This invention relates generally to ice making, and more particularly to improvements in machines for making small pieces of ice suitable for use in drinks or the like.

There is known in the art machines for making ice by freezing water on the inside wall of a vertical cylinder and continuously scraping the ice from the inside vertical wall thereof by a rotating auger within the cylinder. The rotating auger raises the ice within the cylinder and discharges the ice at the upper end of the cylinder.

It is an object of the present invention to provide an ice making machine of the type stated in which the upper and lower ends of the auger-conveyor are journaled to maintain the auger accurately centered in the cylinder, thereby insuring its proper operation and reducing the possibility of damage to the auger or cylinder; and wherein the auger is quickly and easily removable as a unit through the upper end of the cylinder as, for instance, for purposes of cleaning, replacement, or repair.

It is a further object of the present invention to provide an ice making machine of the type stated in which the lower bearing remains fixed and centered within the cylinder when the auger is withdrawn therefrom. The bearing, furthermore, remains sealed or isolated from the freezing chamber of the cylinder irrespective of whether the auger is in or out of the cylinder, so that in either event bearing lubricant is prevented from contaminating the freezing chamber and water from the freezing chamber is prevented from contaminating the bearing lubricant.

It is another object of the present invention to provide a machine of the type stated in which the auger is driven from above the cylinder through a transmission, and wherein a seal is provided for the upper bearing to prevent lubricant that may seep out of the transmission from flowing into the bearing on the auger and into the freezing chamber of the cylinder.

The attainment of the above and further objects of the present invention will be apparent from the following specification taken in conjunction with the accompanying drawing forming a part thereof.

In the drawing wherein like reference characters indicate like parts throughout:

FIG. 1 is a vertical partial sectional view of an ice making machine constructed in accordance with and embodying the present invention; and

FIGS. 2, 3, 4 and 5 are fragmentary sectional views taken along lines 2-2, 3-3, 4-4 and 5-5 respectively of FIG. 1.

Referring now in more detail and by reference characters to the drawing, which illustrates a preferred embodiment of the present invention, A designates a machine for making ice which comprises a cylindrical tube 1 that forms the side wall of a vertically extending cylindrical freezing chamber 2. Surrounding the central portion of the tube 1 are evaporator coils 3 which extend over a substantial portion of the length of the tube 1 and terminate at inlet and outlet lines 4, 5 that are connected to a conventional refrigeration compressor and condenser (not shown). The tube 1 and its evaporator coils 3 are located within a heat insulating casing 6.

The upper end of the tube 1 has a shoulder 7 for receiving a flanged tube-mounting ring 8, and the tube-mounting ring 8 is brazed or soldered at 9 (FIG. 2) to the tube 1. The mounting ring 8 is secured to a rigid plastic plate 10 by a plurality of screw and nut assemblies 11. As seen in FIG. 1, the plate 10 may be secured to a support 13 in any suitable manner, for instance by bolt and nut assemblies 12. The support 13 may form part of a base or stand upon which the entire machine A may be mounted.

Rotateably mounted within the tube 1 and coaxial therewith is an auger or screw conveyor 14 which comprises a sleeve 15 having on its outer periphery a helical thread 16. The helical thread 16 extends above the top of the evaporator coils 3 and below the bottom thereof and is in close proximity to the interior surface of the tube 1. If desired, the auger may optionally have several threads 17 (three being shown) of smaller diameter than the thread 16 and of the same pitch as the thread 16 so as to form a multiple groove helical column of ice, and for purposes set forth in my co-pending application Serial No. 171,770, filed February 7, 1962, and to which reference may be had.

The sleeve 15 has a longitudinal bore 18 for receiving a coaxial drive shaft 19 which extends axially upwardly therethrough. The drive shaft 19 is coupled to the driven member of a power-driven conventional speed reducer 20. In accordance with the preferred form of the invention, the drive shaft 19 and speed reducer 20 may be considered as one unit so that the drive shaft 19 constitutes the output shaft of the speed reducer 20. The speed reducer 20 also has an input shaft 21 which may be directly or indirectly connected to an electric motor (not shown) either directly or through a belt and pulleys. As best seen in FIG. 2, the housing of the speed reducer 20 has a base flange 22 which has threaded holes 23, 23 for receiving screws 24, 24 which secure the speed reducer 20 to a plastic mounting plate 25 which, in turn, is secured to the plate 10 by bolt and nut assemblies 26, 26. The shaft 19 is suspended from the speed reducer by conventional means which includes a thrust bearing in the speed reducer for sustaining the pull of the shaft 19. The conveyor 14 is thus suspended from the speed reducer and extends downwardly therefrom into the tube 1.

