

Description

The present invention relates to cooling apparatus and in particular to apparatus for deep freezing products.

It is known from US-A-4798614, for apparatus for deep freezing foodstuffs to include a transportation device for the foodstuffs which includes a rotating drum. The drum is divided into a series of compartments by radial partition walls. Each compartment successively is loaded with a predetermined quantity of product to be frozen and a cryogenic fluid.

A product loading device and a device for spraying the cryogenic fluid into successive compartments are arranged adjacent each other at a position arcuately spaced from a removal device in the form of a chute for receiving the frozen products.

A disadvantage of this known apparatus is that it requires the injection into each compartment of a predetermined amount of cryogenic fluid which is sprayed into each compartment successively.

It is an aim of the present invention to provide an apparatus for cooling products which is inexpensive to produce and relatively simple to operate.

According to the present invention an apparatus for cooling products comprises a drum mounted for rotary movement such that a portion of its periphery extends into a vessel for containing cryogenic fluid, at least one partition dividing the drum into compartments, an inlet for delivering products to successive compartments as the drum rotates and an outlet for cooled products located along the central axis of the drum at one surface thereof, the axis of rotation of the drum being arranged at an angle to the horizontal such that product within the compartments will move under gravity towards the said one surface.

Embodiments of the invention will now be described, by way of example, reference being made to the Figures of the accompanying diagrammatic drawings in which:-

Figure 1 is cross-section in elevation through an apparatus for cooling products;

Figure 2 is a cross-section on the line 2-2 of Figure 1;

Figure 3 is a detail in cross-section of a further apparatus for cooling liquid products; and

Figure 4 is a detail showing the relationship between sub-compartments in a rotary drum forming part of the apparatus of Figure 3.

As shown in Figures 1 and 2, an apparatus for cooling products such as solid foodstuffs includes a rotary drum 1 made, for example, of stainless steel mesh. The drum 1 is open on one (upper as shown in Figure 1) face and consists of a hollow interior defined by a peripheral surface 3 and a base surface 4. The central axis of the drum 1 which is also, as shown, the axis of rotation is at an angle to the horizontal. An outlet 5 is located along the central axis at the base sur-

face 4 and the outlet 5 communicates with a chute 6. Opposite the outlet 5 and extending in the opposite direction from the chute 6 is a motor drive shaft 7.

The chute 6 and shaft 7 extend through the walls of a housing 8 in which the drum 1 is located and are mounted respectively in bearings 9, 10 each located outside the housing 8.

The drum 1 is divided into compartments 12 by a plurality of partitions 14. Each partition 14 has a generally curved configuration as best seen in Figure 2. The partitions are also made from mesh of a material suitable for use in contact with cryogenic fluids. The open face of the drum 1 provides an inlet for each compartment as will be explained.

Also positioned within the housing 8 is a vessel 11 containing cryogenic fluid such as liquid nitrogen. The position of the vessel 11 relative to the drum 1 is such that during rotation of the drum 1 each compartment 12 will successively descend into and rise from the cryogenic liquid contained in the vessel 11.

On one wall of the housing 8 is an extraction fan 16.

Also extending through a wall of the housing 8 is a delivery means in the form of a hopper 18 which terminates at its inner end adjacent the open face of the drum 1.

In use, the drum 1 is rotated at a predetermined speed by means of a motor (not shown) which can either be directly or indirectly coupled to the shaft 7 in a manner known in the art.

Product to be cooled passes through hopper 18 via the open face of the drum 1 into successive compartments 12 as they rotate beneath the inner or lower end of the chute 18. Each compartment 12 will successively descend into the cryogenic fluid contained within the vessel 11 and rise out from said cryogenic fluid. The time that the products are submerged within the cryogenic fluid is dictated by the speed of revolution of the drum 1 and this is predetermined so that the products are frozen as they rise out of the cryogenic fluid.

By virtue of the angle of the axis of rotation of the drum 1 products will tend to move under gravity towards the base surface 4. However, as the compartments rise from the cryogenic fluid the curvature of the partitions 14 will guide the products under gravity towards the central outlet 5 and hence through the chute 6.

