Nov. 19, 1957 E. A. OSTROM 2,813,403

ICE MAKING MACHINE

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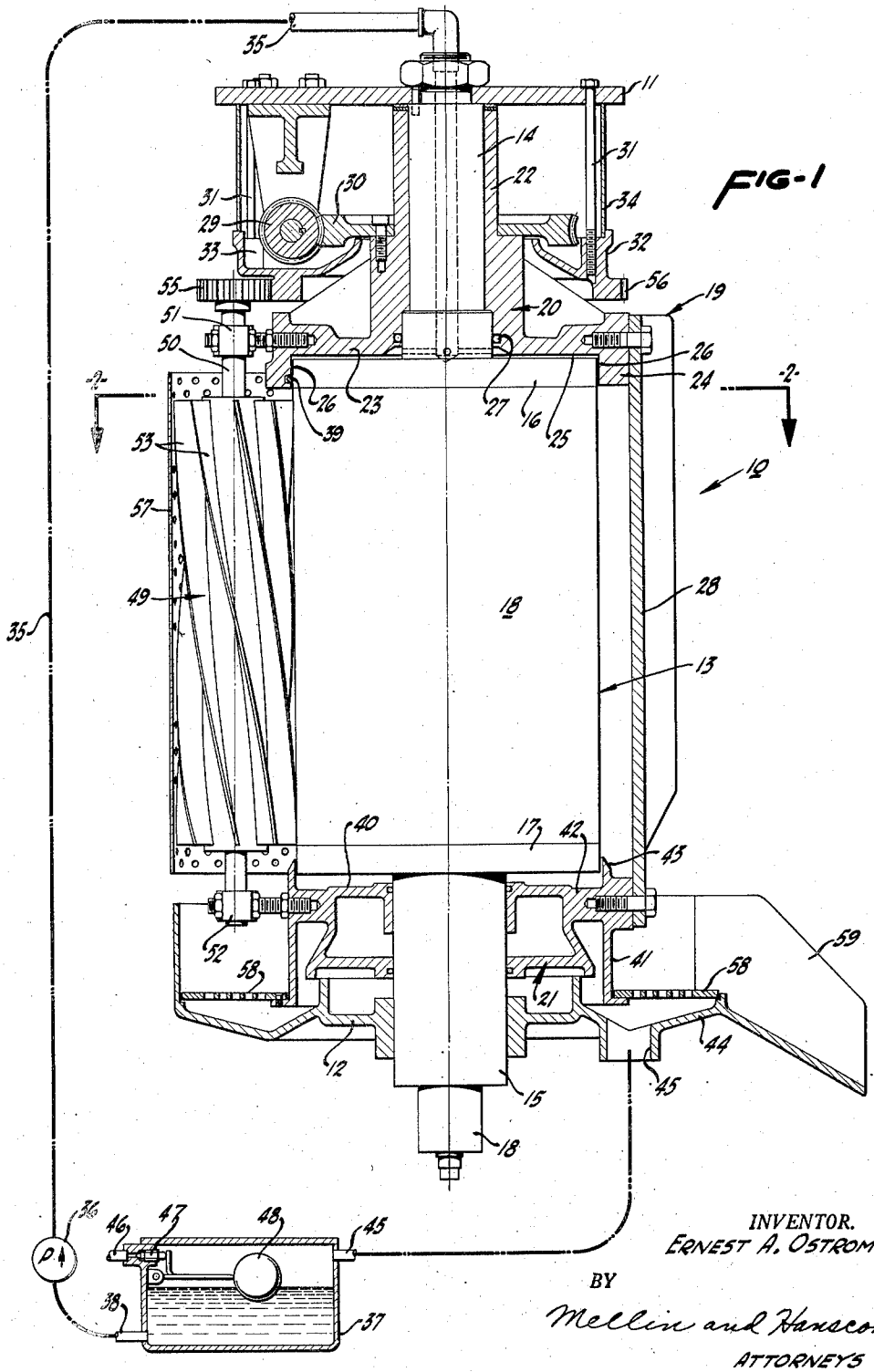