Formed in the speed reducer housing is a downwardly opening cavity 28 that has a shoulder 30 for receiving a radial flange 32 that forms part of an upper bearing housing 34. The upper bearing housing 34 fits snugly, coaxially and removably within the upper end of the tube 1 and terminates in the tube 1 in a seat 36 that supports an upper bearing 38. This bearing 38 journals the drive shaft 19, centering same (and hence the auger 15) coaxially within the tube 1. A snap ring 40 is mounted in the upper bearing housing 34 and cooperates with the seat 36 to prevent axial displacement of the bearing 38. Interposed between the bearing 38 and the upper end of the auger sleeve 15 is a felt washer 42. An umbrella type rubber-like seal 44 surrounds the drive shaft 19 and is disposed across the upper end of the tube 1 and terminates in the tube 1 in a seat 36 that supports an upper bearing 38. This seal 44 prevents lubricant that may seep out of the speed reducer 20 along the drive shaft 19 from entering the tube 1 and contaminating the ice formed therein.

It will be noted that the flange 32 seats against the extreme axial upper end 48 of the tube 1, leaving space 50 between the plates 10, 25. This insures that the upper bearing housing 34 is centered with respect to the tube 1 despite variations in the dimensions of the plate 10, 25. The bolt and nut assemblies 26 need only be tightened to an amount sufficient to hold the plates 10, 25 in assembled relationship.

The drive shaft 19 is coupled to the sleeve 15 by a drive pin 52 that projects diametrically through the drive
shaft 19 and through slots 54, 54 at the bottom of the sleeve 15. The bottom of the sleeve 15 is, furthermore, diametrically reduced for receiving snugly a cup-shaped ring 56 that retains the pin 52 in the slots 54, 54.

Mounted at the bottom of the tumbler 1 is a lower bearing housing 58 that receives a lower bearing 60 and maintains the bearing 60 centered in the tube 1. The bearing housing 58 and bearing 60 are secured to the tube 1 by upper and lower retaining collars 62, 64. The upper retaining collar 62 rests upon a snap ring 66 while the lower retaining collar 64 forms an axial abutment for the bearing 60, the other axial end of the bearing 60 abutting a shoulder 68 in the bearing housing 58. A cap 70 closes the bottom end of the tube 1. The bearing housing 58, bearing 60, collars 62, 64, and cap 70 are removably secured together and to the tube 1 by a plurality of nut and bolt assemblies 72.

Frictionally fitted in and rotatable with the inner race 74 of the lower bearing 60 is a cylindrical socket-forming bearing sleeve 76 that coaxially, telescopically, and slidably receives the lower end of the drive shaft 19. A coil spring 78 is located within the sleeve 76 and is compressed by the lower end of the drive shaft 19 when the latter is mounted in the sleeve 19. The coil spring 78 has one end 79 thereof that fits in a diametrically extending slot 80 at the lower end of the drive shaft 19 so that the spring 78 will rotate with the drive shaft 19. Since the compressor pressure 78 exerts pressure upon the bottom of the sleeve 76, the driving force of the shaft 19 will be transmitted through the spring 78 to the sleeve 76, rotating the inner race 74 of the bearing 60. Thus, the lower bearing 60 journals the shaft 19 and maintains it centered within the tube 1.

The part of the bearing housing 60 that is within the tube 1 is formed with an external annular groove that receives a resilient O-ring 82 that provides a fluid tight seal between the bearing housing 58 and the inside wall of the tube 1 at the region of the O-ring 82. Also formed on the bearing housing 60 is an internal annular groove 84 that receives a U-cup resilient seal 86 that forms a fluid tight seal between the bearing housing 58 and the sleeve 76.

