

May 14, 1935.

C. T. WALTER
HEAT EXCHANGE DEVICE

2,001,084

Filed July 9, 1934

2 Sheets-Sheet 1

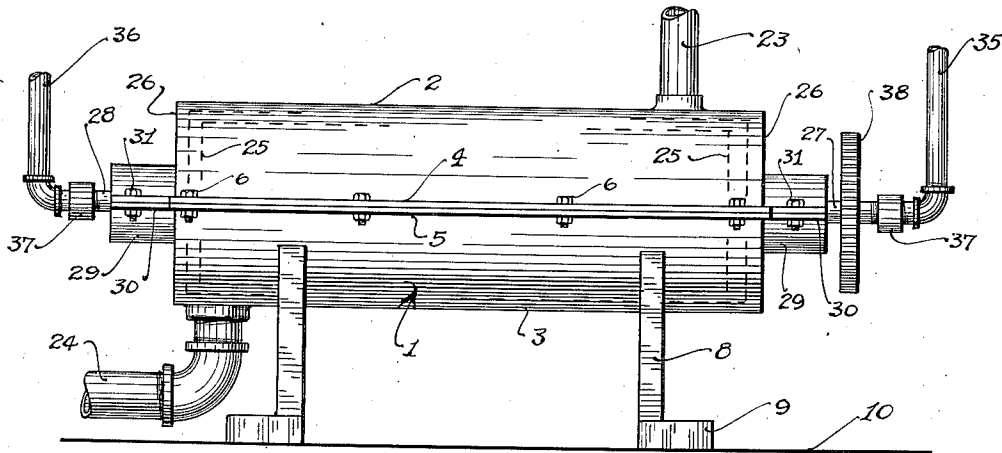


Fig. 1

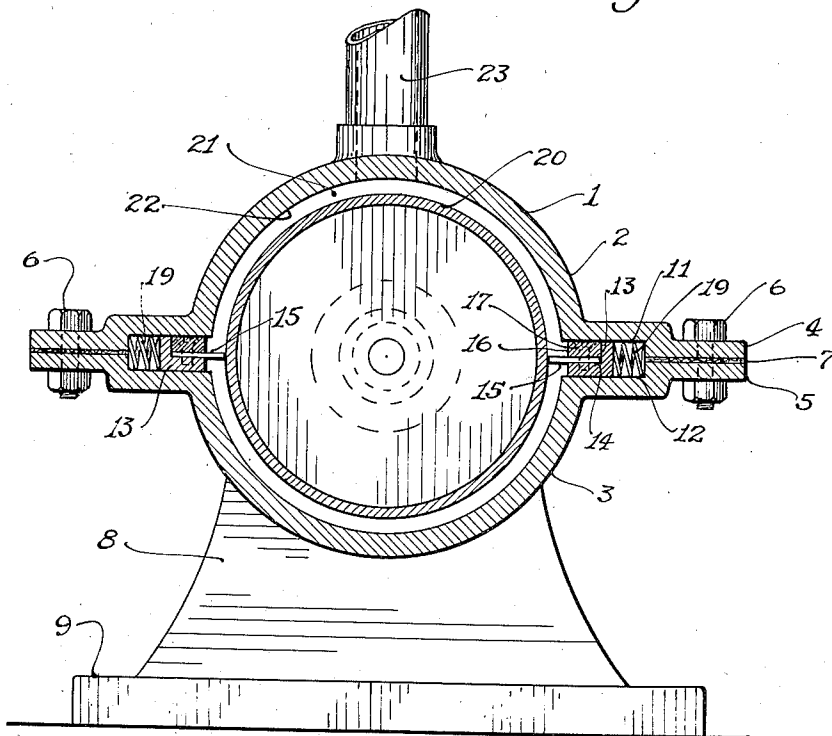


Fig. 2

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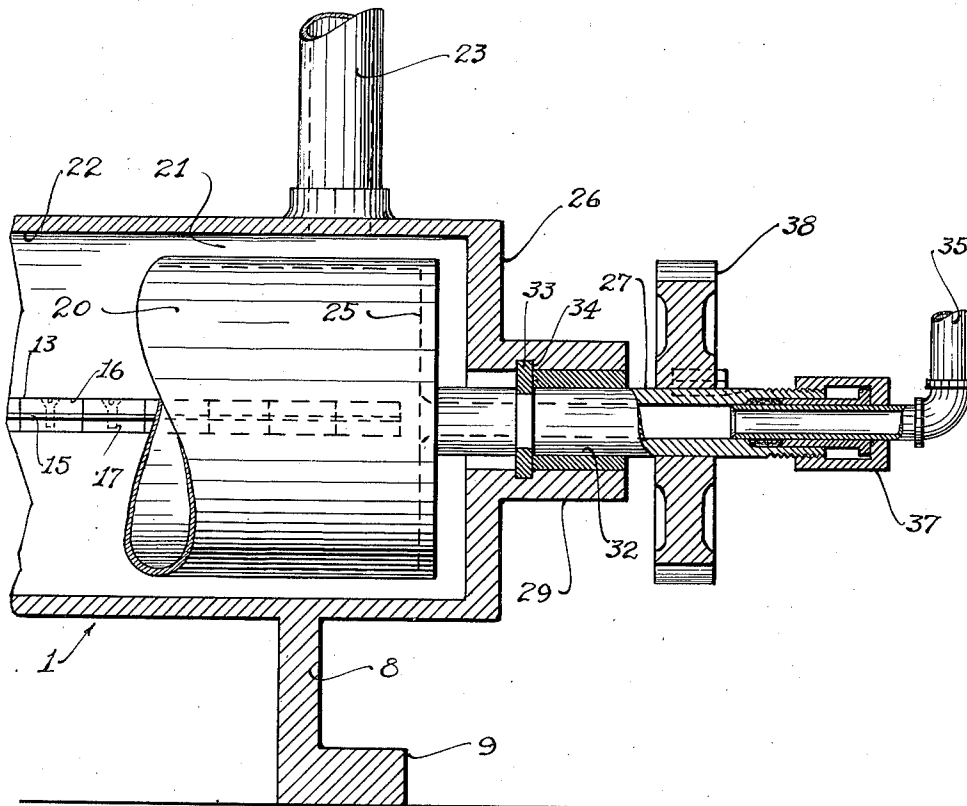


Fig. 3

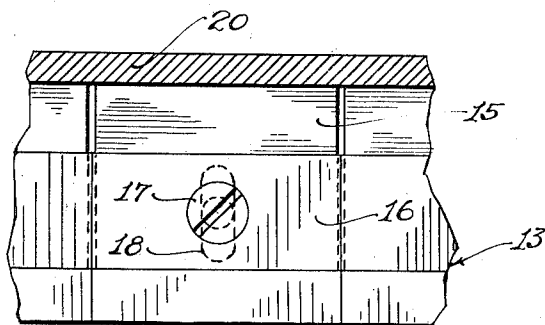


Fig. 4

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UNITED STATES PATENT OFFICE

2,001,084

HEAT EXCHANGE DEVICE

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Application July 9, 1934, Serial No. 734,263

16 Claims. (Cl. 257—96)

The invention relates to a heat exchange device for chilling fluid products, such as shortening, ice cream, etc.

The object of the invention is to provide a simple, practical and efficient heat exchange device of strong, durable and comparatively inexpensive construction designed for chilling fluid products, such as shortening, ice cream, and the like and having a refrigerating medium located entirely within the mass to be chilled, and provided with a relatively small space to be occupied by the product or material to be chilled, whereby the travel of the product through the refrigerating device during the chilling operation will be comparatively rapid, and at the same time the refrigerating medium will be prevented from coming in contact with the casing or housing of the refrigerating device so that practically no refrigerating losses will occur and the necessity of insulating the entire device obviated particularly when the device is employed for chilling products which are discharged from the device at or above the temperature of the surrounding atmosphere.

A further object of the invention is to provide a heat exchange device of this character in which the heat exchange will take place interiorly of the refrigerating device or heat exchange device and in which the heat exchange or refrigerating surfaces will be maintained clean of any frozen product which might through insulation interfere with the heat transfer, whereby the heat exchange device will be maintained at maximum efficiency at all times.

