Jan. 31, 1961 W. A. ESCHENBURG ET AL 2,969,650

ICE MAKING AND VENDING MACHINE

Filed Nov. 1, 1957 4 Sheets-Sheet 1

Fig. 1

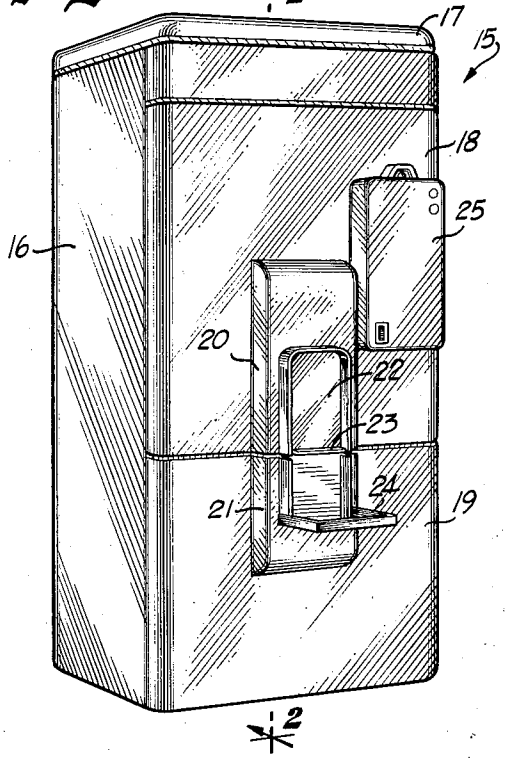
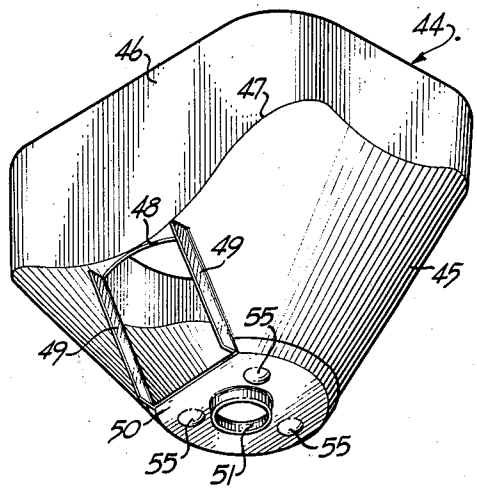


Fig. 6



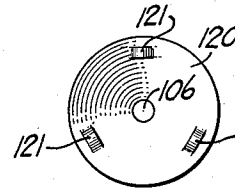


Fig. 9

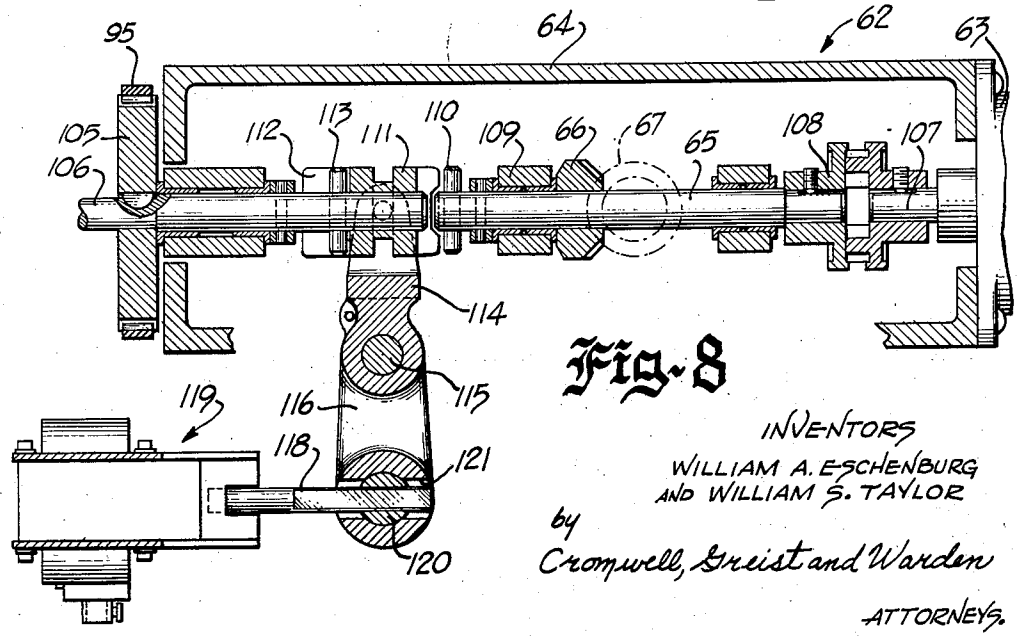


Fig. 8

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ICE MAKING AND VENDING MACHINE

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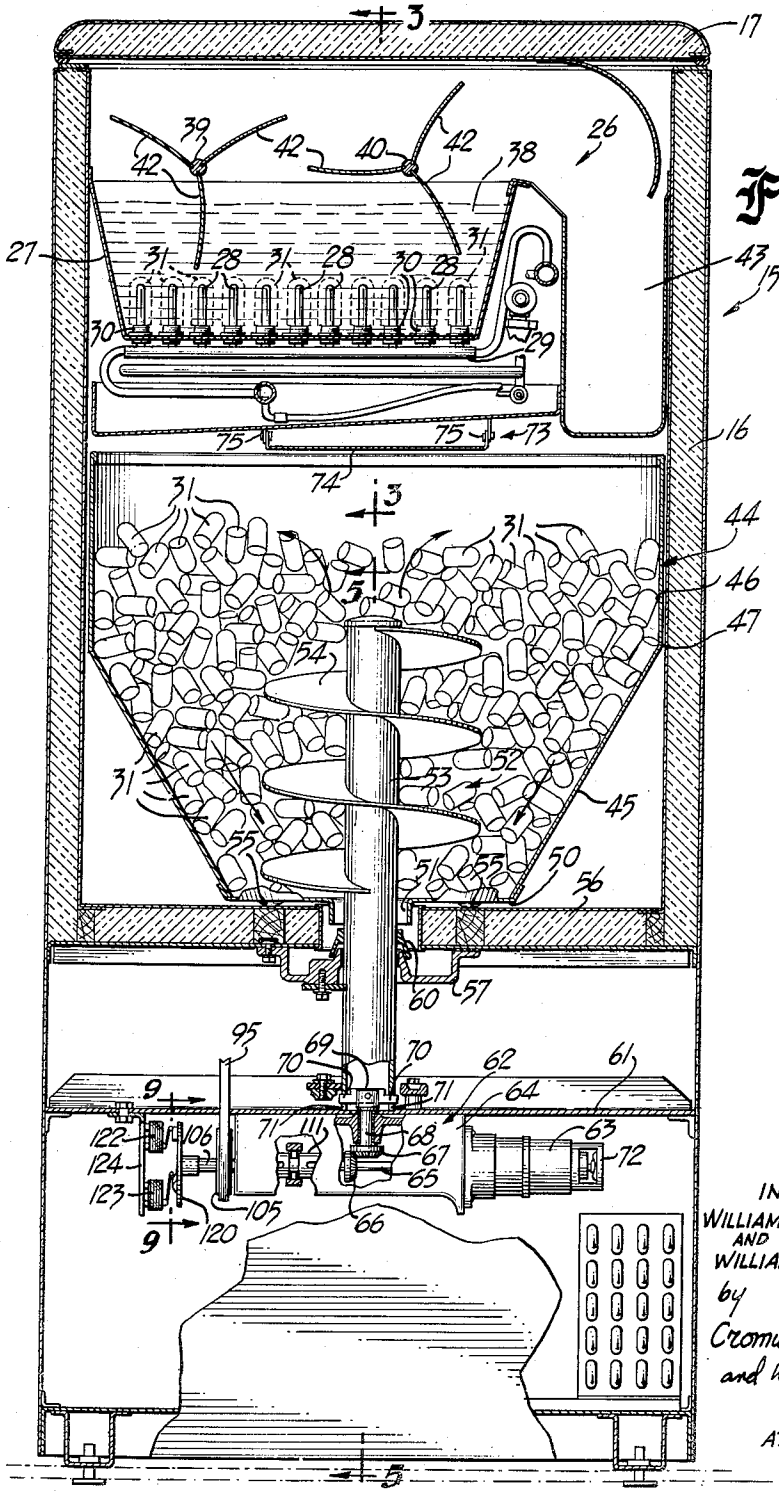

