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(71) Applicant: **Shenzhen Roborock Innovation Technology Co., Ltd.**
Shenzhen, Guangdong 518000 (CN)

(72) Inventors:
- **ZHAO, Fan**
  Shenzhen, Guangdong 518000 (CN)
- **LIU, Yanjun**
  Shenzhen, Guangdong 518000 (CN)
- **YAN, Biao**
  Shenzhen, Guangdong 518000 (CN)

(74) Representative: **Potter Clarkson**
Chapel Quarter
Mount Street
Nottingham NG1 6HQ (GB)

(54) **ICE-MAKING DEVICE**

(57) An ice-making device, comprising: an ice chip preparation assembly, configured to make raw material water into ice chips; an ice-pressing assembly, configured to receive the ice chips and make the ice chips into ice cubes, and comprising: an ice-pressing mold, provided with at least one mold unit, the at least one mold unit being configured to sequentially and cyclically switch between a filling station, an ice-pressing station and an ice-removing station; an ice-pressing push rod, corresponding to the ice-pressing station and being configured to push the ice chips in the mold unit located at the ice-pressing station so as to be pressed into ice cubes; and an ice-removing push rod, corresponding to the ice-removing station and being configured to push the ice cubes in the mold unit located at the ice-removing station so as to be separated from the mold unit located at the ice-removing station.

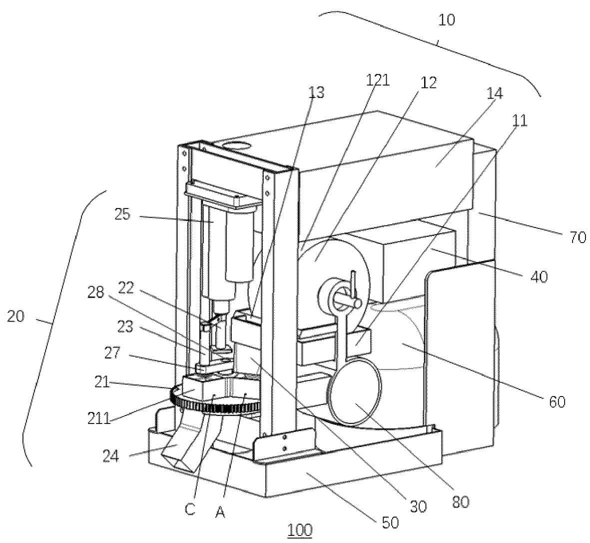

FIG. 1

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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority of the Chinese Patent Application No. 202210675882.6 filed on June 15, 2022, and the disclosure of the Chinese patent application is hereby incorporated herein by reference in its entirety as part of this application.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of ice making techniques, and more particularly to an ice making apparatus for making ice at a food grade.

BACKGROUND OF THE INVENTION

[0003] Currently, ice makers for nugget ice are mainly divided into two categories, i.e., ice makers for commercial use and household use. The commercial ice maker, despite of its large production capacity of nugget ice with high quality, has a large volume and is expensive, and most commercial ice makers require a separate water cooling system, which can hardly be applied to household scenarios. In addition, the household ice maker cannot meet the user's short-term demand for ice since the daily output of nugget ice is low due to its low production of raw ice chips per unit time. Further, the household ice maker has problems such as instable ice production. For example, each time the ice maker is turned on, the water content of the first batch of ice cubes is too large and the texture of the ice cubes is too soft.

[0004] It is to be noted that the information disclosed in the background section merely intends to enhance the understanding of the background of the present disclosure, and thereby may include information that does not constitute the prior art known to those of ordinary skill in the art.

SUMMARY OF THE INVENTION

[0005] Some embodiments of the present disclosure provide an ice making apparatus. The ice making apparatus includes:

an ice chip preparing assembly, configured to make ice chips from feedstock water; and
an ice-pressing assembly, configured to receive the ice chips and make the ice chips into ice cubes, and including:
an ice-pressing mold, having at least one mold unit, wherein the at least one mold unit is configured to sequentially switch among a filling station, an ice-pressing station, and an ice-removing station in a cyclic manner;
an ice-pressing pusher, corresponding to the ice-pressing station, and configured to push and press the ice chips within the mold unit at the ice-pressing station to form ice cubes; and
an ice-removing pusher, corresponding to the ice-removing station, and configured to push the ice cubes in the mold unit at the ice-removing station out of the mold unit at the ice-removing station.

[0006] In some embodiments, the ice-pressing mold includes:

a rotating mold disc, configured to rotate about an axis thereof, wherein the at least one mold unit is provided on the rotating mold disc, and a mold hole of the at least one mold unit is in communication with a through hole of the rotating mold disc; and
a stationary mold disc, co-axially stacked with the rotating mold disc and having an opening, wherein when the at least one mold unit is located at the ice-removing station, an orthographic projection of the mold hole of the at least one mold unit on the stationary mold disc falls into the opening.

[0007] In some embodiments, the at least one mold unit includes three mold units, wherein the three mold units are uniformly provided around a circumferential direction on the rotating mold disc, and the three mold units are configured to be located at the filling station, the ice-pressing station, and the ice-removing station, respectively.

[0008] In some embodiments, the ice-pressing pusher is disposed in parallel with and rigidly connected to the ice-removing pusher, and an end portion of the ice-removing pusher proximate to the ice-pressing mold is closer to the ice-pressing mold than an end portion of the ice-pressing pusher proximate to the ice-pressing mold.

[0009] In some embodiments, the ice making apparatus further includes:
an ice chip collector, corresponding to the filling station, and configured to collect ice chips made by the ice chip preparing assembly and to transfer the ice chips to the mold unit at the filling station, wherein a valve configured to switch between on and off states is arranged at the bottom of the ice chip collector.

[0010] In some embodiments, the ice making apparatus further includes:
an electrical control member, configured to control the on and off states of the valve and to control pushing and retracting of the ice-pressing pusher and the ice-removing pusher.

[0011] In some embodiments, the ice-pressing assembly further includes:
an ice scraping member, provided between the filling station and the ice-pressing station, and configured to remove excess ice chips from the top of the mold unit after passing through the filling station.

[0012] In some embodiments, the ice-pressing assembly further includes:

a recycling box, provided at a side of the ice-pressing mold distal from the ice-pressing pusher and the ice-removing pusher, and configured to recycle ice chips as dislodged during operation of the ice-pressing assembly.

[0013] In some embodiments, the ice-pressing pusher has an adjustable push stroke.

[0014] In some embodiments, a pushing force as exerted by the ice-pressing pusher and its pressure holding time are adjustable.