FIG-1

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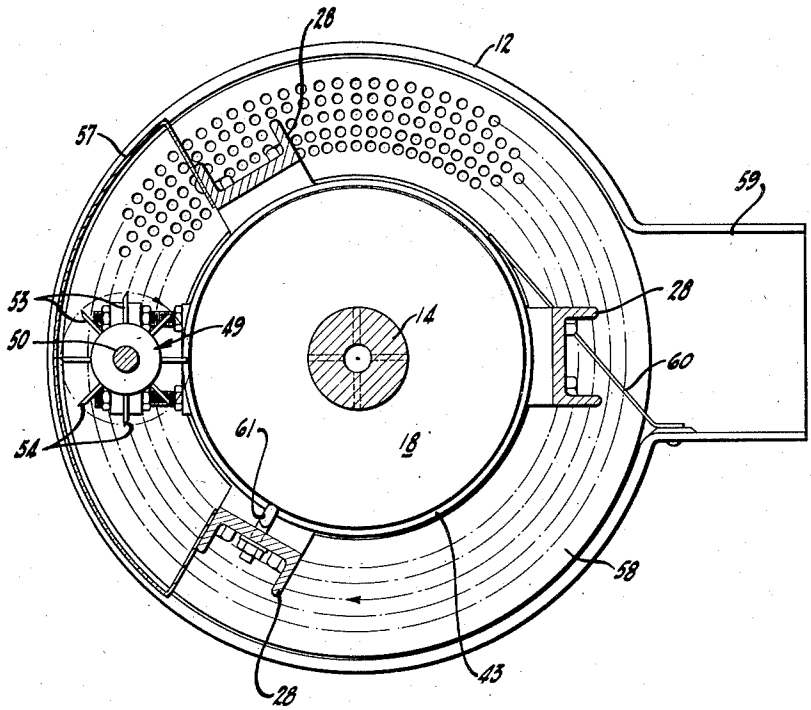


FIG-2

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2,813,403

ICE MAKING MACHINE

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1 Claim. (Cl. 62—107)

This application relates to a machine for making ice. More particularly, the application relates to a machine for making ice in the form of curved flakes.

There are a great many machines for making ice flakes in the prior art which use the principle of freezing a sheet of ice on the surface of a freezing drum and subsequently removing the sheet from the drum in the form of chips or flakes.

It is the principal object of this invention to provide a machine for making chip or flake ice of the type described above wherein a novel, more efficient means is used to remove the sheet ice from the drum so as to produce ice flakes more expeditiously and economically than prior art machines.

A further object of this invention is to provide a novel machine for making chip or flake ice wherein a rotating cutter is moved orbitally relative to a stationary freezing drum while simultaneously rotating about its own axis.

Another object of the invention is to provide an ice making machine as set forth in the previous object wherein the rotating cutter member is rotated with a peripheral speed greater than the orbital speed of the cutter relative to the drum.

A preferred embodiment of the invention is described in the following detailed specification, and illustrated by way of example in the accompaniyng drawings, wherein:

Fig. 1 is a sectional view of an ice making machine embodying the principles of my invention;

Fig. 2 is a sectional view taken on line 3—3 of Fig. 1.

Referring now to the drawings wherein similar reference numerals are used to denote the same elements throughout the various views shown, 10 generally indicates an ice machine embodying the preferred form of the invention.

The machine 10 is mounted on a frame comprising an upper plate member 11 and a lower member 12 connected together by rigid frame structure (not shown). The machine 10 includes a stationary hollow freezing drum 13 rigidly mounted between the frame members 11 and 12 by means of two axially aligned, vertically extending trunnion shafts 14 and 15. The upper trunnion shaft 14 is fixed at its upper end to the upper frame member 11 and at its lower end to the upper drum end 16 concentric therewith. Similarly, the lower trunnion shaft 15 is fixed at its lower end to the lower frame member 12 and at its upper end to the lower drum end 17 concentric therewith. The drum 13 is cooled by refrigerant from any suitable source (not shown) introduced into said drum through suitable passageways (not shown) extending longitudinally through the lower trunnion shaft 15 and connected to a fitting 18 provided on the lower end thereof.

