Oct. 4, 1966 H. L. LUNDE 3,276,223

ICE NUGGET PRODUCING MACHINES

Filed June 8, 1965

Fig. 1

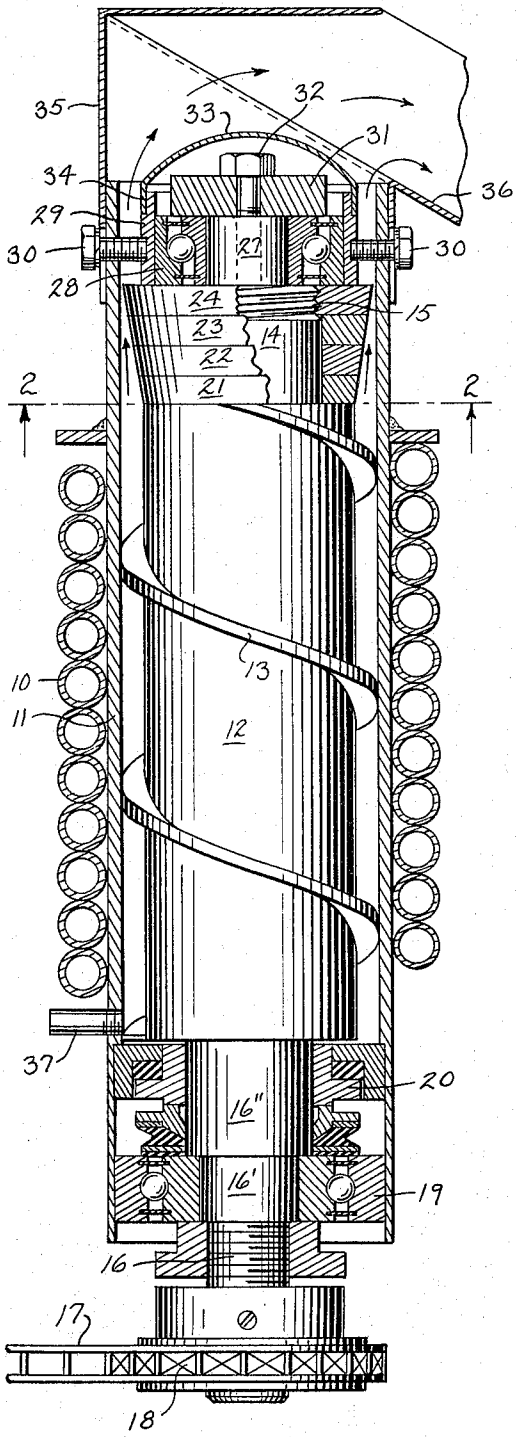


Fig. 2

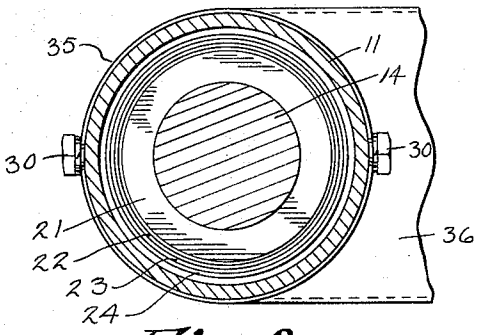


Fig. 3

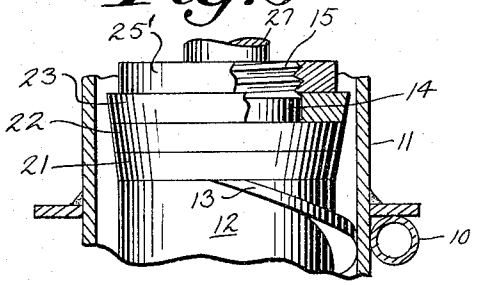


Fig. 4

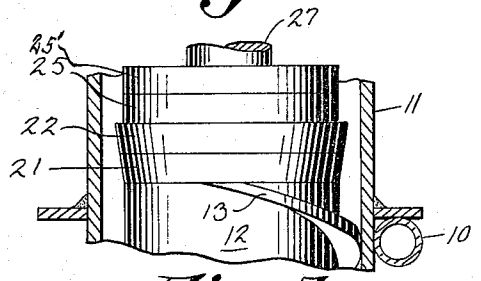
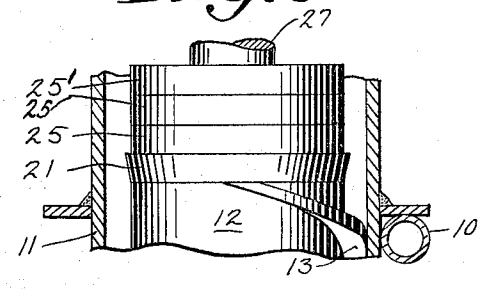


Fig. 5



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ICE NUGGET PRODUCING MACHINES

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This invention relates to improvements in ice nugget producing machines.