A water pipe 88, through which water may be introduced into the tube 1, is located above the bearing housing 58. A constant water level is maintained in the freezing chamber 2 in a conventional manner, as by a flow control valve (not shown), that level being maintained slightly below the top of the coils 3.

The bearing 60 may be packed with lubricant, and it is desirable that the water in the tube 1 be kept out of the bearing 60 and, similarly, it is desirable that the freezing lubricant be kept out of the freezing chamber 2 to avoid contamination of the ice. This is accomplished by the two sealing members 82, 86.

Adjacent to its upper end, the tube 1 is cut away to form an ice discharge opening 90 that opens into a discharge chute 92. As best seen in FIG. 3, a U-shaped sheet metal clamp 93 surrounds a portion of the tube 1 behind the discharge opening 90 and has flanges 94, 95. Companion flanges 96, 97 are formed on the inner end of the discharge chute 92, and screws 98, 99 pass through these to hold the clamp 93, 94, 95, 96, 97 to the discharge chute 92 onto the tube 1.

The upper ends of the helical thread 16 terminates substantially at the upper edge of the discharge opening 90, and the downwardly and outwardly presented surface 100 on the upper end of the thread 16 constitutes a helical abutment. When sleeve 15 rotates, the surface 100 will pass across the discharge opening 90.

When the machine is in use, water in the freezing chamber 2 freezes against the inside surface of the cylinder 1. The input shaft 21 operates through the speed reducer 20 to drive the shaft 19 which, in turn, rotates the screw thread 16 to scrape ice from the tube wall and convey it as a column of ice upwardly toward the discharge opening 90. The column of ice is continuously broken into smaller particles as it reaches any obstruction or its upper limit of travel, and is discharged into the chute 92 through the opening 90. It will be understood that the chute 92 conveys the ice to a suitable storage bin. The helical threads 17, if provided on the auger shaft 18, will assist in raising the column of ice upwardly toward the discharge opening 90.

It will also be noted from FIGS. 1 and 2 that the threads 16, 17 terminate below the extreme upper end of the auger 15, thus leaving, above the ends of the threads and below the extreme upper end of the auger 18, a cylindrical section 101 that is free of threads but is closely spaced from the inside wall of the tube cylinder 1. Therefore, during operation of the auger 15, the ice is prevented from reaching and exerting pressure on the washer 42 or housing 34. This prevents the formation of forces due to the ice at the upper end of the auger to tend to lift the conveyor 14 out of the tube 1. Likewise, the possibility of water entering the bearing 38 is reduced.

When it is necessary to clean the interior of the tube 1 or repair the auger-conveyor 14, it is relatively simple to disassemble the tube and bolt assemblies 26, 26, wherein the speed reducer 20, the plate 25, together with the drive shaft 19 and all parts mounted thereon, including the auger 14, bearing 38, and housing 34, may be lifted upwardly and bodily removed as a unit from the inside of the tube 1. The condenser coil 36, evaporator coils 3, and insulation 6, remain mounted on the support plate 10.

When the auger is removed from the tube 1, as aforesaid, the lower end of the drive shaft 19 will be retracted from the sleeve 76 allowing the spring 78 to expand. However, the sleeve 76, bearing 60, housing 58, and seals 82, 86 will remain in place. Therefore, irrespective of whether or not the auger 14 is in or out of the tube 1, seals 82, 86 prevent water from entering the bearing 60 and likewise prevent lubricant or other foreign matter around the bearing 60 from entering the freezing chamber 2. Furthermore, the bearing 60 and sleeve 76 (which in effect form part of the bearing 60) remain centered in the tube 1 to receive the drive shaft 19 when the auger is again reinserted into the tube 1. When the auger is first so reinserted, its initial rotation will cause the upper end of the spring 78 to shift into the slot 80 to provide the driving connection between the shaft 19 and spring 78.

Should disassembly of the bearing 60, housing 58, and associated parts be required, the screws 72 may be removed for that purpose.

In compliance with the requirements of the patent statutes, I have herein shown and described a preferred embodiment of the invention. It is, however, to be understood that the invention is not limited to the precise structure herein shown, the same being merely illustrative of the principles of the invention.

