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(54) ICE CUBE SEPARATOR DEVICE

(57) An ice cube separator device for separating solid ice cubes from broken ice cubes and ice pieces, the device comprising a conical body (1) having a support structure (2) and a rotation axis (A). The rotation axis (A) extends between a first end (1a) and a second end (1b) of the conical body (1), the conical body (1) is configured to rotate around the rotation axis (A). The conical body (1) comprises rods (3) with spaces (4) between the rods (3), the rods (3) extend between the first end (1a) and the second end (1b) of the conical body (1). The conical body

(1) has a diameter (D_1) at the first end (1a) of the conical body (1) smaller than a diameter (D_2) at the second end (1b) of the conical body (1). The conical body (1) has a distance (x_1) between two neighboring rods (3) at the first end (1a) of the conical body (1) smaller than the distance (x_2) between two neighboring rods (3) at the second end (1b) of the conical body (1). This solution provides an inexpensive and simple ice cube separator device which can separate solid ice cubes from broken ice cubes and ice pieces very softly and efficiently.

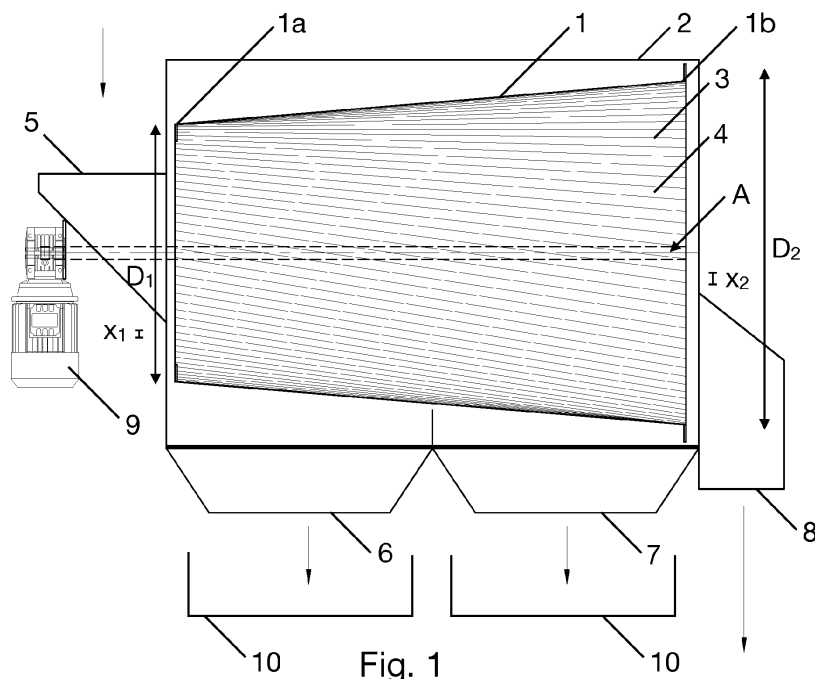


Fig. 1

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Description

TECHNICAL FIELD

[0001] The disclosure relates to an ice cube separator device and to a method for the application of the device.

BACKGROUND

[0002] Ice cubes come in all sorts of shapes and sizes, such as full cubes, half cubes, bullet ice, crescent ice (half-moon shape), cylindrical ice, nugget ice, and any of these with holes through the center. So, they are all ice cubes, despite their shape. The ice cubes, despite name, are often cylindrical.

[0003] In the ice production business, the cleaning and separation of finished ice cubes from snow, flakes, crushed or broken ice cubes is rarely done, since quantity is usually more important than quality. But in the fairly new industry of gourmet coffee that is now flourishing, the perfect balance of coffee, water, syrup and ice is very important. As a result, the size, weight and quality of the ice cubes turned out to be more relevant and it became critical to produce ice cubes having a consistent size.