The fan 16 is used to withdraw nitrogen vapour from the interior of the housing 8.

Once the products fall down the chute 6 they can be caught in a receptacle or conveyer in a manner known per se.

Referring now to Figures 3 and 4, there is illustrated an apparatus for freezing liquid products. For convenience, like reference numerals used in Figures 3 and 4 designate like features to those described in the embodiment illustrated in Figures 1 and 2.

The apparatus of Figures 3 and 4 includes a drum 1 made from mesh material, for example, stainless steel. The drum 1 is open at one (upper as shown in Figure 3) face and consists of a hollow interior defined by a peripheral surface 3 and a base surface 4.

The central axis of the drum 1 which is also the axis of rotation is at an angle to the horizontal. An outlet 5 is located along the central axis at the base 4 and the outlet 5 communicates with the chute 6. Although not shown, opposite the outlet 6 and extending in the opposite direction from the chute 6 is a motor drive shaft. The chute 6 and shaft extend through walls of a housing (not shown) in which the drum is located and each are mounted in bearings located outside the housing as described in the embodiment illustrated in Figures 1 and 2.

The drum 1 is divided into compartments 12 by a plurality of partitions 14. Within each compartment 12 there are provided barriers 20 which divide each compartment into sub-compartments 22. As shown, the sub-compartments 22 within each compartment 12 are arranged concentrically with respect to each other. Each barrier 20 within a compartment does not extend the full width of the compartment but is spaced from one partition to define a path 24 for communication with the outlet 5.

A pipe 26 extends through the housing (not shown) and its inner end is located above the open face of the drum 1 at a position immediately above the vessel 11. Outlet ports 28 are spaced along the pipe 26 such that each port 28 is aligned with a sub-compartment 22 of a compartment 12 when said compartment 12 is immersed in cryogenic fluid contained within the vessel 11.

In use, the drum 1 is rotated at a predetermined speed by means of a motor in the manner described with reference to the embodiment illustrated in Figures 1 and 2.

Liquid product flows through the tube 26 and exits through the ports 28 directly into the sub-compartments 22 which are immersed in the cryogenic fluid contained within the vessel 11.

The liquid product freezes and as the compartment 12 moves free of the cryogenic fluid it will move under gravity towards the base surface 4. However, the curvature of the partitions 14 will guide the frozen product towards the path 24 and hence towards the outlet 5. The product will then proceed along the chute 6 towards a receptacle or conveyer in a manner known per se.

It will be observed that the partitions 14 all meet at the centre of the drum to prevent the products from falling into the following compartment and consequently re-entering the vessel 11.

A particular advantage of the above described embodiment is that the bearings as well as the drive motor are mounted externally of the housing 8 to avoid the cryogenic temperatures within the housing

8.

Although not specifically shown and described the vessel 11 has a solenoid valve operated inlet and manual drain valves. It is also provided with level probes to determine the liquid nitrogen level in the vessel 11.

The housing 8 is provided with access panels to allow for cleaning, maintenance and inspection purposes.

Claims

1. An apparatus for cooling products comprising a drum (1) mounted along a central axis for rotary movement and having at least one partition (14) dividing the drum (1) into compartments (12), an inlet for delivering products to successive compartments (12) as the drum (1) rotates, and an outlet (5, 6) for cooled products, characterised in that the drum (1) is mounted such that a portion of its periphery extends into a vessel (11) for containing cryogenic fluid such that on rotation of the drum (1) each compartment (12) successively descends into and rises from said cryogenic fluid when contained in the vessel (11), said outlet (5, 6) for cooled products being located along the central axis of the drum at one surface (4) thereof, the axis of rotation of the drum (1) being arranged at an angle to the horizontal such that products within the compartments (12) will move under gravity towards said surface (4).
2. An apparatus as claimed in Claim 1, characterised in that the drum (1) and the vessel (11) are each located within a housing (8), a delivery means (18) extending from outside the housing (8) to the inlet for delivering products to be cooled and a chute (6) extending from the outlet (5) at said one surface (4) to a location outside the housing 8 for the passage there along of the cooled products.
3. An apparatus as claimed in Claim 2, characterised in that the chute (6) is mounted in bearings (9) located externally of the housing (8) and a shaft (7) extends from the opposite second surface of the drum (1) through the housing (8) and is mounted in bearings (10) located externally of the housing (8).
4. An apparatus as claimed in Claim 1, 2 or 3, in which a plurality of partitions are provided, characterised in that each partition (14) is curved such that during rotation of the drum (1) product at or adjacent the radial extremity of a partition (14) will be guided under gravity towards the central outlet (5) at said one surface (4) of the drum

