

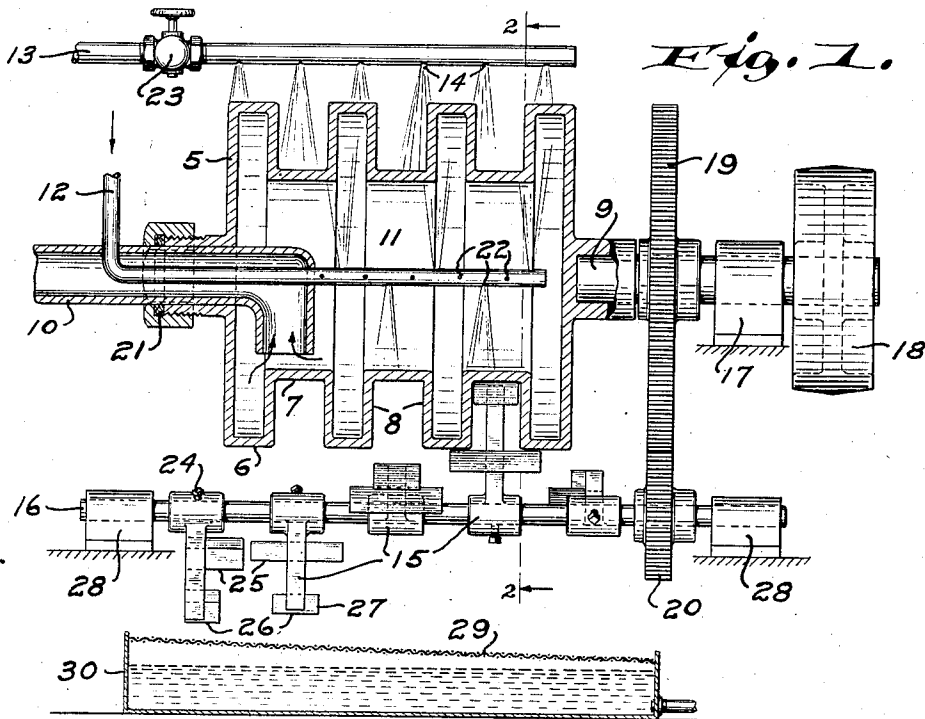
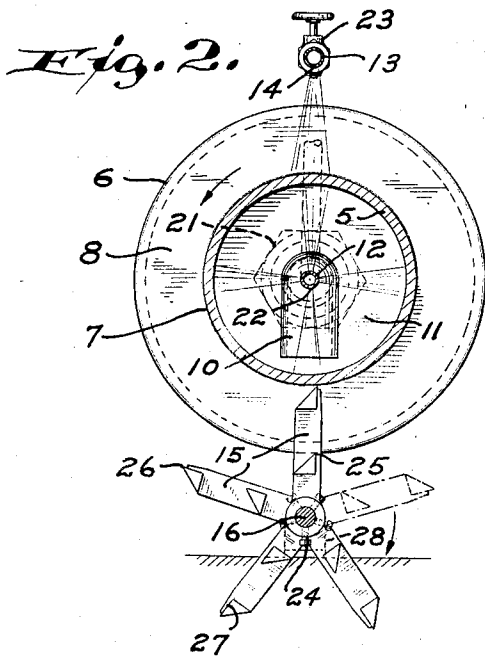
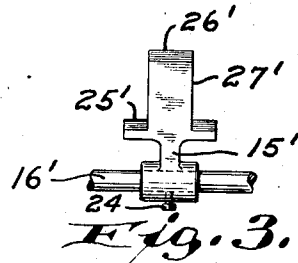
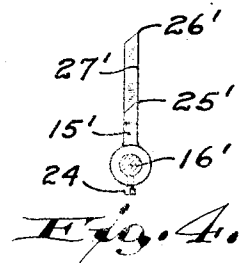
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ICE MACHINE

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ICE MACHINE

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10 Claims. (Cl. 62-106)

The present invention relates generally to improvements in the construction and operation of machines for congealing fluent substances and for constantly removing the congealed material from the cooling surfaces.

An object of the invention is to provide an improved ice machine which is simple and compact in construction, and which is, moreover, highly efficient in operation.

Another object of the invention is to provide an improved liquid congealing machine which may be conveniently actuated to automatically and continuously produce abundant quantities of congealed substance.

A further object of the invention is to provide an improved cooling unit wherein refrigerant may be most effectively applied to a relatively large but compactly arranged cooling surface.

Still another object of the invention is to provide improved mechanism for continuously and effectively removing congealed fluent substance from a cooling surface, with minimum effort.

An additional object of the invention is to provide an improved ice making machine which can be manufactured and operated at moderate cost.

Another object of the invention is to provide an improved rotary ice producing unit having relatively great capacity, which may be safely operated by a novice.

These and other objects and advantages will be apparent from the following specific description.

A clear conception of embodiments of the several features constituting the present improvement, and of the mode of constructing and operating ice machines built in accordance with the invention, may be had by referring to the drawing accompanying and forming a part of this specification, in which like reference characters designate the same or similar parts in the several views.