[0015] In some embodiments, the ice chip preparing assembly includes:

> a water dipping tray, configured to hold the feedstock water;
> an ice making roller, located above the water dipping tray and configured to rotate about an axis thereof, wherein a portion of the ice making roller proximate to the water dipping tray is configured to contact the feedstock water in the water dipping tray, and the ice making roller is internally energized with a refrigerant to form an ice layer on a rotating surface of the ice making roller during rotation of the ice making roller; and
> a scraper, provided at a side of the ice making roller, and configured to scrape ice chips from the rotating surface of the ice making roller.

[0016] In some embodiments, the ice chip preparing assembly further includes:
a feedstock water tank, configured to provide the feedstock water into the water dipping tray.

[0017] In some embodiments, the feedstock water tank provides feedstock water to the water dipping tray via a water pipe, and the water dipping tray is provided with a float valve; and
when the feedstock water in the water dipping tray is below a predetermined level, the float valve causes the water pipe to be enabled to replenish the water dipping tray with feedstock water; and when the feedstock water in the water dipping tray reaches a target water level, the float valve causes the water pipe to shut off.

[0018] Compared with the related art, the solutions according to the embodiments of the present disclosure may have at least the following advantageous effect.

[0019] An independent ice chip preparing assembly is provided to solve the problem of an ice making apparatus in the related art having a slow rate of ice chip production per unit time. The ice chips can be made into ice cubes by pushing and pressing means through the cooperation between the ice-pressing pusher and the mold unit in the ice-pressing mold, thereby improving the ice production rate of the nugget ice.

[0020] By scraping the excess ice chips from the top of the mold unit, the ice chips as filled in each mold unit are of substantially the equal mass, so that each ice cube has uniform mass. By shaping the mold units, the uniform shape of the nugget ice can be ensured.

[0021] A recycling box is provided to recycle ice chips dropped during the ice making process, so as to achieve recycling and reuse of the ice chips. In addition, the ice chips as collected in the recycling box may absorb heat, which can create a low-temperature environment around the ice-pressing assembly, thereby reducing a melting probability during the ice-pressing process.

[0022] The dimensions of the nugget ice can be adjusted by adjusting the push stroke of the ice-pressing pusher, and the texture or hardness of the nugget ice can be adjusted by adjusting a pushing force exerted by the ice-pressing pusher and the pressure holding time, so as to satisfy different eating habits of users.

[0023] The ice chips produced by the ice chip preparing assembly are directly transported to the ice-pressing assembly, which shortens an ice chip transfer path, reduces a melting rate of the ice chips, and thereby improves a utilization rate of the ice chips.

BRIEF DESCRIPTION OF DRAWINGS

[0024] The drawings herein are incorporated in and constitute a part of the specification. They show the embodiments consistent with the present disclosure and are used in conjunction with the specification to explain the principles of the present disclosure. Apparently, the accompanying drawings in the following description show merely some embodiments of the present disclosure, and a person of ordinary skill in the art may still derive other accompanying drawings from these accompanying drawings without creative efforts. In the accompanying drawings:

> FIG. 1 is a schematic structural diagram of an ice making apparatus according to some embodiments of the present disclosure;
> FIG. 2 is a schematic structural diagram of an ice making apparatus according to some embodiments of the present disclosure from another perspective; and
> FIG. 3 is a schematic structural diagram of an ice-pressing assembly according to some embodiments of the present disclosure.

DETAILED DESCRIPTION

[0025] To make the objectives, technical solutions and advantages of the present disclosure clearer, the present disclosure will be further described in detail below with reference to the accompanying drawings. It is obvious that the described embodiments are only some, but not all of the embodiments of the present disclosure. All other embodiments obtained by those of ordinary skill in the art without creative efforts based on the embodiments in the present disclosure are within the protection scope of the present disclosure.

[0026] It is also to be noted that, the terms "including", "containing", or any other variants are intended to cover the nonexclusive inclusion, such that a commodity or device including a series of elements includes not only those elements, but also other elements not listed explicitly or elements inherent to such a commodity or device. Without more limitations, the element defined by the phrase "including a ..." does not exclude the existence of other same elements in the commodity or device including the element.

[0027] In related art, commercial ice makers are too large to be used for home use, and most of them need to use water cooling to dissipate heat generated during the ice making process. A bullet ice maker or nugget ice maker has a low ice production per unit time and also has a slow speed. Specifically, the low production of the bullet ice maker is caused by the limited number of ice molds, and the low production of nugget ice makers is caused by a limited water cooling manner (e.g., a space between a screw and a sleeve is used to create ice chips). In addition, the dimension and/or hardness of the ice cubes produced by the related ice maker is generally not adjustable according to user's needs.

[0028] In order to overcome the defects of the related art, the present disclosure provides an ice making apparatus. The ice making apparatus includes: an ice chip preparing assembly, configured to make ice chips from feedstock water; and an ice-pressing assembly, configured to receive the ice chips and make the ice chips into ice cubes. The ice-pressing assembly includes an ice-pressing mold, having at least one mold unit, wherein the at least one mold unit is configured to sequentially switch among a filling station, an ice-pressing station, and an ice-removing station in a cyclic manner; an ice-pressing pusher, corresponding to the ice-pressing station, and configured to push and press the ice chips within the mold unit at the ice-pressing station to form ice cubes; and an ice-removing pusher, corresponding to the ice-removing station, and configured to push the ice cubes in the mold unit at the ice-removing station out of the mold unit. By providing an independent ice chip preparing assembly, a preparation rate of an ice chip raw material per unit time can be increased. Further, under the cooperation between the ice-pressing pusher and the mold unit in the ice-pressing mold, the ice chips are made into ice cubes by pushing and pressing means, so as to increase an ice production rate of nugget ice. Unlike the related art in which ice chips are formed on the inner wall of the screw and sleeve of the screw ice maker, in some embodiments of the present disclosure, the ice chips are formed on the outer walls of components of the ice chip preparing assembly, which can make full use of the characteristics of the outer wall having a great surface to increase a contact area between a refrigeration surface and the feedstock water and increase the efficiency of heat exchange. Therefore, the preparation efficiency of the ice chips is significantly improved, and the problem of slow supply of raw materials for ice chips when making the nugget ice in the related art is finally solved. The specific embodiments are as follows.

[0029] Optional embodiments of the present disclosure are described in detail below with reference to the accompanying drawings.

[0030] FIG. 1 is a schematic structural diagram of an ice making apparatus according to some embodiments of the present disclosure; FIG. 2 is a schematic structural diagram of an ice making apparatus according to some embodiments of the present disclosure from another perspective; and FIG. 3 is a schematic structural diagram of an ice-pressing assembly according to some embodiments of the present disclosure.