What is considered new and sought to be secured by Letters Patent is:

1. An ice making machine comprising a tube having an upper discharge end and a lower end, means forming a water supply inlet to the interior of the tube, refrigeration means surrounding the tube for freezing water inside of the tube, a concentric rotating shaft terminating at its lower end within the tube and having rotary ice scraping means in the tube for removing ice from the inside surface of the tube and delivering said ice toward and discharge end, means for removably suspending the conveyor in assembled relationship with the tube in a manner to enable the conveyor to be withdrawn as a unit through the upper end of the tube, means for centering the conveyor in the tube; said conveyor-centering means including a bearing assembly having a socket-forming member closed at its lower end and being sized for axial and rotatable sliding engagement with the lower end of the conveyor; means for retaining the bearing assembly in place upon removal of the conveyor from the tube, and means between the lower end of the conveyor and the lower end of the socket-forming member for imposing
pressure on each and establishing a driving connection between the two when the conveyor is in operative position within the tube.

2. An ice making machine comprising a tube having an upper discharge end and a lower end, means forming a water supply inlet to the interior of the tube, refrigeration means surrounding the tube for freezing water inside of the tube, a conveyor terminating at its lower end in the tube and having rotatable ice scraping means in the tube for removing ice from the inside surface of the tube and delivering said ice toward said discharge end, means for removable mounting the conveyor in assembled relationship with the tube in a manner to enable the conveyor to be withdrawn through the upper end of the tube; said conveyor-centering means including a bearing assembly having a sleeve centered in the tube for axial and rotatable sliding engagement with the lower end of the conveyor, said sleeve having an end closure wall that is axially downwardly beyond the lower end of the conveyor, and a spring interposed between said closure wall and the lower end of the conveyor for inhibiting motion between the sleeve and the lower end of the conveyor during operation of the conveyor.

3. An ice making machine comprising a tube having an upper discharge end and a lower end, means forming a water supply inlet to the interior of the tube, refrigeration means surrounding the tube for freezing water inside of the tube, a conveyor terminating at its lower end in the tube and having rotatable ice scraping means in the tube for removing ice from the inside surface of the tube and delivering said ice toward said discharge end, means for removable mounting the conveyor in assembled relationship with the tube in a manner to enable the conveyor to be withdrawn through the upper end of the tube, means including a bearing assembly at the lower end of the tube for centering the conveyor in the tube; said assembly including a housing, a bearing in the housing and having a sleeve coaxial with the conveyor for telescopic engagement with the lower end of the conveyor, a spring in the sleeve forming a driving connection between the conveyor and sleeve, means forming a closure for the lower end of the sleeve, and means in said housing forming a fluid seal with the tube and with the sleeve; and means for retaining the bearing assembly in place when the conveyor is withdrawn from the tube.

4. An ice making machine comprising a straight tube having an upper discharge end and a lower end, means forming a water supply inlet to the interior of the tube, refrigeration means surrounding the tube for freezing water inside of the tube, a conveyor extending into the tube from the upper end thereof and terminating at its lower end within the tube and being removable as a unit through the upper end of the tube; said conveyor including a rotatable screw for scraping ice from the inside surface of the tube and delivering said ice toward said discharge end and means for rotating said screw; said last mentioned means extending outwardly of the upper end of the tube for operative connection to a source of power, upper and lower bearing means in the tube for centering the upper and lower ends of the rotatable parts of the conveyor, means removable with the conveyor for supporting the thrust of the conveyor when it is within the tube, means forming a connection between the upper bearing means and the conveyor for removing the upper bearing means with the conveyor, means for maintaining the lower bearing means centered in the tube when the conveyor is withdrawn therefrom, said lower bearing means including a sleeve that receives the lower end of the conveyor, the lower bearing means also having a housing that telescopes with the tube, and sealing means in the housing for providing a fluid seal between the housing and the tube and between the housing and the sleeve.

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ROBERT A. O'LEARY, Primary Examiner.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,214,935

November 2, 1965

Armando F. Conto

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 63, for "and", second occurrence, read -- said --.

Signed and sealed this 19th day of July 1966.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents