and a second sieve (86), the first sieve (85) being configured to recover a relatively long vascular bundle from the heavy objects, the second sieve (86) being configured to recover a relatively short vascular bundle from the heavy objects.

[0022]

According to the eighth invention, the relatively long vascular bundle and the relatively short vascular bundle can be dividedly recovered.

[0023]

The apparatus for dividing a palm trunk according to the ninth invention includes a centrifugal separator (6) provided at a preceding stage of the gravitational classifier (7), the centrifugal separator (6) being configured to separate dust from the fragments.

[0024]

According to the ninth invention, the dust is removed from the fragments before gravitational weight

classification. This reduces the burden on the gravitational classifier.

[0025]

The apparatus for dividing a palm trunk according to the tenth invention includes a dust collector (10) configured to collect a soft tissue from light objects output from the gravitational classifier (7).

[0026]

According to the tenth invention, the soft tissue can be efficiently recovered by the dust collector.

[0027]

In the apparatus for dividing a palm trunk according to the eleventh invention, the dust collector (10) is further configured to collect a soft tissue from dust discharged from the centrifugal separator (6).

[0028]

According to the eleventh invention, the soft tissue can be efficiently collected.

[0029]

In the apparatus for dividing a palm trunk according to the twelfth invention, the dust collector (10) is further configured to collect a soft tissue from particulates passing through the sieve (8).

[0030]

According to the twelfth invention, the soft tissue can be efficiently collected.

[0031]

The reference signs in the above parentheses denote correspondences to specific means disclosed in the embodiment described later.

[Advantageous Effect of Invention]

[0032]

As above, the method and apparatus for dividing a palm trunk according to the present invention divide, with a relatively simple configuration, the palm trunk into the vascular bundle and the soft tissue in a mass production manner, enabling the total use of the palm trunk.

[Brief Description of Drawings]

[0033]

[Figure 1] Figure 1 is an overall schematic side view of a dividing apparatus according to an embodiment of the present invention.

[Figure 2] Figure 2 is an overall schematic cross-sectional view of a sieve according to an embodiment of the present invention.

[Description of Embodiments]

[0034]

The embodiments described below are by way of example only, and the scope of the present invention includes various design improvements by those skilled in

the art without departing from the gist of the present invention.

[0035]

Embodiment

Figure 1 shows an example of a configuration of a dividing apparatus for implementing a dividing method of the present invention. The dividing apparatus includes a rotary lathe 1 at the foremost stage, a drier 2 subsequent to the rotary lathe 1, a separator 3, a primary crusher 4, a secondary crusher 5, a cyclone 6 as a centrifugal separator, a gravitational classifier 7, a sieve 8, a blower 9, and a bag filter 10 at the last stage as a dust collector.

[0036]

The rotary lathe 1 is supplied with a log oil palm trunk cut off at a certain length (hereinafter an oil palm trunk is abbreviated to a trunk), and the trunk is continuously skived into a thin plate having a thickness of about 3 to 6 mm or less.

[0037]

The skived thin plate is conveyed on a conveyor 11 to the drier 2 and then dried here until the water content reaches about 6 to 15% by mass. A higher water content is not preferable since it may cause the skived thin plate to be entangled in teeth of the separator 3 at the next stage, resulting in poor separability from the teeth. The dried thin plate is separated by the

separator (normally, a cutter) 3 at an appropriate length so as to have a width that enables the dried thin plate to be supplied to the primary crusher 4 at the subsequent stage. In the present embodiment, the separated piece is conveyed to the primary crusher 4 on a conveyor, which is not shown, disposed in a direction perpendicular to the above conveyor 11. The separated piece is coarsely crushed by the preceding primary crusher 4 into fragments having an average length of about 20 to 200 mm and then moves in a conveyance pipe 41 by being sucked by the subsequent secondary crusher (in the present embodiment, a grinder) 5. The secondary crusher 5 has a screen whose opening is about 3 to 10 mm, and by changing this, an average length of a vascular bundle to be obtained can be about 0.1 to 100 mm. A finer opening increases the burden on the crushing, and a coarser one makes fragments to be obtained coarse, which are not preferable. Normally, the above opening is about 5 mm.