[0004] In the prior art, when the cleaning and separation step is included in the manufacturing process, it is usually done by an overly complicated and expensive machine, which is sometimes the same machine that produces the ice cubes. Another method to get rid of the flakes, crushed or broken ice cubes is by shaking or vibrating the finished ice cubes. However, this method has many disadvantages, since it unfortunately also breaks some of the solid, whole ice cubes. Thus, using this method results in a more expensive and time-consuming process. Furthermore, the machine is also exposed to technical failures, because of its several moving parts.

[0005] Machines used in the ice business, such as an ice cube separator device, have their main season in the summer, when the majority of the ice cubes is produced and used, and thus when about 75% of the income of ice cube producing companies is generated. Therefore, these machines must be durable and must be able to function well in this relatively short period of the year, without breaking down. During summer, even a few hours spent with repair can lead to a decline in revenue. Furthermore, the machines must be able to work properly after being shut off for a couple of months. Therefore, comparing to other technical fields where machines are used all year round, in the ice business it is critical to maximize the capacity and the durability of the machine, and it is very important to create the least time-consuming process possible. For this reason, the ice cube separator device which shakes or vibrates the finished ice cubes should be avoided, since its use makes the process time consuming, more expensive, and its technical problems can lead to the stop of ice cube production on important summer days.

SUMMARY

[0006] It is an object to provide an improved ice cube separator device and a method for the application of the device. The conical rotatable device is very durable, moves the ice cube product forward very softly, thus reducing breakage of the solid cubes and very efficiently, using low energy. Both the device and its maintenance are inexpensive, since it has only one moving part. The foregoing and other objects are achieved by the features of the independent claims. Further implementation forms are apparent from the dependent claims, the description, and the figures.

[0007] According to a first aspect, there is provided an ice cube separator device for separating solid ice cubes from snow ice and crushed ice pieces, the device comprising a conical body having a support structure and a rotation axis, the rotation axis A extending between a first end and a second end of the conical body, the conical body being configured to rotate around said rotation axis, the conical body comprising rods with spaces between the rods, the rods extending between the first end and the second end of the conical body, the conical body having a diameter at the first end of the conical body smaller than a diameter at the second end of the conical body, the conical body having a distance between two neighboring rods at the first end of the conical body smaller than the distance between two neighboring rods at the second end of the conical body.

[0008] This solution provides a device that is able to assist in the production of high-quality, whole ice cubes, which separates solid ice cubes from any broken ice cube pieces. All broken ice cube pieces having a smaller dimension than the distance between two neighboring rods automatically fall out of the conical body while it rotates and softly moves ice cubes along the conical body. The device having different distances between the rods at the first end and second end of the conical body facilitates at least two different screen sizes, thus can remove smaller and slightly bigger ice pieces. (Screening means separation based on size.)

[0009] In a possible implementation form of the first aspect, the device comprises at least one, preferably two bins arranged under the conical body for collecting snow ice and crushed ice pieces fallen from the conical body through the spaces. This facilitates the simple collection of any broken ice cube pieces fallen out of the conical body, such as snow ice and crushed ice pieces, under the conical body. This also allows the simple recycling of the broken ice cube pieces. If there are two bins arranged under the conical body, it allows collecting the different sizes of broken ice pieces separately, making any further use easier and quicker.

[0010] In a further possible implementation form of the first aspect, the device comprises a snow exit and a crushed ice exit, and there is a bin arranged under both the snow exit and the crushed ice exit. This facilitates separating ice pieces of smaller size, i.e. snow ice from

the solid ice cubes in the first part of the conical body and collecting them in a first bin; and separating ice pieces of slightly bigger size, i.e. crushed ice pieces from the solid ice cubes in the second half of the conical body and collecting them in a separate bin. This allows the further use of the collected snow ice and crushed ice pieces even separately, for any purpose, such as recycling or packaging and selling them for different purpose.

[0011] In a further possible implementation form of the first aspect, the device comprises an inlet at the first end of the conical body for allowing ice cubes to enter the conical body, and a product exit at the second end of the conical body for allowing solid ice cubes to leave the conical body. This facilitates a simpler use of the device and the possibility to connect the device to other devices, such as a conveyor transporting the solid ice cubes for packaging.