The peripheral freezing surface 18 of the drum is made of a material having a high heat conductivity, while the drum ends 16 and 17 are made of heat insulating material to prevent ice from forming thereon.

A cutter carrier assembly, generally indicated at 19, is mounted for rotary movement about the fixed drum 13. The cutter carrier assembly 19 comprises an upper trunnion 20, rotatably mounted on the upper trunnion shaft 14, and a lower trunnion 21, rotatably mounted on the lower trunnion shaft 15. A plurality of rigid, vertically extending brace members 28 are connected at their opposite ends to the trunnions 20 and 21, respectively.

The upper trunnion 20 is formed with a sleeve portion 22 surrounding the trunnion shaft 14 and journaled thereon. A disc-shaped flange portion 23 extends outwardly from the lower end of the sleeve portion 22 and terminates in a downwardly depending annular flange 24 concentric with the drum 13. The annular disc 23 is spaced from the upper drum end 16 to provide a water chamber 25 therebetween for purposes which will hereinafter be described. Similarly, the depending flange 24 is spaced slightly from the peripheral surface 18 of the drum to provide an annular restricted passageway 26 therebetween. An O-ring 27 prevents the water in the chamber 25 from passing upwardly between the sleeve 22 and the trunnion shaft 14.

In order to rotate the cutter carrier assembly 19 relative to the drum 13, the machine is provided with a worm 29 driven by a suitable motor (not shown) and meshing with a worm gear 30 fixed to the sleeve portion 22 of the upper trunnion 20. An oil pan 32 is mounted beneath the worm gear 30 by a plurality of bolts 31 fixed to the upper frame member 11. The oil pan 32 is provided with a sump 33 beneath the worm 29. An annular gear shield 34 surrounds the worm gear 30 and is confined between the oil pan 32 and the upper frame member 11.

To provide a waterflow in the form of a curtain over the peripheral surface 18 of the drum 13 to be frozen thereon, water is introduced to the chamber 25, previously described, through suitable passageways (not shown) in the upper trunnion shaft 14 by means of a conduit 35 connected to the outlet side of a water-circulating pump 36. The inlet side of the pump 36 is connected to the sump 37 by a conduit 38. The water flows from the chamber 25 downwardly through the annular passageway 26 between the inner surface of the flange 24 and the external surface 18 of the drum. In order to cut off a portion of the curtain of water flowing over the external surface of the drum, an arcuate sealing strip 39 is fixed to the inner surface of the depending flange 24 and bears against the outer surface 18 of the drum 13. The sealing strip 39 extends approximately one-third of the distance around the circumference of the drum. Since the sealing strip 39 is fixed to the rotating flange 24, the cut-off portion of the curtain moves progressively around the drum surface.

The lower trunnion 21, previously mentioned, comprises a central hub 40, rotatably supported in the lower trunnion shaft 15, and a vertically extending annular flange 41 fixed to said hub by a plurality of spider arms 42. The upper end of the flange 41 is beveled downwardly and outwardly in the manner shown at 43 for purposes hereinafter described. The inner surface of the flange 41 is spaced slightly from the exterior surface 18 of the drum 13 to permit any water not frozen on the drum to pass downwardly therebetween. The excess water which passes between the flange 41 and the lower end of the drum 13 is collected in an annular trough 44 provided with a spout 45 emptying into the sump 37. Make-up water to replace that frozen on the drum is supplied to the sump 37 through a conduit 46 from any suitable supply. The admission of water to the sump 37 from the conduit 46 is controlled by a float valve 47 fixed to a float 48.

A rotating cutter assembly, generally indicated at 49, is provided to remove the ice sheet from the surface 18 of the drum 13. The cutter assembly 49 is mounted for orbital movement about the periphery of the drum 13

and for rotational movement about its own axis. In order to provide such orbital and rotational movement, the cutter assembly **49** is provided with a central shaft **50** journaled in bearings **51** and **52** adjustably connected to the upper and lower trunnions **20** and **21**, respectively. As best seen in Fig. 2, a plurality of radially extending, helically disposed cutter blades **53** are fixed to the shaft **50**. The outer edges of the blades **53** are beveled rearwardly and inwardly in the manner shown at **54**.