[0038]

The finely ground fragments are supplied through a conveyance pipe 51 to the cyclone 6 sucked by the blower 9, and dust included in the fragments is separated by the cyclone 6. The separated dust is sent by the blower 9 from a top portion of the cyclone 6 through a conveyance pipe 61 provided with an adjustment valve 611 to the bug filter 10.

[0039]

The fragments separated from the dust are supplied by an air-sealed rotary valve 62 provided at a bottom opening of the cyclone 6 to the gravitational classifier 7 positioned below the rotary valve 62. In the present embodiment, the gravitational classifier 7 is a so-called zigzag classifier using a vertical air flow, and a top portion thereof is connected to the above blower 9 via a conveyance pipe 71 provided with an adjustment valve 711.

[0040]

In a zigzag passage of the gravitational classifier 7 connected to and sucked by the blower 9, an updraft is generated. The fragments supplied from the rotary valve 62 are dispersed again in the passage by collision or a vortex flow and repeatedly classified by the updraft according to particle size and density. Light objects in the fragments classified by the gravitational classifier 7 include a high proportion of a soft tissue constituting the oil palm trunk. The light objects are sucked along with the updraft by the blower 9 from the top portion of the gravitational classifier 7 through the conveyance pipe 71 and sent to the bug filter 10.

[0041]

On the other hand, heavy objects in the fragments classified by the gravitational classifier 7 include a high proportion of a vascular bundle constituting the oil palm trunk. The heavy objects are discharged from the

lower side of the gravitational classifier 7 and supplied to the sieve 8 at the next stage.

[0042]

An example of the sieve 8 is shown in Figure 2. The sieve 8 shown in Figure 2 is a vibratory sieve, and a built-in motor 82 rotates an upper eccentric weight 821 and a lower eccentric weight 822 to vibrate a housing 84 supported on a spring 83. In the present embodiment, the housing 84 includes an upper sieve mesh 85 having a relatively large opening and a lower sieve mesh 86 having a relatively small opening. The upper sieve mesh 85 functions as a first sieve, and the lower sieve mesh 86 functions as a second sieve. The opening sizes of these sieve meshes 85 and 86 are changed, thereby obtaining desired vascular bundles and fines described later.

[0043]

A relatively long vascular bundle included in the heavy objects supplied from the gravitational classifier 7 (in an example, about 30 mm long and an aspect ratio of about 600) is unable to go through the upper sieve mesh 85 and captured here to be recovered from a discharge port 841 of the housing 84. On the other hand, a relatively short vascular bundle included in the above heavy objects (in an example, about 1 mm long and an aspect ratio of about 3.5) is able to go through the upper sieve mesh 85 but unable to go through the lower

sieve mesh 86 and captured here to be recovered from a discharge port 842 of the housing 84.

[0044]

Particulates going through the lower sieve mesh 86 include a soft tissue mixed in the heavy objects or adhering to a vascular bundle. The above particulates reach a discharge port 843 at the lowermost stage of the housing 84. The discharge port 843 communicates with the blower 9 via a conveyance pipe 81 provided with an adjustment valve 811 (Figure 1). Thus, the particulates are sucked by the blower 9 from the discharge port 843 through the conveyance pipe 81 and sent to the bug filter 10 (Figure 1).

[0045]

In the bug filter 10, the dust from the cyclone 6, the light objects from the gravitational classifier 7, and the soft tissue included in the particulates from the sieve 8, which are carried by the air flow to the bug filter 10, are collected by a filter cloth and recovered. According to the dividing apparatus as above, simply increasing the size thereof allows a sufficient trunk throughput of about 10 t/h.

[0046]

Other Embodiments

The above embodiment is not only intended for division of oil palm trunks but also widely applicable to palm trunks.

In the above embodiment, an oil palm trunk is not necessarily required to be skived. A separated (cut off or the like) log trunk may be immediately supplied to the crusher.

In the above embodiment, the crusher is not necessarily required to include the primary crusher and the secondary crusher. The provision of the drier is also not essential. The drier, when provided, may be disposed not immediately behind the rotary lathe but between the primary crusher and the secondary crusher.
[0047]

In the above embodiment, when the thin plate output from the rotary lathe can be immediately put into the crusher, the provision of the separating device (cutting device) is not particularly required.