[0012] In a further possible implementation form of the first aspect, the rods are arranged helically. The helical arrangement of the rods creates self-moving screw conveyor effect that moves the ice cubes within the conical body forward.

[0013] In a further possible implementation form of the first aspect, the device further comprises a motor, the motor being connected to the first end of the conical body via a shaft, the motor being configured to rotate the conical body around the rotation axis. This facilitates the rotation of the conical body electronically, thus more comfortably.

[0014] In a further possible implementation form of the first aspect, the support structure and/or the rods are made of stainless steel. This facilitates a strong structure and a durable device which is also resistant to corrosion.

[0015] According to a second aspect, there is provided a method for the application of the ice cube separator device, comprising the steps of:

- adding ice cubes to the conical body of the device at the first end of the conical body,
- rotating the conical body around its rotation axis and moving the ice cubes along the conical body,
- allowing broken ice cube pieces such as snow ice and crushed ice pieces having a dimension smaller than the distance to fall out of the conical body through a space between any rods while the ice cubes move along the conical body, and
- collecting solid ice cubes at the second end of the conical body at product exit.

[0016] This solution provides a method for cleaning produced ice cubes in order to have high quality ice cubes having a consistent size, with the least amount of broken ice cube pieces. Cleaning of ice cube product means the separation of produced ice cubes from broken ice cube pieces and/or snow ice and/or crushed ice pieces based on their sizes, dimensions. With this method, this separation is done softly, inexpensively, and efficiently, because the ice pieces having smaller dimension than the

distance between two rods automatically fall out of the conical body while the ice cubes move along the conical body from its first end to its second end. The method is very simple and requires very low human intervention, assistance or maintenance. The rotation and the shape of the conical body (has an incline) help the ice cubes to be cleaned move forward within the conical body. The rotation can be done by hand, by a motor connected to the conical body or any other way. The method thus assists the production of high-quality ice cubes.

[0017] In a possible implementation form of the second aspect, the conical body is rotated with a motor connected to the first end of the conical body via a shaft. This facilitates automatic rotation of the conical body at any speed and thus allows the process needing even less human intervention.

[0018] In a possible implementation form of the second aspect, the broken ice cube pieces fallen out of the conical body are collected in at least one bin placed under the conical body. This facilitates the reuse of the broken ice cube pieces, snow ice and/or crushed ice cube pieces for selling them for less, or recycling, or any other purpose. The collected broken ice cube pieces can also be transported from the at least one bin to an ice cube producing device where it is automatically used for producing new ice cubes. Alternatively, the collected broken ice cube pieces can also be transported from the at least one bin to a packaging device where it can be packaged and sold as low-quality ice, or ice for different purpose such as cooling of different meat, fish or drink products.

[0019] In a possible implementation form of the second aspect, the solid ice cubes fallen out at the product exit are collected in at least one bin placed under the product exit. This provides an alternative possibility for collection of the high-quality solid ice cubes, which can then be packaged or transported for a different use. The collected solid ice cubes can also be transported from the bin to a conveyor. However, it is also possible that solid ice cubes leave the conical body through product exit directly to a conveyor. the conveyor can transport the solid ice cubes to a packaging station.

[0020] This and other aspects will be apparent from the embodiments described below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] In the following detailed portion of the present disclosure, the aspects, embodiments and implementations will be explained in more detail with reference to the example embodiments shown in the drawings, in which:

Fig. 1 depicts a side view of an ice cube separator device in accordance with one embodiment of the present invention, and
Fig. 2 depicts a front view of the ice cube separator device shown in Fig. 1.

DETAILED DESCRIPTION

[0022] The ice cube separator device handles produced ice cubes. The device may be connected to an ice producing device so that produced ice cubes automatically continue their way from the ice producing device to the ice separator device, and then, optionally to a packaging device. The purpose of the ice cube separator device is separating solid ice cubes from any smaller, broken ice cube pieces, such as snow ice or crushed ice pieces, in order to have high-quality ice cubes which have consistent size and the least possible number of broken pieces. This separation is also referred to sometimes as the cleaning of ice cubes.