Machines for producing ice flakes, chips, or slush ice are available, and in such machines there is an upright vertical cylindrical ice freezing chamber within which is mounted a rotatable auger which works in closely spaced relation to the internal wall of the cylindrical freezing chamber to remove frozen masses from the chamber wall and to carry the same to the upper end portion of the cylinder. In the conventional machines the augers customarily have associated therewith certain devices to compress and crush the advanced ice mass and eliminate excess water therefrom so that the ice in the form of flakes or chips is discharged for ultimate use through a convenient opening in the upper end portion of the cylindrical freezing chamber.

While the conventional ice flake or chip producing machines are satisfactory for their intended purposes, ice in the form of slush, flakes, or chips is not suitable for all commercial usages. In many instances, it is preferred to produce ice units in the form of hard compressed nuggets of substantial size from which the excess water has been squeezed. Therefore, it is a general object of the present invention to provide an ice nugget producing machine in which slushy masses of ice are progressively conveyed by a bladed auger toward the upper end portion of the freezing cylinder chamber in which the auger operates, together with adjustable upwardly outwardly flared means carried by the upper end portion of the auger which progressively restrict the annular space adjacent the upper inner wall portion of the cylindrical chamber, to thereby effectively compress the slush ice into hard nuggets of ice of a substantial size prior to discharge of the latter through the open outer end of the ice freezing chamber cylinder.

A further object of the invention is to provide, in an ice nugget producing machine of the character described which includes a bladed auger, a frusto-conical member carried by the upper end portion of the auger to compress the ice into hard nuggets prior to discharge of the latter.

A further object of the invention is to provide, in an ice nugget producing machine of the character described, a frusto-conical ice compressing and nugget forming device on the upper end portion of the auger, which frusto-conical member is formed of a variable number of superimposed rings or discs of progressively increasing diameter, one or more of which are readily removable to regulate the height of the working surface of the frusto-conical device, whereby the density and size of the ice nuggets produced by and delivered from the machine are regulatable.

A further object of the invention is to provide in an ice nugget producing machine of the character described having a freezing cylinder chamber with an auger operating therein and an adjustable frusto-conical compressing device associated with the upper end portion of the auger, removable means associated with the upper end portion of the freezing cylinder to afford access to the internal mechanism, including the frusto-conical member.

A further object of the invention is to provide an ice nugget producing machine which is of very simple construction, which is automatic and efficient in operation, which is of compact size, which is strong and durable, and which is well adapted for the purposes described.

With the above and other objects in view, the invention consists of the improved ice nugget producing machine, and its parts and combinations as set forth in the claims, and all equivalents thereof.

In the accompanying drawing, in which the same reference characters indicate the same parts in all of the views:

FIG. 1 is a vertical sectional view through the freezing cylinder or chamber portion of an ice nugget producing machine embodying the features of the present invention;

FIG. 2 is a transverse sectional view taken approximately on the lines 2—2 of FIG. 1;

FIG. 3 is a fragmentary vertical sectional view of the upper end portion of the freezing cylinder showing mounted on the upper end portion of the auger (and secured by a nut) an inverted frusto-conical ice compressing and nugget forming device formed of three superimposed discs or rings of progressively increasing diameter held in place by a superimposed threaded washer;

FIG. 4 is a similar fragmentary detail sectional view wherein several of the discs or rings have been removed and replaced by washers to limit the nugget forming and ice compressing device to a pair of superimposed rings; and

FIG. 5 is a similar fragmentary detail sectional view wherein all of the ice compressing and pellet forming discs or rings have been eliminated and replaced by washers except one.

The present improvements which relate primarily to the cylindrical freezing chamber with its auger therein and an ice compacting device carried by the upper end of the auger, are designed to be housed within a casing (not shown), and an entire assemblage would also include within the casing an ice producing apparatus (not shown), all of which is conventional in the art.

Referring now more particularly to the drawing, it will appear that the numeral **10** designates an expansion coil portion of an ice producing apparatus, which coil may surround the major portion of an elongated hollow cylinder **11** with the result that there is formed within the cylinder **11** a freezing chamber or column which is preferably disposed in an upstanding position.