[0031] As shown in FIGS. 1 to 3, some embodiments of the present disclosure provide an ice making apparatus 100, such as a molded ice making apparatus. The ice making apparatus 100 includes an ice chip preparing assembly 10 and an ice-pressing assembly 20. The ice chip preparing assembly 10 is configured to make ice chips from the feedstock water, and the ice-pressing assembly 20 is configured to make ice cubes from the ice chips. Specifically, the ice-pressing assembly 20 extrudes the ice chips into nugget ice, for example, by means of pressing.

[0032] As shown in FIGs. 1 to 3, the ice-pressing assembly 20 includes an ice-pressing mold 21, an ice-pressing pusher 22 and an ice-removing pusher 23. The ice-pressing mold 21 has at least one mold unit 211, and the number of mold units 211 may be 1 or more. Each mold unit 211 is configured to sequentially switch among a filling station A, an ice-pressing station B, and an ice-removing station C in a cyclic manner. The mold unit 211 is loaded with ice chips at the filling station A. At the ice-pressing station, the ice chips in the mold unit 211 are pressed into ice cubes. At the ice-removing station C, the ice cubes pressed into ice cubes in the mold unit 211 are dislodged from the mold unit 211. For each of the mold units 211, it passes through the filling station A, the ice-pressing station B, and the ice-removing station C in turn during the ice making process, and the cycle is repeated. The mold unit 211 sequentially passes through the filling station A, the ice-pressing station B, and the ice-removing station C in each cycle, completing the steps of loading ice chips, pressing them into ice cubes, and dislodging them from the ice cubes.

[0033] The ice-pressing pusher 22 corresponds to the ice-pressing station B, e.g. by applying a pushing force in a vertical direction. The ice-pressing pusher 22 is configured to push and press the ice chips within the mold unit 211 at the ice-pressing station B to form into ice cubes, i.e., nugget ice. For example, the ice-pressing pusher 22 may be moved in the vertical direction towards the ice-pressing mold 21 to push the ice chips within the mold unit 211 at the ice-pressing station B to press them into ice cubes. Upon completion of the ice-pressing operation, the ice-pressing pusher 22 may be moved in the vertical direction distal from the ice-pressing mold 21 to retract to a non-pushing position, and the mold unit 211, which has completed the ice-pressing operation, may be switched to the ice-removing station C for the ice-removing operation.

[0034] The ice-removing pusher 23 corresponds to the ice-removing station C, e.g. by applying a pushing force in a vertical direction; and the ice-removing pusher 23 is configured to push the ice cubes in the mold unit 211 at the ice-removing station C out of the mold unit 211 at the ice-removing station C. For example, the ice-removing pusher 23 may move in the vertical direction towards the ice-pressing mold 21 to push the ice within the mold unit 211 at the ice-removing station C to dislodge from the mold unit 211 at the ice-removing station C. Upon completion of the ice-removing operation, the ice-removing pusher 23 may be moved in the vertical direction distal from the ice-pressing mold 21 to retract to a non-pushing position, and the mold unit 211 that has completed the ice-removing operation may be switched to the filling station A for the ice chip filling operation to proceed to the next ice making cycle.

[0035] In some embodiments, as shown in FIGs. 1 to 3, the ice-pressing mold 21 includes a rotating mold disc 212 and a stationary mold disc 213.

[0036] The rotating mold disc 212 is configured to rotate about an axis thereof, and the axis extends, for example, in a vertical direction. The mold unit 211 is provided on the rotating mold disc 212, and is of an integral structure or a split structure with the rotating mold disc 212. When they are of an integral structure, the mold unit 211 has a mold hole 2111 passing through the rotating mold disc 212; and when they are of a split structure, the mold hole of the mold unit 211 is in communication with the through hole of the rotating mold disc 212. That is, in both of the above structures, the mold hole of the mold unit is in communication with the through hole of the rotating mold disc. The mold hole 2111 may, for example, be square, round, oval, and other shapes, which determine the shapes of the pressed ice cubes. Exemplarily, in the integral structure, the rotating mold disc 212 has an aperture (or through hole), and sidewalls of the mold unit 211 are provided adjacent to and around the aperture and extending outwardly from the rotating mold disc 212 in a direction substantially perpendicular to the rotating mold disc 212. Further, the hole surrounded by the sidewalls of the mold unit 211 forms the mold hole 2111 of the mold unit 211 together with the aperture of the rotating mold disc 212.

[0037] The stationary mold disc 213 is coaxially stacked with the rotating mold disc 212, is provided at a side of the rotating mold disc 212 distal from the ice-pressing pusher 22 and the ice-removing pusher 23 in a stationary manner, and is provided with an opening 2131. The opening 2131 passes through the stationary mold disc 213, which may be a penetration hole or a notch. The opening 2131 illustrated in FIG. 3 is shown as an example of a notch. The rotating mold disc 212 rotates about its axis relative to the stationary mold disc 213, such that the mold unit 211 on the rotating mold disc 212 can switch sequentially among the filling station A, the ice-pressing station B, and the ice-removing station C.

[0038] The opening 2131 corresponds to the ice-removing station C, which means that the opening 2131 is located at the ice-removing station C.

[0039] When the mold unit 211 is located at the ice-removing station C, an orthographic projection of the mold hole 2111 of the mold unit 211 on the stationary mold disc 213 falls into the opening 2131. The dimension of the opening 2131 may be slightly larger than the dimension of the mold hole 2111, such that when the ice-removing operation is performed at the ice-removing station C, the ice-removing pusher 23 can push the pressed ice cubes in the mold unit 211 out of the mold hole 2111 smoothly to avoid obstruction.

[0040] In some embodiments, as shown in FIGS. 1 to 3, an end portion of the ice-pressing pusher 22 proximate to the ice-pressing mold 21 has substantially the same shape and dimension as the mold hole 2111 of the mold unit 211, thereby allowing the ice-pressing pusher 22 to press the ice chips into ice cubes in the mold unit 211.

[0041] In some embodiments, as shown in FIGs. 1 to 3, the ice-pressing assembly 20 further includes a position limiting member 27, one end of which is socketed to the ice-removing pusher 23, and the other end of which is socketed to a guide column 28. The guide column 28 is slidable in a vertical direction, thereby controlling the movement of the ice-removing pusher 23 in the vertical direction and avoiding its movement direction deviating from the vertical direction.

[0042] In some embodiments, the ice-pressing assembly 20 further includes an ice outlet passage 24, which is coupled to the opening 2131 and configured to receive the ice cubes dislodged from the mold unit 211 and to direct the ice cubes to be output to the outside.