[0023] Fig. 1 illustrates a preferred embodiment of the ice cube separator device. The device comprises a conical body 1 having a support structure 2 and a rotation axis A. The support structure 2 may be for example a base or a stand, or any other support that is able to hold the conical body 1. In the embodiment illustrated in Figs. 1 and 2, the support structure 2 is a base around the conical body 1, preferably supporting it at the first end 1a. The rotation axis A extends between a first end 1a and a second end 1b of the conical body 1, and the conical body 1 rotates around the rotation axis A. The rotation can be done by hand, by a motor connected to the conical body or any other way, and it helps move the ice cubes within the conical body 1 move forward along the conical body 1. The direction of their movement is from the first end 1a to the second end 1b of the conical body 1. The cross-section of the conical body 1 is a circle, or a shape that is close to a circle. The size, diameter and length of the conical body 1 and the rotation speed are determined by the size and volume of the product, i.e. the ice cubes to be cleaned, separated. The conical body 1 has a diameter D_1 at the first end 1a of the conical body 1 smaller than a diameter D_2 at the second end 1b of the conical body 1. The conical body 1 has thus a smaller flange at the first end 1a and a bigger flange at the second end 1b. This means that the conical body 1 is cone shaped, has an incline. This incline also facilitates the forward movement of the ice cubes from the first end 1a to the second end 1b of the conical body 1. The conical body 1 comprises rods 3 with spaces 4 between the rods 3. The rods 3 extend between the first end 1a and the second end 1b of the conical body 1. The purpose of the rods 3 and spaces 4 is to keep ice cubes having a dimension, size bigger than the distance x_1 , x_2 between two neighboring rods 3, i.e. bigger than the space 4, within the conical body 1; and, at the same time, allowing ice cube pieces having a dimension, size smaller than the distance x_1 , x_2 between two neighboring rods 3, i.e. smaller than the space 4, to fall out of the conical body 1. This facilitates the production of high-quality ice cubes having a consistent size. The conical body 1 has a distance x_1 between two neighboring rods 3 at the first end 1a of the conical body 1 smaller than the distance x_2 between two neighboring rods 3 at the second end 1b of

the conical body 1. This means that the space 4 between the rods is smaller in the first part of the conical body 1 than in the second part of the conical body 1; and thus means that the device has at least two different screen sizes. In the first half of the conical body 1 (close to the first end 1a) the device can get rid of the smaller ice pieces, such as snow ice, and in the second half of the conical body 1 (close to the second end 1b) the device can get rid of the slightly bigger ice pieces. The rods 3 are preferably located at equal distance from each other, therefore the distance x_1 is preferably the same between all rods 3 at the first end 1a, around the smaller flange; and similarly, the distance x_2 is preferably the same between all rods 3 at the second end 1b, around the bigger flange.

[0024] The device preferably comprises at least one, preferably two bins 10 arranged under the conical body 1 for collecting snow ice and crushed ice pieces fallen from the conical body 1 through the spaces 4. If there is one single bin 10, it can also be divided into two parts, so it is also possible to collect different sizes of ice pieces in a single bin 10. The device may comprise a snow exit 6 and a crushed ice exit 7, and there can be a bin 10 arranged under both the snow exit 6 and the crushed ice exit 7 in order to collect the pieces fallen out from the conical body 1 separately, based on their size. Snow exit 6 is for snow ice, flakes and other very small ice pieces. These have smaller size, smaller dimensions than the crushed ice pieces, that is why snow exit 6 is closer to the first end 1a of the conical body 1, where the spaces 4 between the rods 3 are smaller. Bigger ice pieces, such as crushed ice pieces, broken ice cube pieces that cannot fall out of this first part of the conical body 1, since they are bigger than the distance x_1 and larger than the space 4 in the first part of the conical body 1, will move along and then fall out of the conical body 1 in a next segment of the conical body 1 where spaces 4 between the rods 3 are larger, via the crushed ice exit 7. It is also possible to use three or more bins 10 and collect three or more different sizes of ice pieces that have fallen out the conical body 1.