Fig. 2

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ICE MAKING AND VENDING MACHINE

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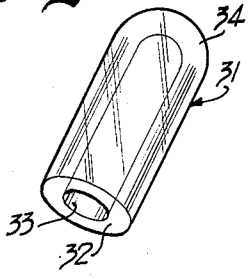
Fig. 4



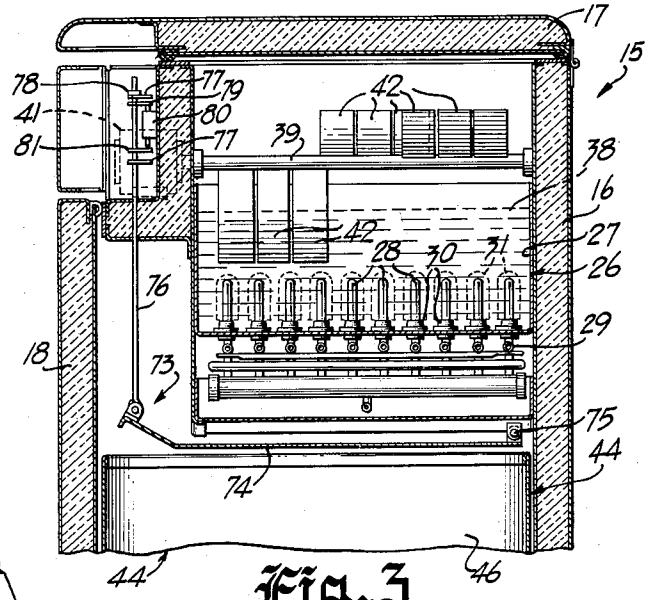


Fig. 3

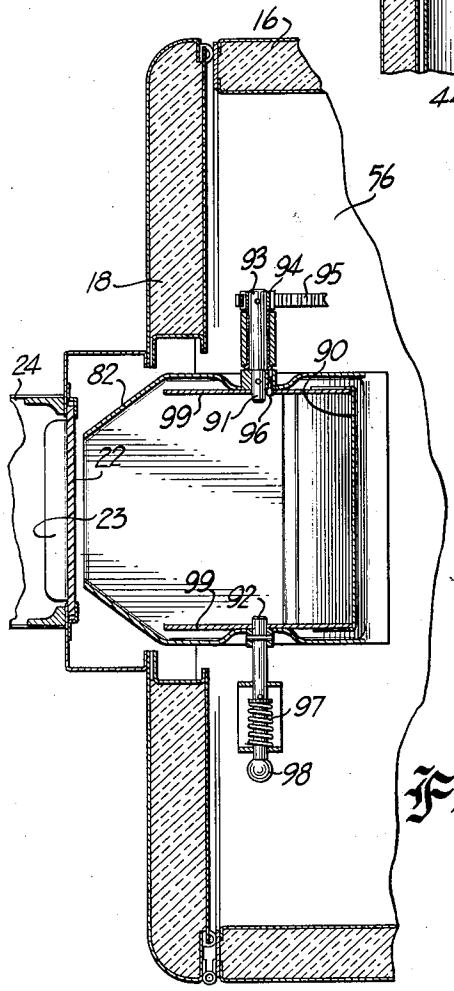


Fig. 7

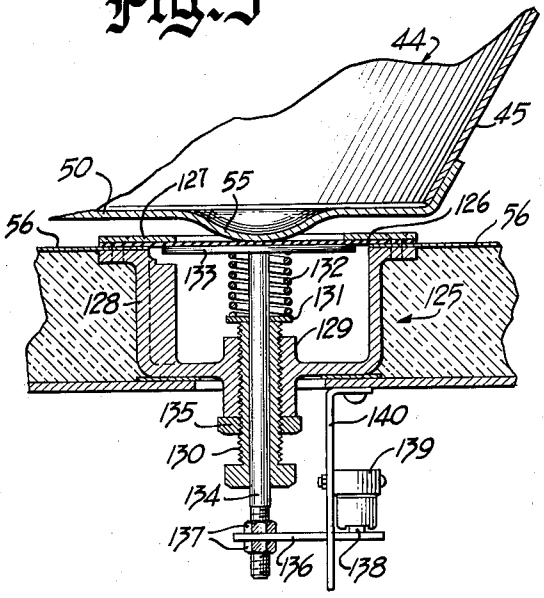


Fig. 10

64

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ICE MAKING AND VENDING MACHINE

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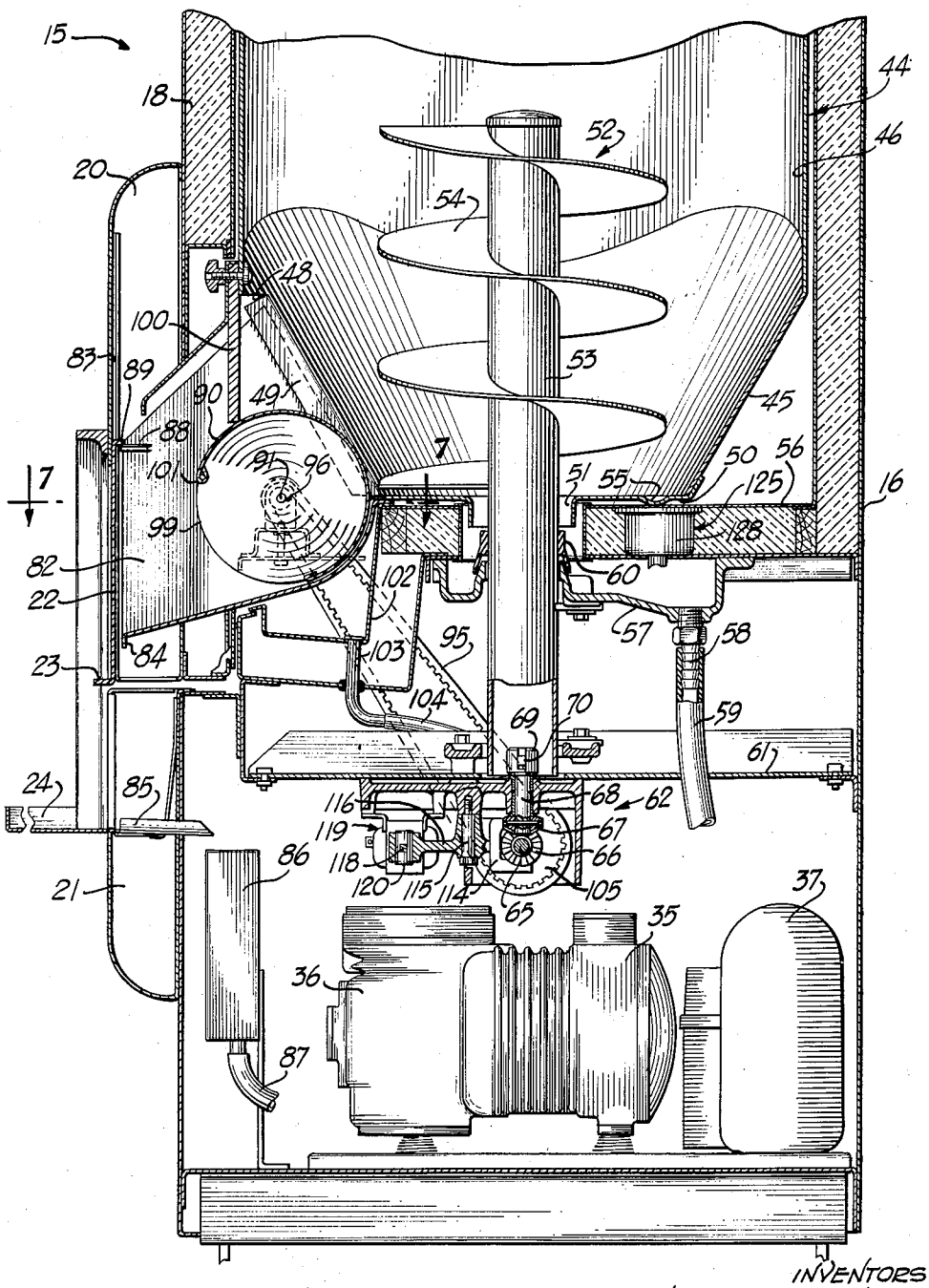

Fig. 5

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United States Patent Office 2,969,650 Patented Jan. 31, 1961

2,969,650

ICE MAKING AND VENDING MACHINE

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Filed Nov. 1, 1957, Ser. No. 693,928
19 Claims. (Cl. 62—68)

The present invention is directed to a new and improved apparatus wherein ice particles are automatically formed, stored and dispensed while making use of a new and improved method of storing fragile ice bodies in a given area and preventing coherence or fusing between adjacent contacting ice bodies therein.

Different forms of unitized product storing and dispensing machines have been developed for substantially widespread commercial use. Examples of the simpler types of such machines which are most commonly known include candy vending and other solid article vending machines. Vending machines of a more complicated nature are those designed for handling liquid products, such as soft drinks, wherein the drinks are actually mixed automatically within the machine and are dispensed therefrom upon operation of the same. Because of the automatic operational characteristics of such machines, widespread use of the same is common and considerable quantities of products can be sold without any substantial expense from the standpoint of labor accompanying such sales. With this advantage along with other well known advantages, the demand for automatic vending machines for use with many different types of products is great. However, limitations in the use of coin operated or otherwise automatically operated vending machines exist where the product involved is difficult to store or handle for vending purposes.

One such product of widespread general use which is not only difficult to store and vend but is also subject to complications during manufacture of the same is individual particles of ice suitable for immediate use without further size reduction. Ice cubes are used for a variety of purposes in substantial quantities and due to their tendency to become fused together upon storage, it is difficult to store a quantity of the same without coherence or fusing occurring unless, of course, each individual cube is maintained separately out of contact with adjacent cubes. Separation of ice cubes for storage purposes is impractical, however, and there has been no widely used storage arrangement up to the present time capable of preventing coherence or fusing between cubes maintained in contact with one another. Without suitable storage means for use with ice bodies or particles, such as cubes, it has been considered impractical to automatically vend the same as a substantial supply must be on hand for periodical peak demand in vending.

It is an object of the present invention to provide a new and improved form of ice body or ice particle storage means particularly adapted for use in vending the bodies or particles, the storage means including a special bin arrangement wherein accumulated ice bodies or particles are maintained in continuously moving condition under adequate refrigeration temperatures to prevent coherence or fusing between contacting bodies or particles.

A further object is to provide a new and improved ice storage vending apparatus wherein the novel ice body or particle storage arrangement operatively cooperates with an automatic vending arrangement to periodically deliver quantities of ice bodies or particles from the storage arrangement without damage to the same.

Still a further object is to provide a new and improved ice body or particle storage and vending arrangement wherein a drive arrangement is provided to continuously operate means forming a part of the storage arrangement

to maintain accumulated ice bodies in continuous movement to prevent coherence or fusing therebetween, the drive arrangement further including periodically operated ice vending portions, the overall arrangement being of an improved nature to require but a single power source for ice storage and vending purposes.

Another object is to provide a new and improved ice making and vending machine which within a single structure includes means for automatically forming ice bodies or particles and delivering the same into a storage area wherein said bodies or particles are maintained in continuously moving condition to prevent coherence or fusing therebetween, the storage area having operatively associated therewith a vending arrangement which delivers pre-determined quantities of ice bodies or particles from the area upon coin operation of a drive arrangement forming a part of the machine.

An additional object is to provide a new and improved ice vending machine of the type described in the foregoing object wherein automatically operated means are provided to discontinue ice body or particle formation upon pre-determined accumulation of bodies or particles in the storage area, further means being provided to prevent continued vending of ice bodies or particles from the storage area upon a decrease in accumulation of the same within the storage area to a pre-determined extent.

Still a further object is to provide a new and improved method of storing fragile ice bodies in a given refrigerated area and preventing coherence or fusing between adjacent contacting ice bodies.

Other objects not specifically set forth will become apparent from the following detailed description made in conjunction with the drawings wherein:

Fig. 1 is a perspective of the ice making and vending machine of the present invention;

Fig. 2 is a fragmentary vertical section of the machine taken generally along line 2—2 in Fig. 1;

Fig. 3 is a fragmentary vertical section taken generally along line 3—3 in Fig. 2;

Fig. 4 is an enlarged perspective of the particular shape of ice body formed by the ice making portion of the machine;

Fig. 5 is an enlarged fragmentary section taken generally along 5—5 in Fig. 2;

Fig. 6 is a perspective of the ice storage bin forming a part of the apparatus;

Fig. 7 is a sectional view taken generally along lines 7—7 in Fig. 5;

Fig. 8 is an enlarged partial section of the drive arrangement forming a part of the present invention;

Fig. 9 is an enlarged end face view of a timing cam as viewed along lines 9—9 in Fig. 2; and

Fig. 10 is an enlarged fragmentary section of the empty bin control mechanism forming a part of the machine.

In Fig. 1 the ice making and vending machine **15** is illustrated as including an insulated housing **16** being provided at the top thereof with an insulated, hingedly mounted top member **17** which is hinge connected along the rear edge thereof to allow the same to be lifted vertically for access into the top of the machine. The front face of the housing **16** is enclosed by an upper door member **18** and a lower door member **19**. Each of these door members is hinged along one side margin for outward swinging to gain access into the front portion of the housing **16**. Suitable locking means are provided to prevent unauthorized opening of the doors **18** and **19** as well as the top member **17**, such locking arrangements being well known and being similar to the type used in soft drink vending machines.

The front faces of the front door members **18** and **19** are provided with sectionalized, cooperating ice body

delivery housings 20 and 21, respectively. The upper housing portion 20 carries a vertically slidable transparent closure member 22 provided with an outwardly directed lip 23 at the bottom thereof for grasping to lift the same during delivery of ice bodies from the machine into a suitable container. Containers such as a paper bag may be placed in resting positon on an outwardly directed support tray 24 forming a part of the lower delivery housing portion 21. Operation of the ice vending portion of the machine 15 is controlled by a known type of coin operated mechanism 25 carried by the front face of the door section 18. Any suitable coin operated mechanism 25 can be used to actuate the various operative elements of the machine 15 and in the following description of the operation of the machine, the particular details of the coin operated mechanism will not be discussed, it being understood that such details are well known in the art due to wide-spread use of various types of these mechanisms.

As shown in Figs. 2 and 3, immediately below the hingedly mounted top 17 of the machine 15 is positioned therein an ice body producing mechanism generally designated by the numeral 26. This mechanism is of the type fully disclosed in U.S. Patent 2,696,717 and for this reason only certain of the important structural features of the same will be described for the purpose of understanding operation of the machine 15. The ice making mechanism 26 includes an open top tank 27 having mounted to the bottom wall thereof a plurality of vertically upwardly directed freezing tubes or fingers 28 which, as disclosed in the aforementioned patent, are hollow tubes having received therein centrally disposed refrigerant conduits which feed refrigerant from a distributor line 29 into the fingers 28 in a continuous manner with the refrigerant being continuously withdrawn therefrom by suitable conduit means. Rubber grommets 30 insulate each finger 28 relative to the bottom wall of the tank 27 and the tank is substantially filled with fresh water for ice body forming purposes.

Fig. 4 illustrates the type of ice body 31 formed on each finger 28 during operation of the mechanism 26. The ice body is generally of a size readily usable in individual glasses for beverage cooling purposes and is provided with a relatively flat bottom surface 32 having a central opening 33 extending upwardly short of the top rounded end 34 thereof. From the shape of the ice body 31 in Fig. 4 and further as illustrated in broken lines in Figs. 2 and 3, it is apparent that each ice body 31 takes the general shape of its associated finger 28 during formation of the same.

As particularly illustrated in Fig. 5, the lowermost portion of the machine housing 16 encloses therein a compressor 35 driven by a suitable electric motor 36 and associated with a condensor 37. The particular interconnection of these commonly known units and the manner in which they operate the ice body forming mechanism 26 is not illustrated or described as such details are not only well known but are disclosed in detail in the aforementioned Patent 2,696,717.

As previously described, refrigerant is delivered to the interior of each of the fingers 28 and ice is formed on the outer surface of each finger resulting from the freezing of surrounding water of a quantity of water 38 received in the tank 27. Suitably mounted above the tank 27 are a pair of rotatable shafts 39 and 40 each of which are driven by an electric motor 41 illustrated in Fig. 3 mounted to one side of the ice forming mechanism 26. Each of the shafts 39 and 40 have attached thereto radially outwardly directed paddle members 42 which are triangularly arranged and which are preferably formed from resilient material such as rubber. The paddles rotate with the shafts 39 and 40 in a counter-clockwise direction as viewed in Fig. 2 to continuously agitate the body of water 38 contained in the tank 27 during ice body formation to assure the formation of substantially

clear ice on each of the tubes 28. The cycle of ice body formation is controlled by suitable means to provide for the circulation of hot refrigerant through the tubes 28 following completed ice body formation thereon to automatically detach each ice body 31 from its respective tube 28 and permit the same to float upwardly towards the surface of the body of water 38 in the tank. Upward floating of the ice bodies 31 results in contact with the resilient paddles 42, which contact causes movement of the ice bodies towards the right hand side of the tank 27 as viewed in Fig. 2. The ice bodies contacted by the paddles 42 carried by the shaft 39 are delivered into contact with the paddles 42 carried by the shaft 40. The right hand side of the tank 27 as viewed in Fig. 2 is provided with a delivery chute 43 into which the ice bodies 31 are delivered by the paddles carried by the shaft 40. The rubber material of the paddles 42 is sufficiently rigid to lift the accumulated ice bodies from the surface of the water 38 and move the same outward of the tank 27 into the delivery chute 43 wherein the ice bodies fall freely downwardly into a storage bin generally designated by the numeral 44.

The storage bin 44 is particularly illustrated in Figs. 2, 5 and 6 and is mounted below the ice making mechanism 26 within the machine housing 16 to substantially fill the same in a transverse sense in alignment with the bottom of the delivery chute 43. Referring particularly to Fig. 6, the storage bin 44 is formed from a bottom section 45 which is frusto-conical in shape conforming to a 60° true angle cone. The upper edge of the cone-shaped bottom portion 45 has integrally joined therewith a rectangular portion 46, the lower margin 47 of which conforms to a true line of intersection of a rectangle with a cone. The line 47 constitutes a seam whereby the bottom edge of the upper rectangular portion 46 is joined with the upper edge of the bottom cone portion 45 in water tight relation.

One side area of the bottom conical portion 45 is provided with an ice body delivery opening 48 having side guide flanges 49 formed therewith for ice body delivery purposes in a manner to be described. The bottom edge of the cone shaped portion 45 has secured thereto an annular bottom plate 50 which is centrally apertured as evidenced by the vertically directed collar 51 to receive therethrough a vertically positioned auger 52. The auger is in the form of a hollow tube-like shaft 53 having integrally formed along the outer periphery thereof a continuous helical blade 54 which is located in its entirety within the storage bin 44. The helical blade 54 commences in close association with the bottom annular plate 50 and spirals upwardly therefrom to a point slightly within the upper rectangular portion 46 of the bin 44. The bottom plate 50 of the bin 44 is provided with downwardly projecting enlargements 55 which as particularly shown in Figs. 2 and 5 support the bin 44 on a centrally apertured, transverse frame member 56 which sub-divides the refrigerated upper portion of the machine 15 from the unrefrigerated lower portion. The side walls of the housing 16, the top 17, the upper door portion 18 and the transverse support wall 56 are all suitably insulated to maintain refrigeration temperatures within the area enclosed thereby in which the ice making mechanism 26 and storage bin 44 are located.

Referring particularly to Figs. 2 and 5, the tube shaft 53 of the auger 52 as previously described extends downwardly through the bottom plate 50 of the storage bin 44 and downwardly through an aligned opening in a drainage pan 57 attached to the under side of the transverse frame member 56. In Fig. 5 the drainage pan 57 is illustrated as including a hose connecting nipple 58 to which a flexible hose 59 is attached and extends to a suitable drain or water storage pan for removal of drainage water from the storage bin 44 out of the machine 15. A shaft seal 60 surrounds the shaft 53 to

seal the same relative to the opening in the pan 57 through which the shaft extends downwardly into bottom end association with a transverse frame member 61 suitably supported within the bottom portion of the housing 16. A drive arrangement generally designated by the numeral 62 is suitably supported on the under side of the frame member 61.

As particularly shown in Fig. 2 an electric motor 63 is mounted to a drive arrangement housing 64 in driving engagement with a horizontally directed shaft 65 which carries a bevel gear 66 which is in driving engagement with a bevel gear 67 attached to the bottom end of a vertically directed connecting shaft 68. The upper end of the connecting shaft 68 has attached thereto a horizontally extending spline member 69 which is provided with a pair of oppositely directed, radially outwardly extending driving lugs 70 each of which are received in a groove 71 formed in the bottom surface of the tube shaft 53. With this arrangement the auger 52 is vertically movable out of driving engagement with the spline element 69 for ready dismounting of the same for a purpose to be described, and to drivingly engage the auger 52 it is necessary merely to lower the same into groove receiving engagement with the driving lugs or projections 70. The auger 52, in effect, rests on the driving lugs 70 which are in continuous driving engagement with the shaft 65.

In the operation of the machine 15 insofar as the ice body forming mechanism 26 and storage bin 44 are concerned, ice bodies 31 are periodically delivered into the storage bin 44 upon completion of each ice body forming cycle of the mechanism 26 and in the manner previously described. Accumulation of ice bodies in the storage bin 44, as shown in Fig. 2, over any substantial period of time would normally result in fusing of the bodies into a substantially solid mass thus preventing efficient vending of limited quantities of the same. The electric motor 63 which is cooled by a known type of fan assembly 72 is continuously operated with the result that the auger 52 is continuously rotated within the storage bin 44. The location of the auger 52 within the storage bin 44 provides for continuous circulation of the ice bodies accumulated therein following the directions of movement indicated by the arrows in Fig. 2. The auger 52 is operated at a very slow speed, such as from 4 to 6 r.p.m., and with the provision of the bottom conical portion 45 of the storage bin 44, ice bodies 31 continuously feed by gravity in a downwardly and inwardly direction toward the auger 52. The auger 52 picks up the ice bodies accumulated at the central bottom portion of the storage bin 44 and slowly delivers the same in a continuous manner centrally upwardly to spill the same into the upper portion of the accumulated ice bodies. In effect, a boiling action exists whereby all of the ice bodies 31 accumulated in the storage bin 44 are maintained in constant motion to an extent that fusing therebetween does not occur. The boiling motion supplied by the auger 52 is sufficiently gentle to prevent breakage of the relatively fragile ice bodies 31 and the ice bodies move to an extent within the storage bin 44 so that one complete revolution of a given ice body, insofar as its path of movement is concerned, occurs in approximately ½ hour. The particular shape of the storage bin 44 described in detail above provides a lower portion which functions to automatically feed ice bodies into association with the centrally located auger 52 while providing an upper portion of substantial capacity to allow sufficient accumulation of ice bodies within the machine 15 to meet peak vending requirements.

During minimum vending requirement periods the storage bin 44 will fill to capacity and a bin fullness control means, generally designated by the numeral 73, is provided to discontinue operation of the ice body forming mechanism 26. As particularly illustrated in Figs. 2 and 3, the bin fullness control means 73 includes a horizontally extending plate 74 located immediately above the top surface of the bin 44 and being connected by hinges 75 at the rear edge thereof to the undersurface of a portion of the ice body forming mechanism 26. The forward edge of the plate 74 is inclined upwardly and has pivotally attached thereto centrally thereof a vertically directed rod 76. The upper end of the rod 76 extends through aligned apertures in vertically spaced mounting brackets 77 suitably supported by an inner surface of the housing 16. The upper end portion of the rod 76 extending above the upper bracket 77 is provided with a fixed abutment collar 78 which limits downward movement of the plate 74 to support the same in a substantially horizontal plane as illustrated in Fig. 3. Below the supporting bracket 77 the rod 76 carries a switch actuating plate 79 which is in engagement with the switch arm forming a part of a two-way switch 80 suitably mounted within the housing 16. Below the switch 80 and above the bottom guide bracket 77 the rod 76 carries a switch actuating arm 81 which is arranged for engagement with the downwardly projecting portion of the switch arm of the switch 80 to open the switch upon upward movement of the plate 74. Upon complete filling of the storage bin 44 with ice bodies 31, the uppermost accumulated ice bodies will eventually contact the plate 74 and raise the same in an upwardly direction about its hinge connections 75. The rod 76 will move upwardly and the switch actuating arm 81 will force the switch arm upwardly to open the switch 80 and de-energize the ice body forming mechanism 26. Upon subsequent vending of ice bodies from the storage bin 44 to an extent that the total accumulation of the same decreases and allows the plate 74 to return to its original position, the uppermost switch actuating arm 79 will again return into engagement with the switch arm, as illustrated in Fig. 3, to close the switch 80 and re-energize the ice body forming mechanism 26.

Referring particularly to Figs. 5 and 7, the vending opening 48 of the bottom conical portion 45 of the storage bin 44 has aligned therewith a delivery chute 82 suitably supported within the housing 16 as by attachment to the flange members 49 along the sides of the opening 48 and the transverse frame member 56 of the housing. The outermost end of the chute 82 is in register with the vertical slidable panel 22 which in turn is mounted in side channels 83 formed in the upper delivery housing 20 of the upper door section 18. The bottom forward edge of the chute 82 is provided with a downwardly directed lip 84 which directs accumulated water downwardly into a drainage pan 85 carried in the bottom portion of the vending housing 21 from which water flows back into the lower portion of the housing 16 and into a collecting pan 86 suitably mounted therein and having attached to the bottom thereof a flexible hose 87 delivering water to a drain or other collecting means externally of the machine 15. The delivery chute 82 is provided with a transverse abutment plate 88 extending across the top thereof against the top forward surface of which an inwardly directed flange portion 89 of the sliding panel 22 rests when the same is in its lowered or closed position.

A rotatable vending drum 90 is mounted within the delivery chute 82 by oppositely positioned stub shafts 91 and 92. The stub shaft 91 is integrally formed with a drive shaft 93 suitably mounted in the housing 16 and having attached thereto at the innermost end thereof a sprocket-type pulley 94 in engagement with a drive belt 95. The stub shaft 91 is suitably received in a side aperture in the drum 90 and has associated therewith to one side thereof a locking pin 96 which rotates with the shaft 93 and is received in a suitable aperture in the side wall of the drum 90 to one side of the aperture receiving the stub shaft 91. The oppositely positioned stub shaft 92 is suitably mounted with a coil

spring 97 which urges the same through an opening in the side of the drum associated therewith into the interior of the drum sufficiently to mount the same for free rotation thereabout. The innermost end of the shaft 92 is provided with a knob 98 for grasping to withdraw the pin 92 out of engagement with the drum 90 against the urging of the spring 97 to provide for dismounting of the drum 90 for cleaning purposes. For drum dismounting purposes, the upper front door section 18 is hingedly connected to the housing 16 as previously described and may be opened with the delivery housing portion 20 forming a part thereof moving outwardly to expose the chute 82 and drum 90.

The periphery of the drum 90 is provided with a relatively large opening 99 through which ice bodies are delivered from the storage bin into the drum when the opening is in register with the opening 48 of the bin and through which the ice bodies are delivered from the drum 90 into the chute 82 against the rear surface of the vertically slidable panel 22 when the drum is rotated into the position shown in Fig. 5. The drive belt 95 functions to rotate the drum 90 into and out of opening register with the opening 48 of the storage bin 44 by operation of the drive arrangement 62 in a manner to be described. The opening 48 in the bottom portion of the storage bin 44 is substantially larger than the drum 90 to assure proper filling of the drum during vending operation. In order to prevent ice body loss from the bin 44 between cycles of vending operation and to prevent falling of the ice bodies from the bin 44 into the chute 82 during movement of the drum 90 into delivery position, a resilient rubber blade or gate 100 is suitably attached at the upper portion thereof to the storage bin 44 and extends in free condition downwardly into light engagement with the outer periphery of the drum 90. The gate 100 is sufficiently resilient to prevent shearing of the ice bodies during movement of the edge 101 of the drum opening 99 past the gate during delivery of ice bodies carried by the drum into the chute 82. The gate is sufficiently rigid, however, to prevent movement of free ice bodies not contained in the drum 90 past the same and still further restrain accumulated ice bodies from moving over the top of the drum 90 and into the delivery chute 82 between vending cycles.