Fig. 1 is a somewhat diagrammatic central vertical longitudinal section through one of the improved ice making units, the normal enclosing casing having been omitted therefrom;

Fig. 2 is a transverse vertical section through the ice producing and removing portion of the unit, the section having been taken along the line 2-2 of Fig. 1;

Fig. 3 is a front elevation of a modified type of ice film removing implement; and

Fig. 4 is a side view of the implement shown in Fig. 3.

While the invention has been shown and described herein as being specifically applied in an

ice making machine for converting liquid into slush-ice, it is not intended to thereby restrict the scope of application of the improvement to such machines and uses, since the improved structure is obviously applicable with the same advantages to the congealment of other fluent substances.

Referring to Figs. 1 and 2 of the drawing, the improved ice making machine illustrated therein comprises, in general, a rotary main casing 5 having external substantially cylindrical outer and inner cooling surfaces 6, 7 connected by spaced, substantially plane cooling surfaces 8; a main shaft 9 drivingly connected to and supporting one end of the casing 5; a refrigerant exhaust or suction pipe 10 rotatably supporting the opposite end of the casing 5 and communicating with the internal chamber 11 formed by the casing; a refrigerant supply pipe 12 extending through the pipe 10 and axially into the chamber 11; one or more liquid supply pipes 13 having perforations 14 for spraying liquid upon the cooling surfaces 6, 7, 8; a series of revolving cutters or scrapers 15 mounted upon an auxiliary rotary shaft 16 and cooperable with the cooling surfaces 6, 7, 8 to remove the congealed liquid therefrom; and mechanism for driving the machine.

The main rotary casing 5 is preferably constructed as a relatively thin shell having substantially uniform thickness at the cooling surfaces 6, 7, 8, and the drive shaft 9 may be welded, or otherwise attached thereto. The shaft 9 is journaled in a bearing 17 and is rotatable by a pulley 18 secured to an end thereof, and the remainder of the driving mechanism comprises a gear 19 mounted on the shaft 9 and meshing with a pinion 20 secured to the auxiliary shaft 16 so as to drive the latter when the casing 5 is revolving. The end of the casing 5 which is journaled upon the exhaust pipe 10, is provided with a seal 21 for preventing escape of refrigerant from the chamber 11; and the end of the pipe 10 within the chamber 11 is preferably located as near to the bottom of this chamber as possible.

The refrigerant supply pipe 12 is preferably provided with a suitable control valve, and the delivery end of this pipe is provided with a multiplicity of radial orifices or holes 22 formed to spray the admitted refrigerant over the entire interior of the chamber 11. The liquid supply pipe 13 may also be provided with a suitable control valve 23 for regulating the quantity of liquid delivered to the cooling surfaces 6, 7, 8, and the extreme ends of the casing 5 may be

provided with insulation if so desired. The scrapers 15 may be adjustably secured to the auxiliary shaft 16 by means of set screws 24 and are provided with cutting edges 25, 26, 27, which are cooperable with the cooling surfaces 6, 7, 8, respectively; and the gearing connecting the shafts 9, 16 may be such that these shafts are rotated either in the same or in opposite directions, and either at the same or at differential speeds. As illustrated, these shafts are rotated in opposite directions, and the shaft 16 is driven at considerably higher speed than the driving shaft 9. The scrapers 15 may be spaced equidistant about the axis of the shaft 16, and this shaft may be journaled in fixed bearings 28 as shown.

The ice making unit is preferably housed within an enclosure, not shown, in order to prevent excessive loss of ice by melting, and the slush-ice removed from the cooling surfaces by the scrapers 15 may be caused to drop by gravity upon a screen 29. This screen 29 may be mounted upon a basin 30 for catching the excess liquid which is separated from the slush-ice by the screen 29, and means for mechanically removing the relatively dry ice particles from the screen 29 may also be provided.

During the normal operation of the improved ice machine shown in Figs. 1 and 2, the casing 5 is revolving in the direction indicated by the arrow in Fig. 2; and the scrapers 15 are being revolved in the opposite direction, as indicated by the arrow, and at somewhat higher speed, to cause the cutting edges 25, 26, 27 to coast with the cooling surfaces 6, 7, 8, respectively. Liquid refrigerant is being admitted in regulated quantities through the pipe 12 and is delivered into the cooling chamber 11 through the orifices 22, thereby maintaining the cooling surfaces 6, 7, 8 below freezing temperatures, at all times. The gaseous refrigerant, together with the oil and other impurities, are being withdrawn from the chamber 12 through the exhaust pipe 10, and liquid is being sprayed in regulated quantities from the holes 14 of the pipe 13, over the revolving surfaces 6, 7, 8. As this liquid strikes the cooling surfaces, films of ice are formed upon the latter, and the revolving scrapers 15 constantly remove portions of these films. By virtue of the fact that both the casing 5 and the cutters or scrapers 15 are revolving, these cutters will describe substantially cycloidal successive paths upon the plane surfaces 8 and will cut a succession of notches in the annular films of ice upon the surfaces 6, 7. By operating the cutter rotor at higher speed than the speed of rotation of the casing 5, all portions of the successive films will ultimately be subjected to the cutting or scraping action and will be removed from the casing 5. The removed ice, together with excess liquid, drops by gravity upon the screen 29, where the excess liquid is drained into the receptacle 30, and from which the relatively dry ice particles may be removed in any convenient manner.