The apparatus of Figures 3 and 4 includes a drum 1 made from mesh material, for example, stainless steel. The drum 1 is open at one (upper as shown in Figure 3) face and consists of a hollow interior defined by a peripheral surface 3 and a base surface 4.

The central axis of the drum 1 which is also the axis of rotation is at an angle to the horizontal. An outlet 5 is located along the central axis at the base 4 and the outlet 5 communicates with the chute 6. Although not shown, opposite the outlet 6 and extending in the opposite direction from the chute 6 is a motor drive shaft. The chute 6 and shaft extend through walls of a housing (not shown) in which the drum is located and each are mounted in bearings located outside the housing as described in the embodiment illustrated in Figures 1 and 2.

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A pipe 26 extends through the housing (not shown) and its inner end is located above the open face of the drum 1 at a position immediately above the vessel 11. Outlet ports 28 are spaced along the pipe 26 such that each port 28 is aligned with a sub-compartment 22 of a compartment 12 when said compartment 12 is immersed in cryogenic fluid contained within the vessel 11.

In use, the drum 1 is rotated at a predetermined speed by means of a motor in the manner described with reference to the embodiment illustrated in Figures 1 and 2.

Liquid product flows through the tube 26 and exits through the ports 28 directly into the sub-compartments 22 which are immersed in the cryogenic fluid contained within the vessel 11.

The liquid product freezes and as the compartment 12 moves free of the cryogenic fluid it will move under gravity towards the base surface 4. However, the curvature of the partitions 14 will guide the frozen product towards the path 24 and hence towards the outlet 5. The product will then proceed along the chute 6 towards a receptacle or conveyer in a manner known per se.

It will be observed that the partitions 14 all meet at the centre of the drum to prevent the products from falling into the following compartment and consequently re-entering the vessel 11.

A particular advantage of the above described embodiment is that the bearings as well as the drive motor are mounted externally of the housing 8 to avoid the cryogenic temperatures within the housing

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Although not specifically shown and described the vessel 11 has a solenoid valve operated inlet and manual drain valves. It is also provided with level probes to determine the liquid nitrogen level in the vessel 11.

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Claims

1. An apparatus for cooling products comprising a drum (1) mounted along a central axis for rotary movement and having at least one partition (14) dividing the drum (1) into compartments (12), an inlet for delivering products to successive compartments (12) as the drum (1) rotates, and an outlet (5, 6) for cooled products, characterised in that the drum (1) is mounted such that a portion of its periphery extends into a vessel (11) for containing cryogenic fluid such that on rotation of the drum (1) each compartment (12) successively descends into and rises from said cryogenic fluid when contained in the vessel (11), said outlet (5, 6) for cooled products being located along the central axis of the drum at one surface (4) thereof, the axis of rotation of the drum (1) being arranged at an angle to the horizontal such that products within the compartments (12) will move under gravity towards said surface (4).
2. An apparatus as claimed in Claim 1, characterised in that the drum (1) and the vessel (11) are each located within a housing (8), a delivery means (18) extending from outside the housing (8) to the inlet for delivering products to be cooled and a chute (6) extending from the outlet (5) at said one surface (4) to a location outside the housing 8 for the passage there along of the cooled products.
3. An apparatus as claimed in Claim 2, characterised in that the chute (6) is mounted in bearings (9) located externally of the housing (8) and a shaft (7) extends from the opposite second surface of the drum (1) through the housing (8) and is mounted in bearings (10) located externally of the housing (8).
4. An apparatus as claimed in Claim 1, 2 or 3, in which a plurality of partitions are provided, characterised in that each partition (14) is curved such that during rotation of the drum (1) product at or adjacent the radial extremity of a partition (14) will be guided under gravity towards the central outlet (5) at said one surface (4) of the drum



(1).