With these and other objects in view, the invention consists in the construction and novel combination and arrangement of parts herein-after fully described, illustrated in the accompanying drawings and pointed out in the claims hereto appended, it being understood that various changes in the form, proportion and minor details of construction, within the scope of the claims, may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:

Fig. 1 is a side elevation of the heat exchange device constructed in accordance with this invention.

Fig. 2 is a transverse sectional view of the same.

Fig. 3 is a longitudinal sectional view through one end of the heat exchange device.

Fig. 4 is a detail view showing slots in the scraper blades which may be provided for adjustment.

In the accompanying drawings in which is illustrated the preferred embodiment of the invention the heat exchange device which is designed for chilling such products as shortening, ice cream, and similar fluid material, comprises in its construction an outer casing or housing 1 of cylindrical form divided horizontally into upper and lower semi-cylindrical sections 2 and 3 provided at opposite sides with extended horizontal flanges 4 and 5 pierced at their outer portions by vertical bolts 6 which firmly and securely clamp the upper and lower sections together, as clearly illustrated in Fig. 2 of the drawings. Gaskets 7 are preferably interposed between the outer portions of the flanges 4 and 5 to provide a liquid tight joint for effectually preventing the escape of any liquid at the sides of the casing. The lower section 3 is preferably provided adjacent its ends with vertical legs 8 having horizontal feet 9 at the lower ends adapted to rest upon a suitable base 10. The base 10 may be of any desired construction and the legs may or may not be secured to the same as desired.

The horizontal flanges 4 and 5 are provided at their inner portions with registering longitudinal recesses 11 and 12 preferably formed by offsetting the flanges vertically and centrally in a longitudinal direction but the recesses may be formed in any desired manner and they provide horizontally longitudinally disposed guideways in the opposite side walls of the housing for the reception of scraper blade holders 13.

The scraper blade holders 13 which are slidably mounted in the horizontal guideways formed by the recesses 11 and 12 are provided in their upper faces at their inner portions with recesses 14 providing seats for scraper blades 15. The scraper blades are firmly and adjustably secured on their seats by clamping members 16 fitting the recesses 14 and secured to the slidable scraper blade holders by screws 17. The screws 17 pierce the clamping members 16 and are threaded into the scraper blade holders, as clearly illustrated in Fig. 2 of the drawings. The scraper blades are preferably provided with slots 18 to permit an adjustment of the scraper blades but the slots may be omitted and the adjustment may be effected by coiled springs 19 interposed between the slidable scraper blade holders and the outer vertical walls of the recesses and adapted to urge the

holders and the scraper blades inwardly for maintaining the scraper blades in contact with a hollow cylindrical rotor 20. The springs 19 by forcing the scraper blades inwardly to maintain the scraper blades in contact with the rotor 20 automatically take up the wear and the springs may be of sufficient strength to cause the scraper blades to properly function until they are worn down to such an extent as to require renewal. When, however, slots are employed in the scraper blades the scraper blades may be adjusted with reference to the scraper blade holders, as will be readily understood.

The hollow cylindrical rotor constitutes a refrigerating or heat exchange element and it is arranged within the casing 1 concentric therewith and it is of a diameter to provide a relatively narrow space 21 between it and the inner face 22 of the outer casing 1 for causing the product to be chilled to completely envelop the rotary heat exchange member in a relatively thin sheet so that the velocity of travel of the product through the chilling device may be comparatively rapid. The outer casing is provided adjacent one end at the top with an inlet pipe 23 by means of which the fluid product to be chilled is introduced into the chilling device and the said casing 1 is provided at the bottom adjacent the other end of the device with an outlet pipe 24 for the discharge of the chilled product. The material is pumped into and out of the casing and as any suitable pumping means may, of course, be employed, illustration thereof is deemed unnecessary.

The ends 25 of the rotary cylindrical heat exchange element are spaced from the ends 26 of the casing 1 and in practice the inner face of the casing and the outer face of the rotor will be machined. The rotor or rotary heat exchange element is provided at its ends with hollow trunnions 27 and 28 which are journaled in tubular extensions 29 of the housing 1.

The tubular extensions 29 are divided horizontally into upper and lower sections similar to the body portion of the housing or casing 1 and are provided with horizontal flanges 30 forming extensions of the flanges 4 and 5 of the upper and lower sections 2 and 3 of a casing and firmly clamped together by bolts 31. The tubular extensions 29 are provided with suitable bearings 32 and with an oil ring 33 located at the inner end of each bearing and arranged in an annular groove 34 of the tubular extension 29 and adapted to prevent liquid from the interior of the chilling device from seeping into the bearing and also for preventing the lubricant of the bearing from entering the interior of the casing 1.

The refrigeration medium which may consist of brine or any other refrigerant is pumped into the hollow rotary cylindrical refrigerating element through an inlet pipe 35 and is discharged from the refrigerating or heat exchange element through an outlet pipe 36, a suitable stuffing box 37 being provided at each end of the chilling device for connecting the rotary heat exchange member with the inlet and outlet pipes.

The hollow cylindrical heat exchange rotor may be driven by any suitable mechanism, a gear wheel 38 constituting an element thereof being shown keyed to the hollow trunnion 27 which is preferably of greater length than the hollow trunnion 28 to provide a space for the mounting of the driven gear 38.

When the hollow cylindrical rotor is rotated

in the operation of the chilling device any frozen product which may adhere to the rotor and tend to insulate the same and interfere with the efficiency of the chilling device is scraped from the outer surface of the rotor by the scraping blades and the chilling device is maintained at all times at maximum efficiency. The heat exchange takes place at the outer surface of the hollow cylindrical rotor, the rotor being completely enveloped by a relatively thin sheet of the fluid product to be chilled. This enables the fluid product to be passed through the chilling device at a velocity which is comparatively rapid and at the same time the fluid product is interposed between the heat exchange rotor and the casing so that no refrigeration losses can take place. For this reason the outer shell or casing need not be insulated, at least for chilling some products for which the discharge temperature may be above that of the surrounding atmosphere. The fluid material circulates freely around the rotor and other portions of the guideways or slots formed by the recesses 11 and 12. The longitudinal recesses terminate short of the ends of the rotor, as clearly illustrated in Fig. 3 of the drawings. The product as rapidly as it tends to freeze on the surface of the rotor is scraped therefrom by the scraper blades and is immediately replaced by a quantity of unchilled material and while the scraping blades maintain the heat exchange rotor at maximum efficiency they also provide for a rapid operation of the chilling device due to this constant removal of the chilled product from the rotor and the rapid replacing of the chilled product by a quantity of the unchilled material.

The space which may be occupied by the fluid to be chilled is comparatively small and the product being chilled is distributed throughout the entire external area of the heat exchange rotor in a relatively thin enveloping sheet. The scraper blades are readily accessible for replacement or adjustment by the removal of the upper section or half of the casing 1.

What is claimed is:

1. A heat exchanger for chilling fluid products including an outer casing having an inlet and an outlet for the passage of the product into and out of the casing, a hollow rotor mounted within the casing and spaced therefrom to form a narrow intervening space for enveloping the rotor within a thin sheet of the product to be chilled, means for introducing a refrigeration medium into the rotor, means for removing it therefrom, and means operating within the narrow intervening space between the rotor and the outer casing for removing frozen material from the surface of the rotor whereby the same is maintained at maximum efficiency.

2. A heat exchanger for chilling fluid products including an outer casing having an inlet and an outlet for the passage of the product into and out of the casing, a hollow rotor mounted within the casing and spaced therefrom to form a narrow intervening space for enveloping the rotor within a thin sheet of the product to be chilled, means for introducing a refrigeration medium into the rotor, means for removing it therefrom, and a scraper blade operating in the narrow intervening space between the rotor and the outer casing and arranged to remove frozen product from the surface of the rotor whereby the latter is maintained at maximum efficiency and a rapid chilling of the product effected.

3. A heat exchanger for chilling fluid products

including an outer casing having an inlet and an outlet for the passage of the product into and out of the casing, a hollow rotor mounted within the casing and spaced therefrom to form a narrow intervening space for enveloping the rotor within a thin sheet of the product to be chilled, means for introducing a refrigeration medium into the rotor, means for removing it therefrom, a scraper blade slidably mounted within the casing and operating in the narrow space between the casing and the rotor, and yieldable means for automatically maintaining the scraper blade in contact with the rotor whereby frozen product is removed from the surface of the rotor and a maximum efficiency of the latter is maintained.

4. A heat exchanger for chilling fluid products including a cylindrical outer casing provided with an inlet and an outlet for introducing the product to be chilled into the casing and for removing it therefrom, a hollow cylindrical heat exchange rotor mounted within the casing concentric therewith and spaced slightly therefrom to provide a narrow intervening space between the cylindrical casing and the rotor, means for introducing a refrigeration medium into the rotor, means for removing it therefrom, and spring actuated slidably mounted scraper blades located at opposite sides of the casing and automatically maintained in constant contact with the rotor for removing frozen product therefrom whereby the heat exchange rotor is maintained at maximum efficiency.

5. A heat exchanger for chilling fluid products comprising an outer casing provided with a longitudinal guideway, a hollow heat exchange rotor mounted within the casing, means for introducing a refrigeration medium into the rotor, means for removing it therefrom, said rotor being spaced from the casing to provide a narrow intervening space for the product to be chilled, a slidable scraper blade holder operating in the said guideway and provided with a scraper blade engaging the rotor for removing frozen product therefrom, and spring means located within the said guideway and actuating the scraper blade holder for yieldably and automatically maintaining the scraper blade in its engagement with the rotor.

6. A heat exchanger for chilling fluid products comprising an outer cylindrical casing divided longitudinally into separable sections and provided with projecting flanges at the margins of the sections, said flanges being provided at their outer portions with attaching means and having recesses at their inner portions forming guideways, a hollow heat exchange rotor mounted within the outer casing, means for introducing a refrigeration medium into the rotor, means for removing it therefrom, scraper blade holders slidable in the guideways of the said outer casing and provided with scraper blades operating in the intervening space between the rotor and the outer casing, and means for urging the scraper blade holders inwardly for maintaining the scraper blades in contact with the rotor for removing frozen product therefrom to maintain the rotor at maximum efficiency.

7. A heat exchanger for chilling fluid products including an outer cylindrical casing divided horizontally into upper and lower sections and provided with marginal horizontal flanges having attaching means at their outer portions and provided at their inner portions with regis-

tering recesses, a hollow cylindrical rotor mounted within the outer casing and spaced therefrom and provided with an inlet and an outlet for the introduction and removal of a refrigeration medium, scraper blade holders slidably mounted in the recesses of the outer casing and provided with scraper blades extending into the intervening space between the rotor and the outer casing, and spring means mounted within the casing and engaging the scraper blade holders for maintaining the scraper blades in engagement with the rotor.

8. A heat exchanger for chilling fluid products comprising an outer cylindrical casing having an inlet and an outlet for the product to be chilled, a hollow cylindrical rotor arranged within the outer casing and spaced therefrom at its circumference, the ends of the casing being spaced from the casing to provide an intervening space between the rotor and the outer casing for causing the rotor to be completely enveloped in the product to be chilled, said casing being provided with a longitudinal guideway terminating short of the ends of the rotor, a scraper blade located at the said guideway and engaging the rotor for removing frozen product therefrom, means located within the guideway for slidably mounting the scraper blade and means for maintaining the same constantly in engagement with the rotor.

9. A heat exchanger for chilling fluid products including a cylindrical outer casing divided horizontally into upper and lower sections and provided at its ends with tubular extensions, means for introducing a fluid product into the casing, means for removing it therefrom, a hollow cylindrical heat exchange rotor having hollow trunnions journaled in the tubular extensions of the outer casing and forming an inlet and an outlet for a refrigeration medium, inlet and outlet pipes for the refrigeration medium, and stuffing boxes connecting the inlet and outlet pipes with the hollow trunnions.

10. A heat exchanger for chilling fluid products including a cylindrical outer casing divided horizontally into upper and lower sections and provided at its ends with tubular extensions, means for introducing a fluid product into the casing, means for removing it therefrom, a hollow cylindrical heat exchange rotor having hollow trunnions journaled in the tubular extensions of the outer casing and forming an inlet and an outlet for a refrigeration medium, inlet and outlet pipes for the refrigeration medium, and an oil ring arranged within each of the tubular extensions of the outer casing and adapted to prevent liquid from the casing seeping into the bearing and for preventing lubricant from entering the interior of the casing.

11. A heat exchanger for chilling fluid products comprising a cylindrical outer casing divided horizontally into upper and lower sections and provided adjacent its ends with inlet and outlet pipes located respectively at the top and bottom of the casing, said casing being also provided at its ends with tubular extensions having bearings, a hollow cylindrical heat exchange rotor located within the outer casing in spaced relation with the same and having hollow trunnions journaled in the bearings of the tubular extensions of the casing and forming an inlet and an outlet for a refrigeration medium, one of the hollow trunnions being extended and provided with a driven element for rotating the rotor, inlet and outlet pipes, and stuffing boxes

connecting the last mentioned inlet and outlet pipes with the hollow trunnions.

12. A heat exchanger for chilling fluid products including an outer casing having an inlet and an outlet for the passage of the product into and out of the casing, a hollow rotor mounted within the casing and spaced therefrom to form an intervening space for enveloping the rotor within a sheet of the product to be chilled, means for introducing a refrigeration medium into the rotor, means for removing it therefrom, and means operating within the intervening space between the rotor and the outer casing for removing frozen material from the surface of the rotor whereby the same is maintained at maximum efficiency.

13. A heat exchanger for chilling fluid products including an outer casing having an inlet and an outlet for the passage of the product into and out of the casing, a hollow rotor mounted within the casing and spaced therefrom to form an intervening space for enveloping the rotor within a sheet of the product to be chilled, means for introducing a refrigeration medium into the rotor, means for removing it therefrom, and a scraper blade operating in the intervening space between the rotor and the outer casing and arranged to remove frozen product from the surface of the rotor whereby the latter is maintained at maximum efficiency and a rapid chilling of the product effected.

14. A heat exchanger for chilling fluid products including an outer casing having an inlet and an outlet for the passage of the product into and out of the casing, a hollow rotor mounted within the casing and spaced therefrom to form an intervening space for enveloping the rotor within a sheet of the product to be chilled, means for introducing a refrigeration medium into the rotor, means for removing it therefrom, a scraper blade slidably mounted within the cas-

ing and operating in the space between the casing and the rotor, and yieldable means for automatically maintaining the scraper blade in contact with the rotor whereby frozen product is removed from the surface of the rotor and a maximum efficiency of the latter is maintained.

15. A heat exchanger for chilling fluid products including a cylindrical outer casing provided with an inlet and an outlet for introducing the product to be chilled into the casing and for removing it therefrom, a hollow cylindrical heat exchange rotor mounted within the casing concentric therewith and spaced slightly therefrom to provide an intervening space between the cylindrical casing and the rotor, means for introducing a refrigeration medium into the rotor, means for removing it therefrom, and spring actuated slidably mounted scraper blades located at opposite sides of the casing and automatically maintained in constant contact with the rotor for removing frozen product therefrom whereby the heat exchange rotor is maintained at maximum efficiency.

16. A heat exchanger for chilling fluid products comprising an outer casing provided with a longitudinal guideway, a hollow heat exchange rotor mounted within the casing, means for introducing a refrigeration medium into the rotor, means for removing it therefrom, said rotor being spaced from the casing to provide an intervening space for the product to be chilled, a slidably scraper blade holder operating in the said guideway and provided with a scraper blade engaging the rotor for removing frozen product therefrom, and spring means located within the said guideway and actuating the scraper blade holder for yieldably and automatically maintaining the scraper blade in its engagement with the rotor.

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