[0043] In some embodiments, as shown in FIG. 3, a region of the stationary mold disc 213 corresponding to the filling station A and the ice-pressing station B is of a solid structure. When the mold unit 211 is located at the filling station A or the ice-pressing station B, the stationary mold disc 213 may seal the mold hole 2111 of the mold unit 211 or seal the through hole of the rotating mold disc. As far as possible, leakage from the contact surface of the stationary mold disc 213 with the rotating mold disc is avoided when the mold unit 211 performs an ice chip filling operation at the filling station A or an ice-pressing operation at the ice-pressing station B.

[0044] In some embodiments, as shown in FIGs. 1 to 3, the number of mold units 211 is, for example, three, and the three mold units 211 are disposed uniformly around a circumferential direction of the rotating mold disc 212. The three mold units 211 are configured to be located at the filling station A, the ice-pressing station B, and the ice-removing station C, respectively. For example, when the first mold unit 211 is located at the refilling station A for performing the ice chip filling operation, the second mold unit 211 is located at the ice-pressing station B to perform the pressing operation for ice cubes, and the third mold unit 211 is located at the ice-removing station C to perform the ice-removing operation. When the corresponding operation of each of the three mold units 211 is completed, the rotating mold disc 212 is rotated, for example, counterclockwise by 120 degrees. As a result, the first mold unit 211 is switched to the ice-pressing station B to perform an ice cube pressing operation; the second mold unit 211 is switched to the ice-removing station C to perform the ice-removing operation; and the third mold unit 211 is switched to the filling station A to perform the ice chip filling operation. When the respective corresponding operation of each of the three mold units 211 is completed again, the rotating mold disc 212 is rotated again, e.g., counterclockwise by 120 degrees. As a result, the first mold unit 211 is switched to the ice-removing station C to perform the ice-removing operation; the second mold unit 211 is switched to the filling station A to perform the ice chip filling operation, and the third mold unit 211 is switched to the ice-pressing station B to perform the ice cube pressing operation. When the respective corresponding operation of each of the three mold units 211 is completed again, the rotating mold disc 212 is rotated again, for example, counterclockwise by 120 degrees. As a result, the first mold unit 211 is switched to the filling station A to perform the ice chip filling operation; the second mold unit 211 is switched to the ice-pressing station B to perform the ice cube pressing operation, and the third mold unit 211 is switched to the ice-removing station C to perform the ice-removing operation. With such cyclic operation, when the ice making apparatus works continuously, the actions of the three stations (i.e., filling ice chips, compressing ice cubes, and dislodging ice cubes) are carried out at the same time, such that the rotating mold disc 212 can produce three pieces of compressed ice cubes, i.e., nugget ice, for every one-week rotation, thereby improving the production efficiency.

[0045] In some embodiments, the ice-pressing pusher 22 and the ice-removing pusher 23 are disposed in parallel and rigidly connected as shown in FIGs. 1 to 3. When the ice-pressing pusher 22 and the ice-removing pusher 23 are in a retracted state, an end portion of the ice-removing pusher 23 proximate to the ice-pressing mold 21 is closer to the ice-pressing mold 21 compared to an end portion of the ice-pressing pusher 22 proximate to the ice-pressing mold 21. For example, the ice-pressing pusher 22 is removably and rigidly connected to the ice-removing pusher 23, both of which can be provided with a pushing force by the pushing member 25, may be simultaneously moved toward the ice-pressing mold 21 to apply the pushing force under the action of the pushing member 25, and may be simultaneously retracted to a non-pushing position under the action of the pushing member 25 to facilitate rotation of the rotating mold disc 212. The ice-pressing pusher 22 and the ice-removing pusher 23 are rigidly connected to achieve linkage, which can reduce the number of transmission mechanisms and reduce costs. In some embodiments, the push stroke of the ice-pressing pusher 22 and the push stroke of the ice-removing pusher 23 may be the same or different. In the solution shown in FIGs. 1 to 3, the ice-pressing pusher 22 and the ice-removing pusher 23 have the same push stroke. In this case, when the ice-pressing pusher 22 and the ice-removing pusher 23 are in the retracted state, an end portion of the ice-removing pusher 23 proximate to the ice-pressing mold 21 is closer to the ice-pressing mold 21 than the end portion of the ice-pressing pusher 22 proximate to the ice-pressing mold 21, which is conducive for the ice-removing pusher 23 to dislodge the ice cubes from the mold unit 211.

[0046] In other embodiments, the ice-pressing pusher 22 and the ice-removing pusher 23 may also be driven without linkage, and may for example be driven by separate driving devices.

[0047] In some embodiments, as shown in FIGs. 1 to 3, the rotating mold disc 212 is driven by the mold rotating motor 90 to rotate around its axis. For example, the mold rotating motor 90 drives the rotating mold disc 212 to rotate using a gear engagement manner.

[0048] In some embodiments, the ice making apparatus 100 further includes an ice chip collector 30, for example in the form of a funnel. The ice chip collector 30 corresponds to the filling station A and is configured to collect ice chips made by the ice chip preparing assembly 10 and transfer the ice chips to the mold unit 211 at the filling station A. A valve configured to switch between the on and off states is arranged at the bottom of the ice chip collector 30. The bottom of the ice chip collector 30 is aligned with the mold unit 211 at the filling station A. When the valve is turned on, the ice chips collected in the ice chip collector 30 are filled to the mold unit 211 at the filling station A to achieve the operation of filling ice chips.

[0049] In some embodiments, the ice making apparatus 100 further includes an electrical control member 40. The electrical control member 40 is configured to control the on and off states of the valve, and further control the movement of the pushing member 25, thereby controlling the pushing and retracting of the ice-pressing pusher 22 and the ice-removing pusher 23 in the vertical direction. With this design, the actions of the three stations (i.e., filling ice chips, compressing ice cubes, and dislodging ice cubes) of the filling station A, the ice-pressing station B, and the ice-removing station C can be performed simultaneously, which can improve the efficiency of ice production.

[0050] In some embodiments, the ice-pressing assembly 20 further **includes** an ice scraping member 26. The ice scraping member 26 is provided between the filling station A and the ice-pressing station B, and is configured to remove excess ice chips from the top of the mold unit 211 after passing through the filling station A. After the mold unit 211 is filled with ice chips at the filling station A, excess ice chips may protrude from the top surface of the mold unit 211. During the process of switching the mold unit 211 loaded with ice chips from the filling station A to the ice-pressing station B under rotation of the rotating mold disc 212, the ice scraping member 26, for example, may fit against the top surface of the mold unit 211 and remove the excess ice chips from the top of the mold unit 211, such that the amount of ice chips within the mold unit 211 switched to the ice-pressing station B remains stable, and thus the mass of ice cubes subsequently obtained by pushing and pressing the ice chips is substantially equal.