An auger, generally indicated by the numeral **12**, extends from the lower end portion of the cylinder **11** toward the upper end portion. The outer surface of the major enlarged portion of the auger is formed with a spirally-trending auger blade **13** of a desired, substantial pitch, which auger blade terminates adjacent the upper end portion of the enlarged part of the auger. The auger, immediately beyond the upper end of its major enlarged portion, has a reduced shaft portion **14** which is unthreaded, but thereabove, as a continuation of said shaft portion, is an externally threaded stub portion **15**. The auger **12**, with its uniform pitch spiral blade **13** is of a diameter slightly smaller than the inside diameter of the cylinder or chamber **11** to provide a very slight space between the outer peripheral edge of the auger blade **13** and the inside wall of the cylinder **11** in order to remove ice layers from the inside wall surface of said cylinder without direct contact between the edge portions of the auger blade and the cylinder wall.

The auger **12** is power-driven by any suitable means such as an electric motor (not shown), which is connected to chain **17** which drives a sprocket **18** secured onto the auger shaft portion **16**. Certain reduced portions **16'** and **16''** between the major enlarged extent of the auger and the auger shaft portion **16** are mounted within a bearing **19** and a water seal **20**, respectively.

As was previously observed, the auger **12**, beyond the upper end of its major enlarged portion, is formed with

a reduced shaft portion 14 whose outer surface is smooth and which portion is of a length to have mounted thereon in superimposed relation a plurality of discs or rings 21, 22 and 23 (according to FIG. 1). Also, in this arrangement an additional top ring 24 is internally threaded to engage the threaded portion 15 of the auger shaft and serve as a securing nut for the stack of rings. All of said rings 21–24, inclusive, are of progressively upwardly slightly enlarged diameters and their outer surfaces are upwardly outwardly inclined, with the result that a stack of said discs or rings forms an inverted frustum of a cone to progressively outwardly restrict or limit the annular space within the cylinder 11 between the inner wall of the same and said stack of washerlike discs. As shown in FIG. 1, four of such discs are utilized in superimposed relation to form a frusto-conical ice compressing and fragmenting device of a desired height, but, within the contemplation of the present invention, any desired number of such washerlike discs may be utilized to create a frusto-conical ice compacting and fragmenting device of different heights. In FIG. 3 there is disclosed the elimination of the uppermost disc 24 so that the frusto-conical device is in this event composed of three rings, i.e. Nos. 21, 22 and 23, but the uppermost ring is replaced by a threaded washer or nut 25'. In FIG. 4 only two of said discs or rings are utilized with a threaded washer 25' and an interposed washer 25, and in FIG. 5 there is disclosed the extreme condition wherein but a single ring 21 is utilized with two filler washers 25 and the top securing washer 25'. In any stacked condition of the rings on the shaft portion 14 or 14 and 15, the smallest external diameter of the lowermost ring 21 corresponds to the outside diameter of the enlarged portion of the auger 12 and the rings superimposed thereabove flare outwardly gradually.

Inasmuch as the ice scraped from the interior surface of the cylinder 11 is advanced upwardly along the auger by the spiral blade 13, when masses of slush ice reach the upper enlarged end of the auger they are compacted and formed into nuggets by passage through the progressively decreasing space between the annular external surface of the frusto-conical device formed by the various washerlike rings and the adjacent inner wall portion of the freezing cylinder 11. This action on the ice mass prior to its reaching the discharge end of the chamber or column will serve to squeeze excess water from the ice. The degree of compression and the size of the resulting nuggets is, of course, controlled by the height of the frusto-conical compacting device formed of the various discs 21–24 which, in turn, is dependent upon the number of discs utilized in the assemblage at a given time.

The auger shaft, above the threaded portion 15, is further reduced in diameter as at 27 and is journaled within a bearing 28 secured to a ring 29 whose external diameter corresponds to that of the cylindrical nut 26 therebelow. A plurality of spaced-apart clamping bolts 30 threaded through upper wall portions of the cylinder 11 extend into the bearing anchoring ring 29. Above the bearing ring 29 there is a washer or disc 31 having a central opening therein to receive a securing bolt 32 which extends through the mid portion of the shaft portion 28 and is threaded into the portion 15 of the auger shaft. The washer 31 and its mounting bolt 32 are covered by a domed cap 33 whose lower marginal portion has a force fit within an annular groove 34 provided therefor in the upper margin of the securing ring 29. Thus, by removing the cap 33 and the securing bolt 32, the washer 31 may be removed, and by releasing the bolts 30, the bearing 28 and its ring 29 may be removed from the reduced portion 27 of the auger shaft. With this accomplished the cylindrical nut 26 may be unthreaded from the auger shaft portion 15 whereby direct access to the various discs 21–24 is afforded in order that the number of such discs in the superimposed stack to form the frusto-conical device may be readily varied. When the various parts associated with the upper end portion of the assemblage are replaced and the top threaded ring 24, or a threaded filler washer 25' is turned down tightly into the superimposed discs or against a spacing washer 25, should one or more of the discs be removed, the superimposed stack of such discs will be clamped tightly onto the reduced portion 14 of the auger so as to turn therewith.