As shown in Fig. 5, further drainage collection means in the form of a pan 102 is positioned below the drum 90 and the inner bottom surface of the chute 82. Suitable drainage holes may be provided in the inner bottom surface of the chute 82 through which water draining from the storage bin 44 may flow into the pan 102. The pan 102 is tilted slightly as illustrated and is provided with a drainage tube 103 connected to a flexible hose 104 for delivering water to a suitable drain or other collection means externally of the machine 15. While the various collection and drainage basins or pans illustrated are not described in detail, it will be appreciated that any number of such pans may be utilized to properly accumulate all drainage from the various portions of the machine. Within the scope of the present invention it is not intended to be limited to structural arrangement and location of various water collection and disposal means which must form a part of the machine for proper installational use of the same.

Referring to Figs. 2, 5 and 8 and particularly to Fig. 8, the drum drive belt 95 is drivingly engaged with a sprocket gear 105 fixed to a shaft 106 journalled in the drive arrangement housing 64 through an end thereof opposite to the end through which the continuously driven shaft 65 is journalled. As particularly shown in Fig. 8, the end of the drive shaft 107 of the electric motor 63 is flattened and coupled by a coupling member 108 to an oppositely positioned flattened end of the drive shaft 65. The location of the bevel gear 67 forming a part of the drive connection of the auger 52 is shown in broken lines in Fig. 8. The opposite end of the shaft 65 carries the bevel gear 66 previously described which is locked in engagement with the bevel gear 67 by a suitable locking means 109 with a free end of the shaft 65 extending therethrough and having fixedly received therethrough a drive pin 110. The innermost end of the shaft 106 has axially slidably mounted thereon a shaft coupling element 111 of a known type which is provided with a radial slot 112 in the rear face thereof through which a pin 113 extends, which pin is fixedly attached to the shaft 106. The forward end of the coupling element 111 is provided with a radially directed slot defining clutch projections of known type which upon sliding movement of the element toward the free end of the shaft 106 project outwardly therefrom and are adapted to receive therein the drive pin 110 of the shaft 65 to thus couple or interconnect the shafts 65 and 106.

In order to slide the coupling element 111 along the shaft 106, a pivotal operating clevis 114 is suitably mounted on a fixed shaft 115 in association with a rocker arm 116 which is suitably engaged with the clevis 114 to rock the same relative to the shaft 115 and move the clutch element 111 into and out of shaft interconnecting engagement with the pin 110. The rocker arm 116 is mounted about the shaft 115 inwardly of the end engaged with the clevis 114 and at its remaining end is connected in a known manner to an actuating rod 118 of a solenoid 119. The actuating rod 118 is provided with a ball joint 120 which is internally received within the end of the rocker arm 116 having a wide transverse slot 121 associated therewith to permit rocking of the arm 116 upon reciprocating movement of the solenoid arm 118.

While the structural features of the drive engagement 62 are rather diagrammatically shown in Fig. 8, it will be appreciated that the separate elements of the same are well known and the purpose of the arrangement is to cause coupling of the shaft 106 which drives the drum 90 with the continuously rotating shaft 65 upon energization of the solenoid 119 with coin operation of the machine. Referring to Fig. 5, the relative location of the important elements of the drive arrangement 62 are illustrated and the solenoid 119 is suitably wired to the coin operated mechanism 25 carried by the upper door section 18. To initiate the vending cycle, a coin is inserted in the box 25 resulting in energization of the solenoid 119 and sliding of the shaft coupling element 111 into engagement with the pin 110 to cause rotation of the shaft 106 with the shaft 65, the total rotation of both shafts being accomplished by operation of the single electric motor 63. With rotation of the sprocket pulley 105 and operation of the belt 95, the drum 90 will rotate in a counter-clockwise direction as viewed in Fig. 5 to an extent that the opening 99 thereof is brought into register with the opening 48 of the storage bin 44. With continued rotation of the drum 90, the same is filled with ice bodies received from the storage bin 44 and the gate 100 prevents delivery of ice bodies from the bin over and above that contained within the drum 90. Upon one complete rotation to the position of rest as illustrated in Fig. 5, the vending cycle has been completed and a pre-determined quantity of ice bodies has been delivered into the chute 82 from which they may be removed by lifting of the sliding panel 22 as previously described.

Referring to Fig. 2, the outermost end of the shaft 106 has coupled thereto a vending cycle timing cam 120, the outer surface of which, as shown in Fig. 9, is provided with circumferentially spaced projections 121. Fixedly associated with the timing cam 120 is a pair of micro-switches 122 and 123 suitably mounted on a downwardly extending bracket 124 attached to the under surface of the transverse drive arrangement support 61. The micro-switch 122 has a switch arm riding the outer face of the timing cam 120 and upon contacting one of the projections 121 the switch 122 is opened to interrupt

further vending operation of the drum **90**. The timing cam **120** illustrated is provided with three projections for use in a drive arrangement of the type wherein the drum drive sprocket **105** is three times the diameter of the drum sprocket **94**. Thus one third rotation of the shaft **106** causes the switch arm of the micro-switch **122** to move from one projection **121** to the next projection **121** during which time the drum **90** has made one complete revolution. The micro-switch **123** is provided with a spring arm which also rides the face of the timing cam **120** in the path of the projections **121** and functions to reset the coin operated electric circuit following completion of each vending cycle. The use of reset switches of this type is common in coin operated vending apparatus and it is believed unnecessary to provide herein a detailed explanation of the rather complicated electrical circuit constituting the control mechanism of coin operated machines. However, with completion of a single venting cycle by contact of the switch arm of the delivery switch **122** with a projection **121** of the timing cam **120**, the entire control circuit is de-energized but is immediately reset by functioning of the switch **123** to allow subsequent coin energization for a subsequent vending cycle operation.

The storage capacity of the bin **44** should be such that peak vending demands on the machine **15** can be readily met. Where unusual or unexpected vending demands are made of a machine of a given capacity, there is always the possibility that insufficient ice body accumulation has occurred within the storage bin between consecutive vending cycles. To meet these circumstances an empty bin control arrangement **125** is provided, which arrangement is illustrated in detail in Fig. 10. As previously described, the bottom annular plate **50** of the storage bin **45** is provided with three circumferentially spaced support projections **55** with two of these projections, as particularly illustrated in Fig. 6, being arranged toward the front of the bin relative to the vending opening **48** therein. The third projection **55** is located at the central rear area of the bottom surface of the bin **44** and it is this projection which is shown in Fig. 10. The relative location of the empty bin control **125** is illustrated in Fig. 5 and it will be noted that the same is mounted within the transverse storage bin support member **56** immediately below the rearwardly located projection or foot **55**.