[0051] In some embodiments, the ice scraping member 26 may move up and down in a vertical direction, and descend to a predetermined height to scrape excess ice chips from the top of the mold unit 211 when only an ice scraping operation needs to be performed.

[0052] In some embodiments, the ice making apparatus 100 further includes a recycling box 50. The recycling box 50 is provided at a side of the ice-pressing mold 21 distal from the ice-pressing pusher 22 and the ice-removing pusher 23, and is configured to recycle ice chips as dislodged during the operation of the ice-pressing assembly 20, e.g., ice chips scraped by the scraping member 26, etc. The recycling box 50 also recycles feedstock water formed from the melting of ice chips or ice cubes during the manufacturing of ice cubes by the ice-pressing assembly 20.

[0053] The ice chips collected in the recycling box 50 may absorb the surrounding heat, such that the ice chip preparing assembly 10 and the ice-pressing assembly 20 are in a low-temperature environment, which further reduces a melting rate of the ice chips or ice cubes in the process of making the ice chips and forming the ice cubes by pressing the ice chips, thereby ensuring the quality of the nugget ice as obtained therefrom.

[0054] The feedstock water collected in the recycling box 50 may be pumped via a pipeline to a feedstock water tank described subsequently to realize the full utilization of the feedstock water.

[0055] In some embodiments, the push stroke of the ice-pressing pusher 22 is adjustable. At the ice-pressing station B, the ice-pressing pusher 22 compresses the ice chips within the mold unit 211 to be gradually harden into blocks. A compression ratio is determined by the texture of the ice cubes selected by the user and is related to the push stroke of the ice-pressing pusher 22, and different compression ratios can be obtained by adjusting different compression strokes of the ice-pressing pusher 22, which in turn obtains a fluffy or firm texture. In addition, the push stroke of the ice-pressing pusher 22 also determines the dimensions of the pressed ice cubes, and the push stroke of the ice-pressing pusher 22 can be adjusted to the dimensions of the pressed ice cubes.

[0056] In some embodiments, the pushing force as exerted by the ice-pressing pusher 22 and its pressure holding time are adjustable. In the process of adjusting the texture or hardness of the ice cubes, it is necessary to reasonably control an extruding force and pressure holding time of the ice-pressing pusher, such that the extruding force can be transferred from the extruding contact surface to the inside of the ice cubes, such that the density of the ice cubes as a whole is basically equal, thereby obtaining ice cubes of uniform texture. Exemplarily, the pressure holding time may indicate that the ice-pressing pusher 22 maintains a pressure on the ice chips for a certain length of time after running to a predetermined position when pushing the ice chips or indicate that the ice-pressing pusher 22 pushes the ice chips for a certain length of time at a constant pressure or range of pressures, and so on.

[0057] As can be seen from the above description, the uniform shape of the nugget ice can be ensured in the present disclosure by shaping the mold, which can overcome the problem of the related art in which the shape and dimension of the nugget ice are unstable since the location of fracture is uncontrollable for the nugget ice as formed from ice bars by means of extruding and fracturing.

[0058] In some embodiments, as shown in FIGs. 1 to 3, the ice chip preparing assembly 10 includes a water dipping tray 11, an ice making roller 12, and a scraper 13.

[0059] The water dipping tray 11, such as a box-shaped container with an open top surface, is configured to hold the feedstock water. The depth of the feedstock water in the water dipping tray 11 is maintained within a predetermined range to ensure that a portion of the ice making roller 12 proximate to the water dipping tray 11 is accessible to the feedstock water held in the water dipping tray.

[0060] The ice making roller 12 is located above the water dipping tray 11 and is configured to rotate along its axis, which extends, for example, in a horizontal direction, the horizontal direction being perpendicular to the vertical direction. A portion of the ice making roller 12 proximate to the water dipping tray 11 is configured to contact the feedstock water as held in the water dipping tray, and the ice making roller 12 is internally energized with a refrigerant to form an ice layer on a rotating surface 121 of the ice making roller 12 during rotation of the ice making roller 12.

[0061] The scraper 13 is provided at a side of the ice making roller 23, and configured to scrape ice chips from the rotating surface 121 of the ice making roller 12.

[0062] In the process of preparing ice chips utilizing the ice chip preparing assembly 10, the refrigerant is piped into an internal cavity of the ice making roller 12, such that the circumferential internal sidewalls of the ice making roller 12 are all in uniform contact with the refrigerant. For example, the ice making roller 12 may be made of metal, such as food-grade stainless steel, which not only ensures food safety, but also gives it good thermal conductivity. The temperatures of the circumferential sidewalls of the ice making roller 12, which is made of a metal material, are substantially the same during the execution of the ice chip preparing process. In this way, as the ice making roller 12 rotates, the water adhering to the rotating surface 121 of the ice making roller 12 may complete heat exchange with the refrigerant to form an ice layer on the circumferential sidewalls of the ice making roller 12, and the ice layer is gradually frozen during the rotation process to form a stable ice layer. Then, as the ice making roller 12 rotates, the scraper 13 scrapes ice chips from the ice layer on the rotating surface 121 of the ice making roller 12 to form snowflake-like fine ice chips.

[0063] Based on the above configuration, a uniform ice layer can be formed on the surface of the ice making roller quickly by rotating the ice making roller to dip the feedstock water and feeding refrigerant into the ice making roller. The contact area between the refrigerant and the feedstock water is large, which leads to high heat transfer efficiency, and thereby causes a greater ice making area and faster ice making speed than that of the screw ice maker in the related art. The use of a scraper to scrape ice chips from the ice layer on the rotating surface of the ice making roller allows a rapid formation of uniformly fine ice chips. In embodiments of the present disclosure, the characteristics of the outer wall of the ice making roller having a great surface are fully utilized to increase the contact area between the refrigeration surface and the feedstock water and improve the efficiency of heat exchange. Therefore, the preparation efficiency of the ice chips is significantly improved, and the problem of slow supply of raw materials for ice chips when making the nugget ice in the related art is finally solved.

[0064] In the present disclosure, the ice chip preparing assembly that has substantially higher production efficiency per unit time compared to the ice chip production efficiency of the nugget ice maker (or ice cube maker) in the related art, thereby improving the production efficiency of ice cubes per unit time and satisfying the user's need for large quantities of nugget ice or a short period of time.

[0065] The scraper 13 is disposed substantially above the ice chip collector 30, and ice chips scraped by the scraper 13 fall substantially into the ice chip collector 30 to be supplied to the ice-pressing assembly 20.

[0066] In some embodiments, as shown in FIGS. 1 to 3, both the scraper 13 and the ice chip collector 30 are disposed above the recycling box 50, and ice chips scraped by the scraper 13 that are not collected by the ice chip collector 30 may fall into the recycling box 50 for recycling.

[0067] In the ice making roller 12, the heat-exchanged refrigerant is transported via a pipeline to the heat exchanging member 60, such as a compressor, a condenser, etc., to turn back into a low-temperature medium after the heat exchange, and is then circularly transported to the ice making roller 12 again. The heat as exchanged is diffused to the outside environment via the heat dissipating member 70. The heat dissipating member 70 includes, for example, structures such as heat dissipation fins, heat pipes, and/or fans.

[0068] In some embodiments, the ice making roller 12 may be driven by a roller motor 80, and a gear portion 81 of the roller motor 80 is connected, for example, via a chain to a gear portion 122 of the ice making roller 12, thereby driving the ice making roller to rotate via the roller motor 80.

[0069] In some embodiments, the ice chip preparing assembly 10 further includes a feedstock water tank 14, and the feedstock water tank 14 is located, for example, above the ice making roller 12, and is configured to provide the feedstock water into the water dipping tray 11.

[0070] In some embodiments, the feedstock water tank 14 provides the feedstock water to the water dipping tray 11 via a water pipe 141. The water dipping tray 11 is provided with a float valve. When the feedstock water in the water dipping tray 11 is below a predetermined water level, the float valve causes the water pipe 141 to be enabled to replenish the water dipping tray 11 with the feedstock water; and when the feedstock water in the water dipping tray 11 reaches a target water level, the float valve causes the water pipe 141 to shut off. The predetermined water level is less than or equal to the target water level. That is, by providing the float valve, the water is automatically fed into the water dipping tray 11 when the liquid level is low, and water feeding is automatically stopped when the liquid level is high, such that the water level in the water dipping tray 11 is maintained at a certain height to satisfy the water dipping demand of the ice making roller 12 when it is rotating. The control of the above water level is realized via a mechanical structure, which avoids the safety problem and the problem of waterproof sealing of circuits caused by the circuit control, and reduces the production cost.

[0071] The following specifically explains a working principle of the ice making apparatus according to some embodiments of the present disclosure, which includes an ice chip preparing process and an ice cube preparing process.

[0072] In the process of preparing ice chips, the feedstock water required for making ice is stored in the feedstock water tank 14 via a filling port at the top of the apparatus. The lower portion of the feedstock water tank 14 extends into the water dipping tray 11 via the water pipe 141 of the feedstock water tank, and the lower portion of the water pipe 141 is connected with a float valve which can automatically feed water into the water dipping tray 11 when the level of the water dipping tray 11 is low and automatically stop the feeding of water when the level of the water dipping tray 11 is high, such that the water level in the water dipping tray 11 is maintained at a certain height, and meets the dipping water demand of the rotating surface 121 of the ice making roller when it is working.

[0073] When the ice making roller 12 is rotating, the refrigerant is fed into the internal cavity of the ice making roller 12 via a pipeline, such that the circumferential inner sidewalls of the ice making roller 12 are all in contact with the refrigerant. The temperatures of the circumferential walls of the ice making roller 12 are basically the same, and the water adhering to the ice making roller 12 completes heat exchange with the refrigerant and forms an ice layer on the circumferential outer wall, i.e., the rotating surface 121, of the ice making roller 12. The roller motor 80 drives the ice making roller 12 to rotate, and the ice layer is gradually frozen and forms a stable ice layer during the rotation process. Then, the stable ice layer is scraped at the scraper 13 during the rotation process of the ice making roller 12 to form snowflake-like fine ice chips.

[0074] During the ice cube preparing process, the ice chips scraped at the scraper 13 are collected into the ice chip collector 30, and a top opening of the ice chip collector 30 is used to collect the scraped ice chips. A valve that is electrically connected to the electrical control member 40 is arranged at the bottom of the ice chip collector 30. When the bottom opening of the ice chip collector 30 is aligned with the mold unit 211 at the filling station A on the ice-pressing mold 21, the valve is turned on, and the ice chips may slide down into the mold unit 211 under gravity. Driven by the mold rotating motor 90, the rotating mold disc 212 switches among the three stations in one rotational step of 120° counterclockwise. When the ice chips are filled to meet a certain time, the rotating mold disc 212 is controlled to rotate 120 degrees, such that another mold unit 211 switched to the filling station A continues to receive the ice chips. Then, the mold unit 211 that has just been filled with ice chips is switched to the ice-pressing station B. During the above switching process, the excess ice chips on the mold unit 211 that has just been filled with ice chips are scraped off by the ice scraping member 26, such that the amount of ice chips as fed remains stable. At the ice-pressing station B, the electrical control member 40 controls the ice-pressing pusher 22 to start downward pushing, compressing the ice chips of the mold unit 211 to gradually harden into ice cubes.

[0075] After the ice cubes are pressed, the ice-pressing pusher 22 is controlled to be retracted, and the rotating mold disc 212 is controlled to be rotated, such that the mold unit 211 carrying the pressed ice cubes is switched to the ice-removing station C. At the ice-removing station C, the ice-removing pusher 23 is pushed downwardly, such that the ice cubes made in the mold unit 211 are supplied to the user via an ice outlet passage 24.

[0076] In the present disclosure, a mode of making the ice chips by dipping water with the roller and s multi-station pushing mode are combined, which can improve the ice making efficiency of the ice chips and the ice making efficiency of the ice cubes. Specifically, the characteristics of the outer wall of the ice making roller having a great surface are fully utilized to increase the contact area between the refrigeration surface and the feedstock water, improve the heat exchange efficiency, and thereby significantly improve the efficiency of the preparation of the ice chips. Moreover, the actions of the three stations (i.e., filling ice chips, compressing ice cubes, and dislodging ice cubes) in the multi-station pushing mode are carried out at the same time, such that three compressed ice cubes can be produced for every week of rotation of the rotating mold disc, thereby improving the production efficiency.

[0077] Finally, it should be noted that various embodiments in the Description are described in a progressive manner, each embodiment focuses on the differences from other embodiments, and the same or similar parts among the various embodiments may refer to one another. Since the system or device disclosed in the embodiment corresponds to the method disclosed in the embodiment, the description is relatively simple, and the relevant parts may refer to the description of the method part.

[0078] The above embodiments are only configured to illustrate the technical solutions of the present disclosure and are not intended to limit the present disclosure. Although the present disclosure has been described in detail with reference to the foregoing embodiments, those of ordinary skills in the art should understand that, they can still make modifications to the technical solutions described in the foregoing embodiments or make equivalent substitutions to some of the technical features; and these modifications or substitutions do not make the essence of the corresponding technical solutions deviate from the spirit and scope of the technical solutions of the various embodiments of the present disclosure.