Regardless of the number of discs 21–24 utilized in the inverted frusto-conical stack, there is nevertheless a progressively restricted annular space adjacent the inner wall portion of the freezing cylinder 11 through which the formed ice elements advance. As compacted and formed by the frusto-conical device the compressed ice elements are relatively dense and devoid of an undue water content and are in the form of nuggets whose size may be regulatable. When the auger is turning, the formed nuggets are advanced out of the upper end of the cylinder or chamber in the path represented by the arrows in FIG. 1. The open upper end of the cylinder 11 has telescopically mounted thereon a removable housing 35 which is held in place by the bolts 30 and which forms an enclosed chamber over the open discharge end of the cylinder 11. One side of the housing 35 has extending outwardly downwardly therefrom an inclined chute 36 whereby the discharged ice nuggets may slide downwardly along said chute into a reservoir or collection receptacle.

As is common in the art, means in the form of a pipe or conduit 37 connected with a source of water supply (not shown) is provided for maintaining a suitable level of water within the cylinder 11. With water delivered into the cylinder 11, and with the expansion coil system 10 functioning, ice will be formed on the inner surface of the cylinder 11. When the auger is power driven at a suitable speed it will scrape ice from the interior wall of the cylinder and the spiral blade 13 of the auger will advance the removed ice toward the top of the enlarged portion of the auger where the ice will be effectively compressed and formed into dense nuggets by the frusto-conical device formed of the superimposed outwardly flaring discs 21–24. These nuggets of ice of a desired size and from which water has been squeezed are then advanced upwardly in the cylinder chamber 11 and are discharged into the housing 35 from whence the ice nuggets gravitate along the chute 36 to a suitable collection station.

The improved ice nugget producing machine is automatic and efficient in operation, its ice compacting and nugget forming device is variable, and the machine is furthermore strong and durable and well adapted for the purposes described.

What is claimed as the invention is:

1. In an ice nugget producing machine including an upright freezing cylinder having a discharge opening in its upper end portion and an ice scraping and advancing auger rotatably mounted within said freezing cylinder and of uniform diameter throughout a variable height, inverted frusto-conical ice compressing and fragmenting device rigidly carried by an upper portion of the auger with all outer surfaces of said device forming its compression surface and being within and spaced from the adjacent inner wall portions of the freezing cylinder to form an upwardly progressively restricted ice passage, the smallest external diameter of said frusto-conical ice compressing and fragmenting device corresponding to the outside diameter of the auger body.

2. In an ice nugget producing machine which includes a freezing cylinder having a discharge opening in its outer end and an auger rotatably mounted within said freezing cylinder to scrape ice from the inner wall portions of the cylinder and advance the same, means rigidly secured to the auger to rotate therewith entirely within the outer end portion of the cylinder, said means being in the form of an inverted section of a cone whose outer surface is in the path of the ice mass advanced by the auger and including

a plurality of independent superimposed removable sections to compress and regulate the size of the ice nuggets to be expelled from the freezing cylinder, the smallest external diameter of said inverted section of a cone corresponding to the outside diameter of the auger body.

3. In an ice nugget producing machine which includes an upright freezing cylinder having a discharge opening in its upper end and an auger rotatably mounted within said freezing cylinder to scrape ice from the inner wall portions of the cylinder and advance the same, an inverted frusto-conical ice compressing and fragmenting member rigidly mounted on an upper end portion of the auger entirely within said cylinder, the annular outer surface of said member being spaced from the adjacent inner wall portion of the freezing cylinder and forming a work surface in the path of the ice mass advanced by the auger and including a plurality of independent superimposed removable, tapered discs of progressively upwardly enlarged diameters, one or more of said discs being removable to vary the effective height of said compressing and fragmenting members, the smallest diameter of the innermost disc corresponding to the outside diameter of the body of the auger and forming a flush continuation thereof.

4. In an ice nugget producing machine which includes an upright freezing cylinder having a discharge opening in its upper end and an auger rotatably mounted within said freezing cylinder to scrape ice from the inner wall portions of the cylinder and advance the same, an inverted

frusto-conical ice compressing and fragmenting member rigidly mounted on an upper end portion of the auger to rotate therewith, the annular outer surface of said member being entirely within the cylinder and spaced from the adjacent inner wall portion thereof and being in the path of the ice mass advanced by the auger and including a plurality of independent superimposed removable, tapered discs of progressively upwardly enlarged diameters, one or more of said discs being removable to vary the effective height of said compressing and fragmenting members, the smallest diameter of the lowermost disc corresponding to the outside diameter of the auger body and means carried by the auger above the superimposed discs to releasably clamp a predetermined group of the same on the auger.

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