If so desired, the revolving cutter or scrapers 15 of Figs. 1 and 2 may be replaced by fixed scrapers 15', as shown in Figs. 3 and 4. These fixed scrapers 15' are adjustably mounted upon a fixed shaft 16' and have scraping edges 25', 26', 27', which are cooperable with the revolving casing surfaces 6, 7, 8, respectively. By fixedly mounting the scrapers 15', the scraping edges completely remove the entire ice films from the surfaces 6, 7, 8 during each revolution

of the casing 5, so that greater care must be exercised in the delivery of liquid to these cooling surfaces, than is necessary with the revolving scraper structure of Figs. 1 and 2. If the films are permitted to become relatively thick, the scrapers 15' will be subjected to enormous strains and excessive power will be required to revolve the casing 5. Aside from the scraper formation shown in Figs. 3 and 4, the machine would be otherwise substantially the same as shown in Figs. 1 and 2; and it is to be noted that in order to effectively utilize the scrapers of Figs. 3 and 4, the casing 5 should be revolved in a direction opposite to that indicated in Fig. 2.

From the foregoing description it will be apparent that the present invention provides an improved ice making unit which is simple, compact, and durable in construction and which is, moreover, highly efficient in operation. By forming the casing 5 as shown, relatively large cooling surfaces are made available in a rotor of limited dimensions, and the injection of the refrigerant by means of a perforated pipe 12, as shown, insures most efficient distribution of the cooling medium within the chamber 11. While the scraper structure of Figs. 1 and 2 reduces the power consumption to a minimum, the structure of Figs. 3 and 4 is somewhat less complicated and will more rapidly remove the successive films from the casing 5. The capacity of the machine may be readily varied by varying the rate of revolution of the casing 5, and by regulating the quantity of liquid supplied through the pipe 13, and the quantity of refrigerant delivered to the chamber 11; and the improved machine may be readily operated by a novice and is entirely automatic in operation when proper adjustments have been made.

It should be understood that it is not desired to limit the invention to the exact details of construction and to the precise mode of operation herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. In combination, a casing rotatable about an axis and having external annular cooling surfaces, means for cooling said surfaces, means for delivering liquid to said surfaces, and a series of revoluble cutters driven by said casing and cooperable with said surfaces to remove congealed material therefrom.

2. In combination, a rotary casing forming a chamber and having a series of external annular cooling surfaces, means for admitting refrigerant to said chamber, means for delivering liquid to said cooling surfaces, and a revolving cutter having a series of cutting edges successively cooperable with said surfaces to remove congealed material therefrom.

3. In combination, a rotary casing forming a chamber and having an external cooling surface, means for delivering refrigerant centrally axially into said chamber throughout the entire length thereof, means extending adjacent the chamber wall for removing spent refrigerant peripherally therefrom, means for delivering fluent substance to said cooling surface, and means for removing congealed material from said surface.

4. In combination, a rotary casing forming a chamber and having an external cooling surface, means for delivering refrigerant centrally

into said chamber and for removing spent refrigerant peripherally therefrom, means for delivering fluent substance to said cooling surface, and a revolving cutter for removing congealed material from said surface during rotation of said casing.

5. In combination, a rotary casing having annular cooling surfaces of different diameters and intervening substantially plane cooling surfaces, means for cooling said surfaces, means for delivering fluent substance to said surfaces, and means traveling in a substantially cycloidal path for removing congealed material from said surfaces.

6. In combination, a casing rotatable about an axis and having external annular cooling surfaces, means for cooling said surfaces, means for delivering liquid to said surfaces, and a series of angularly separated cutters movable about a common axis and cooperable with said surfaces to remove congealed material therefrom.

7. In combination, a rotary casing having substantially cylindrical and substantially plane external cooling surfaces, means for cooling said surfaces, means for delivering fluent substance to said surfaces, a plurality of revoluble cutters for removing congealed material from both the cylindrical and plane surfaces, a common mount-

ing for said cutters, and means for simultaneously driving the casing and cutter mounting.

8. In combination, a casing having an external cooling surface rotatable about an axis in one direction, means for cooling said surface, means for delivering liquid to said surface, and a cutter cooperable with said surface to remove congealed liquid therefrom, said cutter being rotatable by said casing in the opposite direction.

9. In combination, a casing having an external plane cooling surface rotatable in one direction about an axis disposed perpendicular to said surface, means for cooling said surface, means for delivering liquid to said surface, and a cutter removable along said surface to remove congealed liquid therefrom, said cutter being rotatable about a different axis by said casing and in the opposite direction.

10. In combination, a casing having a series of parallel external plane cooling surfaces rotatable in one direction about an axis extending perpendicular to said surfaces, means for cooling said surfaces, means for delivering liquid to said surfaces, and cutters movable along said surfaces to remove congealed liquid therefrom, said cutters being rotatable about a different axis and in the opposite direction.

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