Claims

1. An ice making apparatus, comprising:

    an ice chip preparing assembly, configured to make ice chips from feedstock water; and
    an ice-pressing assembly, configured to receive the ice chips and make the ice chips into ice cubes, and comprising:

        an ice-pressing mold, having at least one mold unit, wherein the at least one mold unit is configured to sequentially switch among a filling station, an ice-pressing station, and an ice-removing station in a cyclic manner;
        an ice-pressing pusher, corresponding to the ice-pressing station, and configured to push and press the ice chips within the mold unit at the ice-pressing station to form into ice cubes; and
        an ice-removing pusher, corresponding to the ice-removing station, and configured to push the ice cubes in the mold unit at the ice-removing station out of the mold unit at the ice-removing station.

2. The ice making apparatus according to claim **1**, wherein the ice-pressing mold comprises:

    a rotating mold disc, configured to rotate about an axis thereof, wherein the at least one mold unit is provided on the rotating mold disc, and a mold hole of the at least one mold unit is in communication with a through hole of the rotating mold disc; and a stationary mold disc, co-axially stacked with the rotating mold disc and having an opening, wherein

when the at least one mold unit is located at the ice-removing station, an orthographic projection of the mold hole of the at least one mold unit on the stationary mold disc falls into the opening.

3. The ice making apparatus according to claim 2, wherein the at least one mold unit comprises three mold units, wherein the three mold units are uniformly provided around a circumferential direction on the rotating mold disc, and the three mold units are configured to be located at the filling station, the ice-pressing station, and the ice-removing station, respectively.

4. The ice making apparatus according to any one of claims 1 to 3, wherein the ice-pressing pusher is disposed in parallel with and rigidly connected to the ice-removing pusher, and an end portion of the ice-removing pusher proximate to the ice-pressing mold is closer to the ice-pressing mold than an end portion of the ice-pressing pusher proximate to the ice-pressing mold.

5. The ice making apparatus according to any one of claims 1 to 3, further comprising:
an ice chip collector, corresponding to the filling station, and configured to collect ice chips made by the ice chip preparing assembly and to transfer the ice chips to the mold unit located at the filling station, wherein a valve configured to switch between on and off states is arranged at a bottom of the ice chip collector.

6. The ice making apparatus according to claim 5, further comprising:
an electrical control member, configured to control the on and off states of the valve and to control pushing and retracting of the ice-pressing pusher and the ice-removing pusher.

7. The ice making apparatus according to any one of claims 1 to 3, wherein the ice-pressing assembly further comprises:
an ice scraping member, provided between the filling station and the ice-pressing station, and configured to remove excess ice chips from a top of the mold unit after passing through the filling station.

8. The ice making apparatus according to any one of claims 1 to 3, wherein the ice-pressing assembly further comprises:
a recycling box, provided at a side of the ice-pressing mold distal from the ice-pressing pusher and the ice-removing pusher, and configured to recycle ice chips as dislodged during operation of the ice-pressing assembly.

9. The ice making apparatus according to any one of claims 1 to 3, wherein the ice-pressing pusher has an adjustable push stroke.

10. The ice making apparatus according to any one of claims 1 to 3, wherein a pushing force as exerted by the ice-pressing pusher and its pressure holding time are adjustable.

11. The ice making apparatus according to any one of claims 1 to 3, wherein the ice chip preparing assembly comprises:

a water dipping tray, configured to receive the feedstock water;

an ice making roller, located above the water dipping tray and configured to rotate about an axis thereof, wherein a portion of the ice making roller proximate to the water dipping tray is configured to contact the feedstock water received in the water dipping tray, and the ice making roller is internally introduced with a refrigerant to form an ice layer on a rotating surface of the ice making roller during rotation of the ice making roller; and

a scraper, provided at a side of the ice making roller, and configured to scrape ice chips from the rotating surface of the ice making roller.

12. The ice making apparatus according to claim **11,** wherein the ice chip preparing assembly further comprises:
a feedstock water tank, configured to provide the feedstock water into the water dipping tray.

13. The ice making apparatus according to claim 12, wherein the feedstock water tank provides the feedstock water to the water dipping tray via a water pipe, and the water dipping tray is provided with a float valve; and
when the feedstock water in the water dipping tray is below a predetermined water level, the float valve causes the water pipe to be enabled to replenish the water dipping tray with the feedstock water; and when the feedstock water in the water dipping tray reaches a target water level, the float valve causes the water pipe to shut off.