[0025] The device comprises an inlet 5 at the first end 1a of the conical body 1 for allowing ice cubes to enter the conical body 1, and a product exit 8 at the second end 1b of the conical body 1 for allowing solid ice cubes to leave the conical body 1. Ice cubes can be added manually or using another device or come from an ice producing device. These ice cubes that enter the conical body 1 are usually ice cubes produced by any kind of ice producing device. These produced ice cubes are mixed, so they cannot be packaged straight away after production, it would not be a high-quality package of ice cubes. Some of the produced ice cubes might be broken, so they have to enter the ice cube separator device in order to separate the whole ice cubes from the broken ice cubes, small ice pieces, snow ice, ice flakes. This separation is done such that all broken product (ice) are automatically removed from the conical body 1 while the ice cubes move forward within the conical body 1, since

they have smaller size than the space 4 between the rods 3. So, the undesirable ice cube pieces simply fall out of the conical body 1 through any of the spaces 4. This way, the ice cubes leaving the conical body 1 are high-quality, solid ice cubes free of all undesirable broken ice cubes, so the high-quality, solid ice cubes can be packaged and sold. The solid ice cubes can leave the conical body 1 by falling out of the product exit 8 into a bin 10, or onto a conveyor, or into a bin 10 and then to a conveyor, or into an ice cube packaging device, or any other way. As mentioned, there can be a bin 10 placed below the product exit 8 for allowing solid ice cubes to drop in the bin 10 (not illustrated in the Figs.).

[0026] Preferably, the conical body 1 is helical, which means that the rods 3 are arranged helically. This embodiment is illustrated in Figs. 1 and 2. As the conical body 1 rotates, the helical arrangement of the rods creates a self-moving screw conveyor effect that moves the ice cubes within the conical body forward, in the direction parallel with the rotation axis A. The moving direction of the ice cubes within the helical conical body 1 is from the first end 1a to the second end 1b. The cross-section of the conical body 1 is a circle both at the first end 1a and at the second end 1b. All other features described in our application may be combined with this embodiment of the device when the conical body 1 is helical. The helical conical body 1 also has an incline which also helps the ice cubes move forward, toward the second end 1b and the product exit 8. The helical arrangement contributes to the device being efficient, durable but inexpensive. It is able to move the ice cubes very softly, thus reducing the breakage of the ice cubes. The application of the device requires low energy.

[0027] The device according to a preferred embodiment further comprises a motor 9. The embodiment illustrated in Fig. 1 illustrates the motor 9. The motor 9 is preferably connected to the first end 1a of the conical body 1 via a shaft, and the motor 9 is able to rotate the conical body 1 around the rotation axis A via the shaft. The flange at the first end 1a is preferably secured to the shaft. The flange at the second end 1b can be an eccentric flange resting to spin on two bearings. However, different interconnection of the conical body 1 and the motor 9 is also possible. The motor 9 may have a gearbox controlled by a frequency inverter. The device according to a preferred embodiment is a conical helical rotating cam-shaft or eccentric ice cube separator device. The conical body can be rotated by hand as well, but motor is the more preferred way. The speed of the rotation can be set according to the requirements, user's needs, size, shape and type of the ice cubes. With the motor 9, it can also be possible to make soft, small vibrations, shaking movement to the conical body 1 or its bigger flange to help ice cube pieces fall out of the conical body 1.

[0028] Preferably, the support structure 2 and/or the rods 3 are made of stainless steel. The rods 3 are preferably attached to the conical body 1 via welding. Stainless steel has multiple advantages. At the first end 1a,

the rods 3 are welded narrower to each other. Close to the second end 1b, the clearance of the rods 3 is wider.