Referring again to Fig. 10, the top plate of the frame member **56** is provided with an opening across which extends a thin rubber diaphragm **126** peripherally clamped by an annular top plate **127** secured to an upwardly opening housing **128** positioned within the frame member **56** by suitable securing means such as screws or bolts. The bottom wall of the housing **128** is provided with a vertically directed sleeve portion **129** through which is threadedly received an adjusting screw **130** which supports at its innermost end a washer **131** defining one seat for a coil spring **132** compressed between the same and the inner surface of a round diaphragm support plate **133** fixedly attached to the innermost end of a slidable rod **134** received within the housing **128**. The rod **134** extends through a central bore in the adjusting screw **130** and the washer **131** and the adjustment of the coil spring **132** is afforded by advancing or retracting the screw **130** with a lock nut **135** being received thereabout to fixedly locate the same. The outermost end of the rod **134** is threaded and receives thereabout one end of a switch operating arm **136** which is adjustably locked in place by oppositely positioned locking nuts **137**. The switch arm **136** extends into engagement with the operating arm **138** of a micro-switch **139** suitably mounted by a bracket **140** to the under surface of the frame member **56**.

With ice body accumulation within the storage bin **44** being sufficient to meet immediate vending requirements, the weight of the bin as exerted through its rearmost foot **55** against the empty bin control arrangement **125** is sufficient to hold the switch arm **136** out of actuating engagement with the arm **138** of the micro-switch **139**. In this position the switch **139** is closed and vending operation occurs upon coin operation of the machine. Upon continuous vending operation of the machine to an extent that the accumulated ice body supply in the storage bin decreases to an extent incapable of providing full quantity vending operation, the weight of the bin and accumulated ice bodies transferred to the control arrangement **125** is insufficient to overcome the strength of the coil spring **132** and maintain the switch arm **136** sufficiently depressed and out of operative engagement with the arm **138**. Upward movement of the switch arm **136** results in opening the micro-switch **139** thus interrupting the coin operated vending circuit of the machine and preventing further vending of ice bodies until such time that accumulation thereof results in the transmitting of sufficient weight to the empty bin control arrangement **125** to an extent that the switch arm **136** is depressed into its original position. The flexible diaphragm **126** is provided to prevent seepage of moisture caused by sweating on the outer surfaces of the storage bin into the interior of the control mechanism **125** or into the insulation of the transverse support member **56**. Operation of the micro-switch **139** as described can not only be arranged to function to prevent further coin operation of the machine but also to energize a warning light carried by the coin box **25** of the machine indicating insufficient accumulation of ice bodies for vending purposes.

Proper operation of the empty bin control arrangement **125** is at least somewhat dependent on the mounting of the storage bin **44** within the housing **16**. The storage bin **44** in effect tilts somewhat in response to ice accumulation therein in order to provide proper actuation of the switch arm **136** of the control arrangement **125**. Furthermore, the mounting of the storage bin within the interior of the housing **16** provides for ready removal of the same for cleaning purposes to meet local health requirements. In this respect the opening of the upper door section **18** of the machine provides for access to the storage bin **44** for removal purposes as well as access to the rotatable drum **90** for dismounting in the manner previously described. All surfaces against which the ice bodies come into contact can be readily cleansed without expensive maintenance and without technical knowledge of the operational features of the machine of an extent normally necessary in dismounting various parts thereof. The top **17** is hingedly mounted, as previously described, for immediate access into the interior of the ice body forming mechanism **46** for cleaning purposes without necessitating dismantling or dismounting of the same. The particular manner in which the auger **52** is freely mounted by spline connections to the drive arrangement **62** provides for ready removal of the same to allow complete withdrawal of the storage bin **44** from the interior of the machine.

From the foregoing it will be appreciated that the ice making and vending machine disclosed is of compact design and arrangement capable of highly efficient operation. The particular ice body storage arrangement disclosed is not only readily adaptable for use in the particular machine described but may be used in other environments where it is necessary to prevent fusing between accumulated ice bodies over a substantial period of time without resulting ice body breakage or otherwise destruction of a vendable product.

Obviously many modifications and variations of the invention as hereinbefore set forth may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

We claim:

1. In an ice making and vending machine including

an insulated cabinet having an ice delivery opening in a face thereof, and ice particle forming means in said cabinet adapted to continuously supply ice particles for storage and vending purposes, the provision of ice particle storage means in said cabinet defining an area of substantial dimensions in which ice particles are accumulated for vending purposes, ice particle delivery means communicating said ice particle forming means with said storage means to feed ice particles thereinto, ice particle moving means in said storage means to impart circulatory-type motion to the ice particles therein to prevent coherence and fusing therebetween during storage, and ice particle vending means communicating said storage means with said delivery opening to deliver ice from said storage means for vending purposes.

2. In an ice making and vending machine including an insulated cabinet having an ice delivery opening in a face thereof, and ice particle forming means in said cabinet at the top thereof adapted to continuously supply ice particles for storage and vending purposes, the provision of ice particle storage means in said cabinet centrally thereof defining an area of substantial dimensions in which ice particles are accumulated for vending purposes, ice particle delivery means extending from said ice particle forming means and including a chute which is downwardly directed into communication with said storage means to feed ice particles thereinto, ice particle moving means in the form of a centrally positioned and vertically directed auger in said storage means to impart circulatory-type motion to the ice particles therein to prevent coherence and fusion therebetween during storage, and ice particle vending means including a rotatable drum having an opening therein and being associated with said storage means and said delivery opening to deliver ice from said storage means for vending purposes.

3. In an ice making and vending machine including an insulated cabinet having an ice delivery opening in a face thereof, and ice particle forming means in said cabinet at the top thereof adapted to continuously supply ice particles for storage and vending purposes, the provision of ice particle storage means in said cabinet centrally thereof defining an area of substantial dimensions in which ice particles are accumulated for vending purposes, ice particle delivery means extending from said ice particle forming means and including a chute which is downwardly directed into communication with said storage means to feed ice particles thereinto, ice particle moving means in the form of a centrally positioned and vertically directed auger in said storage means to impart circulatory-type motion to the ice particles therein to prevent coherence and fusion therebetween during storage, ice particle vending means including a rotatable drum having an opening therein and being associated with said storage means and said delivery opening to deliver ice from said storage means for vending purposes, and a drive arrangement for said auger and drum powered by a single source and arranged to drive said auger while periodically driving said drum.

4. In an ice making and vending machine including an insulated cabinet having an ice delivery opening in a face thereof, and ice particle forming means in said cabinet at the top thereof adapted to continuously supply ice particles for storage and vending purposes, the provision of ice particle storage means in said cabinet centrally thereof defining an area of substantial dimensions in which ice particles are accumulated for vending purposes, said storage means comprising an open top bin formed from an upper rectangular portion and a lower conical portion, ice particle delivery means extending from said ice forming means and including a chute which is downwardly directed into communication with said storage means to feed ice particles thereinto, ice particle moving means in the form of a centrally positioned and vertically directed auger in said storage means to impart motion to the ice particles therein to prevent coherence and fusion therebetween during storage, said auger extending through the bottom of the conical portion of said bin and being provided with a continuous helical blade for delivering ice particles upwardly from the bottom of said bin to uniformly spill the same near the top of the accumulated mass of ice particles in said bin and provide for boiling-like movement of the ice particles in said bin at a non-damaging rate sufficient to prevent fusing coherence therebetween, and ice particle vending means including a rotatable drum having an opening therein and being associated with said storage means and said delivery opening to deliver ice from said storage means for vending purposes.