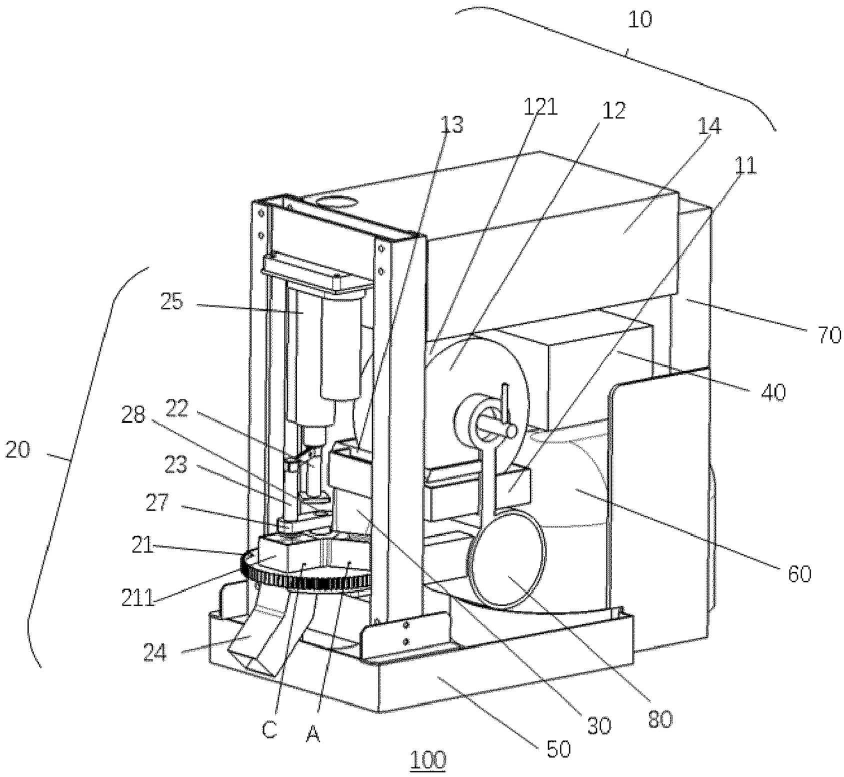

FIG. 1

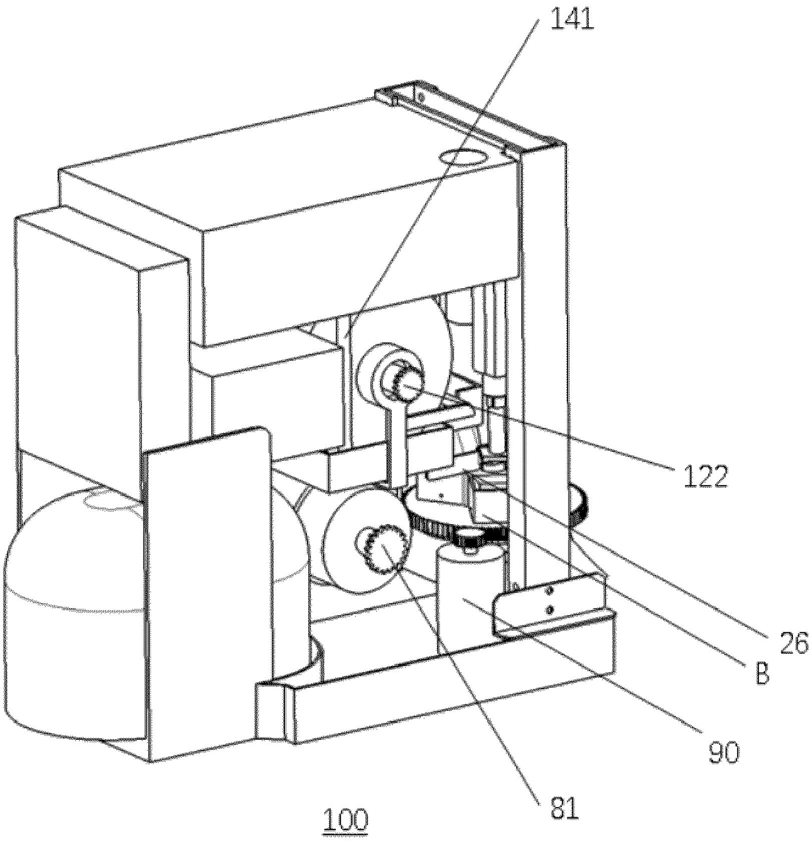

FIG. 2

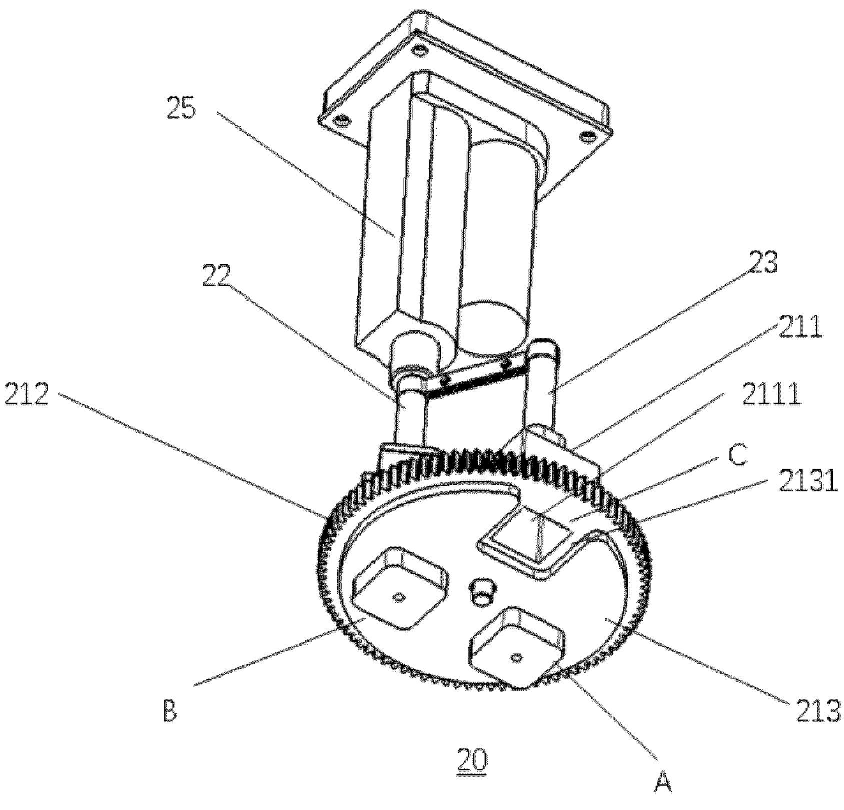

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/121036

A. CLASSIFICATION OF SUBJECT MATTER

F25C 1/14(2018.01)i

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)

F25C1/14; F25C1/00; F25C5/14; F25C5/00

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)

CNABS, CNTXT, CNKI, VEN: 制冰, 冰屑, 挤压, 模具, 压冰, 推杆, 脱冰, 旋转, 模具盘, 刮刀; ICE, MAKING, CHIP, SCREW, FLAKE, NEEDLE, MOLD, MOULD, COMPRESS, STAMP, DIAL, SLEWING, SWIVEL, TURN+, PLATE, TABLE, SCRAP

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 104930777 A (JIANGSU FOCUSUN REFRIGERATION CO., LTD.) 23 September 2015 (2015-09-23) description, page 2, and figures 1-2	1, 4-10
Y	CN 101455246 A (LING DONGYE) 17 June 2009 (2009-06-17) description, pages 2 and 3, and figures 1-10	1, 4-10
A	CN 202623202 U (CIXI JINGCHENG MOULD CO., LTD.) 26 December 2012 (2012-12-26) entire document	1-13
A	CN 105765323 A (PEPSICO INC.) 13 July 2016 (2016-07-13) entire document	1-13
A	CN 1934398 A (FOLLETT CORP.) 21 March 2007 (2007-03-21) entire document	1-13
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A	CN 111829243 A (CHONGQING VOCATIONAL & TECHNICAL UNIV OF MECHATRONICS) 27 October 2020 (2020-10-27) entire document	1-13

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"P" document published prior to the international filing date but later than the priority date claimed
"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
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 December 2022	**20 December 2022**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China**	
Facsimile No. **(86-10)62019451**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/121036

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A	CN 201272036 Y (HANGZHOU WANDA HYDRAULIC MACHINERY CO., LTD.) 15 July 2009 (2009-07-15) entire document	1-13

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/121036

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CN	101455246	A	17 June 2009	None			
CN	202623202	U	26 December 2012	None			
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CN	201272036	Y	15 July 2009	None			

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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