[0029] The method for the application of the ice cube separator device as above described, comprises the steps of adding ice cubes to the conical body 1 of the device at the first end 1a of the conical body 1, preferably via the inlet 5, rotating the conical body 1 around its rotation axis A and moving the ice cubes along the conical body 1. The conical body 1 may be rotated with a motor 9 connected to the first end 1a of the conical body 1 via a shaft. Then, the next step is allowing broken ice cube pieces such as snow ice, ice flakes, broken ice cube pieces and crushed ice pieces having a dimension smaller than the distance x_1 , x_2 to fall out of the conical body 1 through a space 4 between any rods 3 while the ice cubes move along the conical body 1. Finally, collecting the solid ice cubes at the second end 1b of the conical body 1 at product exit 8. The solid ice cubes are then packaged and can be sold. The solid ice cubes that fall out at the product exit 8 are preferably collected in at least one bin 10 placed under the product exit 8.

[0030] The broken ice cube pieces fallen out of the conical body 1 may be collected in at least one bin 10 placed under the conical body 1, preferably there are two separate compartments used which can be in a single bin 10 or two bins 10. As already mentioned, more than two bins 10 may also be used for collection of the fallen ice cube pieces. From these bins 10, the ice pieces can be collected for recycling or another purpose.

[0031] The invention has multiple advantages. The produced ice cubes entering the conical body 1 - optionally having helical rods 3 - move forward with minimal friction and minimal energy. Thus, we can avoid additional breakage. This saves time and costs. The moment the produced ice cubes enter the conical body 1, the separation of solid ice cubes from ice flakes and snow ice begins, and ice flakes and snow ice fall into the first bin 10. As the produced ice cubes move, the spaces 4, i.e. gaps between rods 3 become wider and bigger ice pieces, such as broken ice cubes fall through into the second bin 10. Before exiting, the eccentric flange at the second end 1b can create slight vibrations so that any additional broken material can fall into the second bin 10, thus allowing only solid ice cubes to fall out at the product exit 8, where a third bin 10 may be placed. The device has limited moving parts, has at least two different size screens, has limited down time and cost on repairs. Furthermore, the device offers zero waste and an increase of income, because of being able to recapture all types of product (small size, slightly bigger size of ice pieces and then the final solid ice cubes) and it is possible to sell any type of the product according to industry needs.

[0032] When the word ice cube is used in our application, it is to be understood as to include any shape and size. So, the ice cubes can be full cubes, half cubes, rectangular, bullet ice, crescent ice (half-moon shape), cylindrical ice, nugget ice, or any of these with holes through the center. By solid ice cubes, we mean high-

quality, whole, unbroken ice cubes, or almost completely whole ice cubes. (Very small, almost unnoticeable breaks are allowed.) By snow ice, we mean small and very small ice pieces, flakes that have to be separated from the solid ice cubes so that only high-quality ice cubes are sold. By crushed ice, we also mean small ice pieces, broken ice cube pieces that should not be sold in a high-quality package of ice cubes. By crushed ice, we mean bigger pieces than the snow ice, but still smaller than the whole ice cubes. By cleaning the ice cubes, we mean the mechanical separation process of solid ice cubes from any small ice pieces, such as broken ice cubes, snow ice, ice flakes, crushed ice, and any small ice pieces. Thus, in our application, the phrases cleaning of ice cubes and separation of ice cubes mean the same process.

[0033] Other variations than those described above can be understood and effected by a person skilled in the art. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The reference signs used in the claims shall not be construed as limiting the scope. Unless otherwise indicated, the drawings are intended to be read (e.g., cross-hatching, arrangement of parts, proportion, degree, etc.) together with the specification, and are to be considered a portion of the entire written description of this disclosure. As used in the description, the terms "horizontal", "vertical", "left", "right", "up" and "down", simply refer to the orientation of the illustrated structure as the particular drawing figure faces the reader.

Claims

1. Ice cube separator device for separating solid ice cubes from snow ice and crushed ice pieces, the device comprising a conical body (1) having a support structure (2) and a rotation axis (A), said rotation axis (A) extending between a first end (1a) and a second end (1b) of the conical body (1), the conical body (1) being configured to rotate around said rotation axis (A), the conical body (1) comprising rods (3) with spaces (4) between the rods (3), the rods (3) extending between the first end (1a) and the second end (1b) of the conical body (1), the conical body (1) having a diameter (D_1) at the first end (1a) of the conical body (1) smaller than a diameter (D_2) at the second end (1b) of the conical body (1), the conical body (1) having a distance (x_1) between two neighboring rods (3) at the first end (1a) of the conical body (1) smaller than the distance (x_2) between two neighboring rods (3) at the second end (1b) of the conical body (1).
2. The device according to claim 1, wherein the device comprises at least one, preferably two bins (10) ar-

ranged under the conical body (1) for collecting snow ice and crushed ice pieces fallen from the conical body (1) through the spaces (4).