5. An apparatus as claimed in any one of Claims 1 to 4, characterised in that each compartment (12) has located therein spaced barriers (20) which define between them sub-compartments (22), and a path (24) from each sub-compartment communicating with the outlet (5).
6. An apparatus as claimed in Claim 5, characterised in that the delivery means is a pipe (26) having at one end outlet ports (28) each port (28) being aligned with a sub-compartment (22) when said compartment (12) is located within the vessel (11).
7. An apparatus as claimed in any one of Claims 1 to 6, characterised in that the drum (1) and the or each partition (14) is made from mesh material.
8. An apparatus as claimed in any one of Claims 2 to 7, characterised in that an extractor fan (16) is located in a wall of the housing (8).

Patentansprüche

1. Vorrichtung zum Kühlen von Produkten, bestehend aus einer Trommel (1), die um eine Zentralachse drehbar gelagert ist und zumindest eine Trennwand (14) enthält, welche die Trommel (1) in Kompartimente (12) unterteilt, einem Einlaß zum Übergeben von Produkten an nacheinanderfolgende Kompartimente (12) während die Trommel (1) rotiert, und einem Auslaß (5, 6) für gekühlte Produkte, dadurch gekennzeichnet, daß die Trommel (1) derart angeordnet ist, daß sich ein Teil ihres Umfangs in ein Gefäß (11) zur Aufnahme eines Kühlfluids erstreckt, so daß während der Rotation der Trommel (1) jedes Kompartiment (12) nacheinander in das Kühlfluid im Gefäß (11) ein- und wieder daraus auftaucht, wobei der Auslaß (5, 6) für gekühlte Produkte längs der Zentralachse der Trommel (1) an einer ihrer Stirnflächen (4) angeordnet ist und die Rotationsachse der Trommel (1) mit der Horizontalen einen Winkel einschließt, so daß sich die Produkte innerhalb der Kompartimente (12) unter der Schwerkraft in Richtung der erwähnten Stirnfläche (4) bewegen.
2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß sich die Walze (1) und das Gefäß (11) innerhalb eines Gehäuses (8) befinden, daß sich eine Zuführvorrichtung (18) von außerhalb des Gehäuses (8) bis zum Einlaß für die zu kühlenden

Produkte erstreckt und eine Rutsche (6) für die Weiterleitung der gekühlten Produkte vorgesehen ist, die sich von dem Auslaß (5) an der erwähnten Stirnfläche (4) bis zu einer Position außerhalb des Gehäuses (8) erstreckt.

3. Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß die Rutsche in Lagern (9) gelagert ist, welche sich außerhalb des Gehäuses (8) befinden, und daß sich eine Welle (7), von der gegenüberliegenden zweiten Stirnfläche der Trommel (1) durch das Gehäuse (8) erstreckt und in Lagern (10) außerhalb des Gehäuses (8) gelagert ist.
4. Vorrichtung nach Anspruch 1, 2 oder 3, in der eine Anzahl von Trennwänden vorhanden ist, dadurch gekennzeichnet, daß jede Trennwand (14) derartig gekrümmt ist, daß während der Rotation der Trommel (1) das Produkt am bzw. benachbart dem radialen Ende einer Trennwand mit Hilfe der Schwerkraft in Richtung des zentralen Auslasses (5) an der erwähnten Stirnfläche (5) der Walze (1) geführt wird.
5. Vorrichtung nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß sich in jedem Kompartiment (12) Barrieren (20) in bestimmtem Abstand zueinander befinden, welche zwischen sich Unterkompartimente (22) definieren, und daß jedes Unterkompartiment durch einen Pfad (24) mit dem Auslaß (5) verbunden ist.
6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß die Zuliefernvorrichtung aus einem Rohr (26) besteht, das an einem Ende Auslaßöffnungen (28) besitzt, wobei jede Öffnung (28) auf ein Unterkompartiment (22) ausgerichtet ist, wenn sich das Kompartiment (12) in dem Gefäß (11) befindet.
7. Vorrichtung nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß die Trommel (1) und die bzw. alle Trennwände (14) aus gitterförmigem Material hergestellt sind.
8. Vorrichtung nach einem der Ansprüche 2 bis 7, dadurch gekennzeichnet, daß sich in einer Wand des Gehäuses (8) ein Abzugsventilator befindet.