5. In an ice making and vending machine including an insulated cabinet having an ice delivery opening in a face thereof, and ice particle forming means in said cabinet at the top thereof adapted to continuously supply ice particles for storage and vending purposes, the provision of ice particle storage means in said cabinet centrally thereof defining an area of substantial dimensions in which ice particles are accumulated for vending purposes, said storage means comprising an open top bin formed from an upper rectangular portion and a lower conical portion, ice particle delivery means extending from said ice particle forming means and including a chute which is downwardly directed into communication with said storage means to feed ice particles thereinto, ice particle moving means in the form of a centrally positioned and vertically directed auger in said storage means to impart motion to the ice particles therein to prevent coherence and fusion therebetween during storage, said auger extending through the bottom of the conical portion of said bin and being provided with a continuous helical blade for delivering ice particles upwardly from the bottom of said bin to uniformly spill the same near the top of the accumulated mass of ice particles in said bin and provide for boiling-like movement of the ice particles in said bin at a non-damaging rate sufficient to prevent fusing coherence therebetween, ice particle vending means including a rotatable drum having an opening therein and being associated with said storage means and said delivery opening to deliver ice from said storage means for vending purposes, and a drive arrangement for said auger and drum powered by a single source and arranged to drive said auger while periodically driving said drum.

6. The machine of claim 2 wherein said drum is mounted on centered pins for controlled rotation into and out of drum opening communication with a particle supply opening in said storage means near the bottom thereof and with said delivery opening.

7. The machine of claim 5 wherein said drum is mounted on centered pins for controlled rotation into and out of drum opening communication with a particle supply opening in said bin the bottom thereof and with said delivery opening, said particle supply opening being of substantial size relative to said drum opening and having associated therewith a resilient scraper blade a free margin of which rides the outer periphery of said drum to prevent ice particle by-passing of said drum and ice particle breaking during operation of said drum.

8. The machine of claim 3 wherein a coin operated means forms a part thereof and includes a drum operating circuit having a solenoid therein which is connected to a coupling shaft member drivingly connected to said drum, said coupling shaft being arranged for coupling with a continuously driven shaft upon operation of said solenoid which driven shaft is coupled with said single power source for continuous driving of said auger.

9. The machine of claim 5 wherein a coin operated means forms a part of said machine and includes a drum operative circuit having a solenoid therein which is connected to a coupling shaft member drivingly connected to said drum, said coupling shaft member being arranged

for coupling with a continuously driven shaft upon operation of said solenoid which driven shaft is coupled with said single power source for continuous driving of said auger.

10. The machine of claim 9 wherein said drum is mounted on centered pins, one of which is spring held for drum dismounting purposes for controlled rotation into and out of drum opening communication with a particle supply opening in said bin near the bottom thereof and a delivery chute aligned with said delivery opening, said particle supply opening being of substantial size relative to said drum opening and having associated therewith a resilient scraper blade a free margin of which rides the outer periphery of said drum to prevent ice particle by-passing of said drum and ice particle breakage during operation of said drum.

11. The machine of claim 3 which further includes a storage means fullness control comprising a pivotal plate in associated with the top surface of the accumulation of ice particles to move with the same upon increased accumulation and being operatively connected with said ice particle forming means to de-activate the same upon predetermined ice particle accumulation in said storage means.

12. The machine of claim 9 which further includes a bin fullness control comprising a pivotal plate in association with the top surface of the accumulation of ice particles to move with the same upon increased accumulation and being operatively connected with said ice particle forming means to de-activate the same upon pre-determined ice particle accumulation in said bin, and an empty bin control arrangement including weight sensing means operatively associated with the base of said bin to de-activate said vending means including said coin operated means upon reduction in ice particle accumulation in said bin to a pre-determined extent.

13. The machine of claim 10 which further includes a bin fullness control comprising a pivotal plate in association with the top surface of the accumulation of ice particles to move with the same upon increased accumulation and being operatively connected with said ice particle forming means to de-activate the same upon predetermined ice particle accumulation in said bin, and an empty bin control arrangement including weight sensing means operatively associated with the base of said bin to de-activate said vending means and said coin operated means upon reduction in ice particle accumulation in said bin to a pre-determined extent.

14. An ice particle storage and vending arrangement including a storage bin in which ice particles are accumulated for vending purposes, ice particle moving means in the form of a centrally positioned and vertically directed auger in said bin to impart circulatory-type motion to the ice particles therein to prevent coherence and fusion therebetween during storage, said storage bin being of substantially larger total area than that occupied by said auger therein to permit said circulatory-type motion, and ice particle vending means including a rotatable drum having an opening in the periphery thereof for alignment with a delivery opening in said bin for ice particle delivery purposes.

15. An ice particle storage and vending arrangement including a storage bin in which ice particles are accumulated for vending purposes, ice particle moving means in the form of a centrally positioned and vertically directed auger in said bin to impart circulatory-type motion to the ice particles thereof to prevent coherence and fusion therebetween during storage, an ice particle vending means including a rotatable drum having an opening in the periphery thereof for alignment with a delivery opening in said bin for ice particle delivery purposes, said auger extending through the bottom of said bin, and a drive arrangement for said auger and drum powered by a single source and arranged to drive said auger while periodically driving said drum.

16. An ice particle storage and vending arrangement including a storage bin in which ice particles are accumulated for vending purposes, ice particle moving means in the form of a centrally positioned and vertically directed auger in said bin to impart motion to the ice particles therein to prevent coherence and fusion therebetween during storage, ice particle vending means including a rotatable drum having an opening in the periphery thereof for alignment with a delivery opening in said bin for ice particle delivery purposes, and a drive arrangement for said auger and drum powered by a single source and arranged to continuously drive said auger while periodically driving said drum, said bin being provided with a lower conical portion through which said auger extends, said auger being provided with a continuous helical blade for deliverying ice particles upwardly from the bottom of said bin to uniformly spill the same onto the top of the accumulated mass of ice particles in said bin and provide for boiling-like movement of the ice particles in the bin at a non-damaging rate sufficient to prevent fusing coherence therebetween.

17. An ice particle storage arrangement adapted for use in ice making and vending machines, said arrangement including a storage bin having a bottom forming conical surface through which extends a driven auger received centrally within said bin and directed vertically upwardly therein, and means externally of said bin to drive said auger, said auger being provided with a continuous helical blade for delivering ice particles upwardly from the bottom of an accumulated mass of ice particles confined in said bin to uniformly spill the same onto the top of said accumulated mass of ice particles in said bin and provide for boiling-like movement of the ice particles in said bin at a non-damaging rate sufficient to prevent fusing coherence therebetween.

18. The method of storing fragile ice bodies in a given refrigerated area and preventing coherence or fusion between adjacent contacting ice bodies which comprises, continuously and slowly moving a centrally located mass of said ice bodies in an upwardly direction from the bottom of said area to the top thereof, spilling said mass at the top of said area radially outwardly from the center thereof in all directions relative thereto, and continuously moving ice bodies from the bottom of said area at the center thereof to define said centrally located mass for upward movement and cause gravitational downward movement of the spilled ice bodies towards the bottom of said area for recirculation.

19. The method of storing fragile ice bodies in a given refrigerated area and preventing coherence or fusion between adjacent contacting ice bodies which comprises continuously and slowly moving a centrally located mass of said ice bodies in an upwardly direction from the bottom of said area radially outwardly from the center thereof in all directions relative thereto, and continuously removing ice bodies from the bottom of said area at the center thereof to define said centrally located mass for upward movement and cause gravitational continuous downward movement of the spilled ice bodies towards the bottom of said area for recirculation, the movement of said ice bodies during complete circulation being sufficiently slow to prevent breakage while in addition preventing fusing coherence.

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