3. The device according to claim 2, wherein the device comprises a snow exit (6) and a crushed ice exit (7), and there is a bin (10) arranged under both the snow exit (6) and the crushed ice exit (7).
4. The device according to any of claims 1 to 3, wherein the device comprises an inlet (5) at the first end (1a) of the conical body (1) for allowing ice cubes to enter the conical body (1), and a product exit (8) at the second end (1b) of the conical body (1) for allowing solid ice cubes to leave the conical body (1).
5. The device according to any of claims 1 to 4, wherein the rods (3) are arranged helically.
6. The device according to any of claims 1 to 5, wherein the device further comprises a motor (9), the motor (9) being connected to the first end (1a) of the conical body (1) via a shaft, the motor (9) being configured to rotate the conical body (1) around the rotation axis (A).
7. The device according to any of claims 1 to 6, wherein the support structure (2) and/or the rods (3) are made of stainless steel.
8. Method for the application of the ice cube separator device according to claim 1, comprising the steps of:
 - adding ice cubes to the conical body (1) of the device at the first end (1a) of the conical body (1), rotating the conical body (1) around its rotation axis (A) and moving the ice cubes along the conical body (1), allowing broken ice cube pieces such as snow ice and crushed ice pieces having a dimension smaller than the distance (x_1 , x_2) to fall out of the conical body (1) through a space (4) between any rods (3) while the ice cubes move along the conical body (1), collecting solid ice cubes at the second end (1b) of the conical body (1) at product exit (8).
9. Method according to claim 8, wherein the conical body (1) is rotated with a motor (9) connected to the first end (1a) of the conical body (1) via a shaft.
10. Method according to claim 8 or 9, wherein the broken ice cube pieces fallen out of the conical body (1) are collected in at least one bin (10) placed under the conical body (1).
11. Method according to any of claims 8 to 10, wherein the solid ice cubes fallen out at the product exit (8)

are collected in at least one bin (10) placed under the product exit (8).