Revendications

1. Dispositif pour refroidir des produits, comprenant un tambour (1) monté sur un axe central en vue d'un mouvement rotatif et ayant au moins une cloison (14) divisant le tambour (1) en compartiments (12), une entrée pour alimenter en produits les compartiments (12) successifs lorsque le tambour (1) tourne, et une sortie (5, 6) pour les produits refroidis, **caractérisé en ce que** le tambour (1) est monté de manière telle qu'une partie de sa périphérie s'avance à l'intérieur d'une cuve (11) destinée à contenir un fluide cryogénique de telle façon que, lors de la rotation du tambour (1), chaque compartiment (12) plonge et émerge successivement dans et hors dudit liquide cryogénique lorsqu'il est contenu dans la cuve (11), ladite sortie (5, 6) pour les produits refroidis étant située le long de l'axe central du tambour sur une première surface (4) de celui-ci, l'axe de rotation du tambour (1) définissant un angle par rapport à l'horizontale de telle façon que les produits à l'intérieur des compartiments (12) se déplacent par gravité vers ladite surface (4).
2. Dispositif selon la Revendication 1, **caractérisé en ce que** le tambour (1) et la cuve (11) sont l'un et l'autre situés à l'intérieur d'une cage (8), des moyens de déversement (18) partant de l'extérieur de la cage (8) jusqu'à l'entrée d'alimentation en produits à refroidir et une goulotte (6) partant de la sortie (5) à ladite première surface (4) jusqu'à un emplacement à l'extérieur de la cage (8) pour assurer le passage des produits refroidis.
3. Dispositif selon la Revendication 2, **caractérisé en ce que** la goulotte (6) est montée sur des paliers (9) situés à l'extérieur de la cage (8) et qu'un arbre (7) s'étend d'une seconde surface opposée du tambour (1) en traversant la cage (8) et est monté sur des paliers (10) situés à l'extérieur de la cage (8).
4. Dispositif selon la Revendication 1, 2 ou 3, dans lequel sont présentes une pluralité de cloisons, **caractérisé en ce que** chaque cloison (14) est incurvée de manière telle que pendant la rotation du tambour (1), un produit situé au niveau de, ou adjacent à, l'extrémité radiale d'une cloison (14) soit guidé par gravité vers la sortie centrale (5) sur ladite première surface (4) du tambour (1).
5. Dispositif selon l'une quelconque des Revendications 1 à 4, **caractérisé en ce que** chaque compartiment (12) possède intérieurement des séparations (20) qui définissent entre elles des sous-compartiments (22), et un trajet (24) partant de chaque sous-compartiment communiquant avec la sortie (5).
6. Dispositif selon la Revendication 5, **caractérisé en ce que** les moyens d'alimentation sont un tuyau (26) ayant sur une extrémité des orifices (28) de sortie alignés avec un sous-compartiment (22) lorsque ledit compartiment (12) est situé dans la cuve (11).
7. Dispositif selon l'une quelconque des Revendications 1 à 6, **caractérisé en ce que** le tambour (1) et la ou chaque cloison (14) sont réalisés en matériau de treillis métallique.
8. Dispositif selon l'une quelconque des Revendications 2 à 7, **caractérisé en ce qu'un** ventilateur extracteur (16) est situé dans une paroi de la cage (8).