In order to rotate the cutter assembly **49** about its own axis, a pinion gear **55** is fixed to the upper end of the shaft **50** and meshes with a stationary sun gear **56** formed integrally with the oil pan **32**. The gear ratio between the pinion gear **55** and the sun gear **56** is so chosen that as the cutter carrier **19** rotates to orbit the cutter assembly **49** about the drum **13**, the cutter assembly **49** will rotate about its own axis with a peripheral speed approximately 1.75 times its orbital speed relative to the periphery of the drum **13**.

In order to harvest the flakes of ice chipped from the surface **18** of the drum **13** by the cutter assembly **49**, a foraminous arcuate cutter shield **57** surrounds the outside of the cutter assembly **49** to prevent the ice flakes from flying outwardly whereby said flakes will drop downwardly onto an annular horizontal shelf **58** fixed to and extending outwardly from the lower end of the annular flange **41**, previously described, and to prevent accidental contact with the cutter assembly **49** by the operator. The shield **57** is made foraminous to permit the ambient air to reach the cutter assembly **49** to prevent the cutter from becoming too cold and causing ice to freeze thereon. A delivery chute **59** is fixed to the lower frame member **12** at one point adjacent the periphery of the horizontal shelf **58** and a doctor blade **60** is fixed to the lower frame member **12** adjacent the chute **59** to scrape the ice flakes from said shelf into said chute as said shelf rotates relative thereto.

A water spreader **61** is fixed at its opposite ends to the upper and lower trunnions **20** and **21**, respectively, and bears against the surface **18** of the drum **13** rearwardly of the cutter assembly **49** when considered with respect to the direction of rotation of said trunnions. The water spreader is located just to the rear of the trailing edge of the water cut-off strip **39** and spreads the water which jets rearwardly therefrom in an even curtain on the surface of the drum **13**. The water spreader **61** is also adapted to either scrape off any particles of ice left on the drum surface by the cutter assembly **49** or to force them in against the drum so that the water will flow downwardly thereover in an even curtain.

In the operation of the device, the pump **36** is started to initiate the flow of the water curtain over the freezing surface **18** of the drum **13**, and the motor driving the worm **29** is started to commence the orbital movement of the cutter assembly **49** about the drum **13**. The sealing strip **39** is so located relative to the cutter assembly **49** that there is no water flow at the point of contact between the drum and the cutter assembly **49** and for a substantial distance in front of said cutter assembly, whereby the ice sheet on the drum is permitted to cure before the cutter assembly removes the ice from the drum.

The excess water not frozen on the drum passes between the flange **41** and the drum **13** and returns to the sump to be recirculated by the pump **36**. The ice flakes are deflected outwardly by the beveled upper edge **43** on the flange **41** to fall onto the annular shelf **58** and ultimately be scraped into the delivery chute **59** by the doctor blade **60**.

While I have shown and described the preferred form of my invention, it is obvious that various changes may be made in its construction by those skilled in the art, without departing from the spirit of the invention as defined in the appended claim.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

In an apparatus for manufacturing ice, a vertically disposed stationary drum, a rotatable flange portion covering the upper end of said drum, said flange portion being spaced from said drum to form a compartment therebetween, said flange terminating in a downwardly depending annular flange concentric to said drum, means to supply liquid to said compartment whereby said liquid may fill said compartment and flow downwardly over the surface of said drum in the form of a curtain, cut-off means carried by said depending flange in contact with said drum surface for progressively interrupting a portion of said curtain, means for rotating said rotatable flange portion in relation to said drum to move said curtain cut-off means around said drum, means for cooling said drum to congeal said liquid to form a sheet of ice thereon, rotatable cutter means carried by said flange portion in an orbital movement relative to said drum for removing successive body portions of said ice sheet, a stationary sun gear fixed relative to said drum, a planet gear fixed to said rotatable cutter means and meshing with said sun gear for simultaneously rotating said cutter means about its own axis at a peripheral speed substantially greater than the orbital speed of said cutter means relative to said drum, and a foraminous arcuate cutter shield surrounding said cutter means.

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