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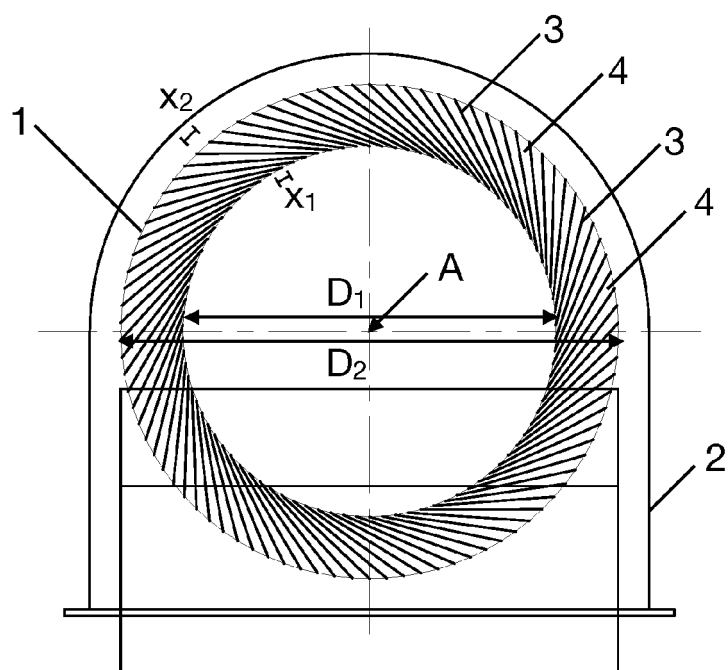
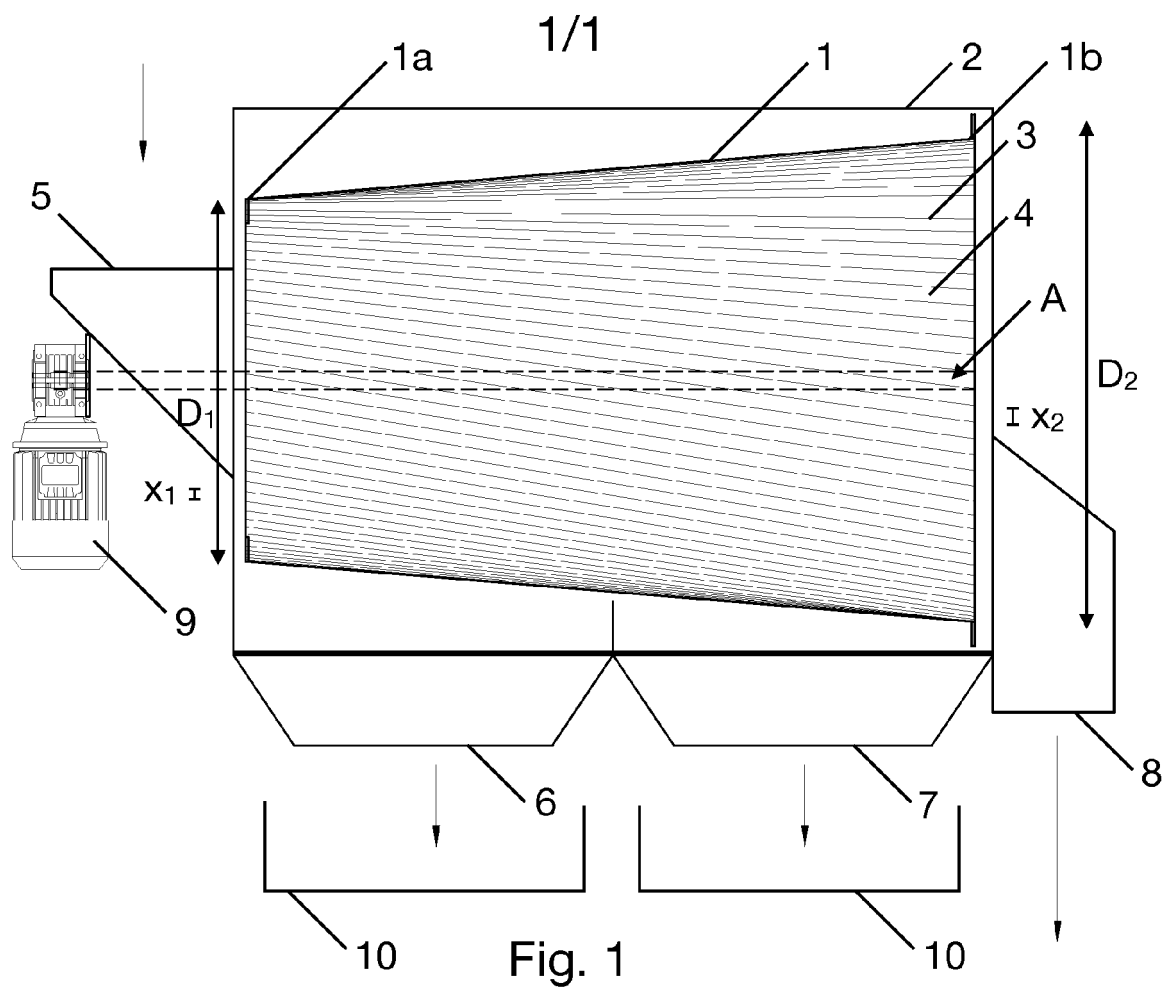
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EUROPEAN SEARCH REPORT

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Place of search The Hague		Date of completion of the search 30 September 2021	Examiner Yousufi, Stefanie
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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JP 2016097366 A	30-05-2016	NONE	