In the above embodiment, when a desired vascular bundle can be obtained in the gravitational classifier, the provision of the sieve is not particularly required. Furthermore, the sieve is not necessarily required to include the primary sieve and the secondary sieve.
[0048]

In the above embodiment, the collection of a soft tissue is not necessarily required to use the dust collector. Furthermore, in the above embodiment, although a soft tissue is also collected from the dust separated by the centrifugal separator and the particulates going through the sieve, this is not

necessarily required. The dust collector is not limited to the bug filter.

In the above embodiment, the provision of the centrifugal separator for separating the dust ahead of the gravitational classifier is not necessarily required.

[Reference Signs List]

[0049]

- 1: rotary lathe
- 2: drier
- 3: separator (cutter)
- 4: primary crusher
- 5: secondary crusher (grinder)
- 6: cyclone (centrifugal separator)
- 7: gravitational classifier
- 8: sieve
- 85: upper sieve mesh (first sieve)
- 86: lower sieve mesh (second sieve)
- 9: blower
- 10: bug filter (dust collector)

[Document Name] Claims

[Claim 1]

A method for dividing a palm trunk, comprising:
crushing a thin plate obtained by skiving the palm trunk;
gravitationally classifying fragments; recovering a
vascular bundle from gravitationally classified heavy
objects; and recovering a soft tissue from
gravitationally classified light objects.

[Claim 2]

An apparatus for dividing a palm trunk, comprising:
a crusher configured to crush a separated piece into
fragments, the separated piece being separated from the
palm trunk and having a predetermined size; and a
gravitational classifier configured to classify supplied
fragments into heavy objects and light objects, wherein a
vascular bundle of the trunk is recovered from heavy
objects classified by the gravitational classifier, and a
soft tissue of the trunk is recovered from light objects
classified by the gravitational classifier.

[Claim 3]

The apparatus for dividing a palm trunk according to
claim 2, further comprising a rotary lathe provided at a
preceding stage of the crusher, the rotary lathe being
configured to skive the palm trunk.

[Claim 4]

The apparatus for dividing a palm trunk according to claim 2 or 3, wherein the crusher includes a preceding primary crusher configured to perform coarse crushing and a subsequent secondary crusher configured to perform fine crushing.

[Claim 5]

The apparatus for dividing a palm trunk according to any of claims 2 to 4, further comprising a drier provided at a subsequent stage of the rotary lathe or at a subsequent stage of the primary crusher.

[Claim 6]

The apparatus for dividing a palm trunk according to any of claims 2 to 5, further comprising a separator provided at a subsequent stage of the rotary lathe or at a subsequent stage of a drier provided at the subsequent stage of the rotary lathe, the separator being configured to separate a skived thin plate.

[Claim 7]

The apparatus for dividing a palm trunk according to any of claims 2 to 6, further comprising a sieve configured to divide heavy objects output from the gravitational classifier and recover a vascular bundle.

[Claim 8]

The apparatus for dividing a palm trunk according to claim 7, wherein the sieve includes a first sieve and a second sieve, the first sieve being configured to recover a relatively long vascular bundle

from the heavy objects, the second sieve being configured to recover a relatively short vascular bundle from the heavy objects.

[Claim 9]

The apparatus for dividing a palm trunk according to any of claims 2 to 8, further comprising a centrifugal separator provided at a preceding stage of the gravitational classifier, the centrifugal separator being configured to separate dust from the fragments.

[Claim 10]

The apparatus for dividing a palm trunk according to any of claims 2 to 9, further comprising a dust collector configured to collect a soft tissue from light objects output from the gravitational classifier.

[Claim 11]

The apparatus for dividing a palm trunk according to claim 10, wherein the dust collector is further configured to collect a soft tissue from dust discharged from the centrifugal separator.

[Claim 12]

The apparatus for dividing a palm trunk according to any of claims 10 to 11, wherein the dust collector is further configured to collect a soft tissue from particulates passing through the sieve.