

Nov. 4, 1958

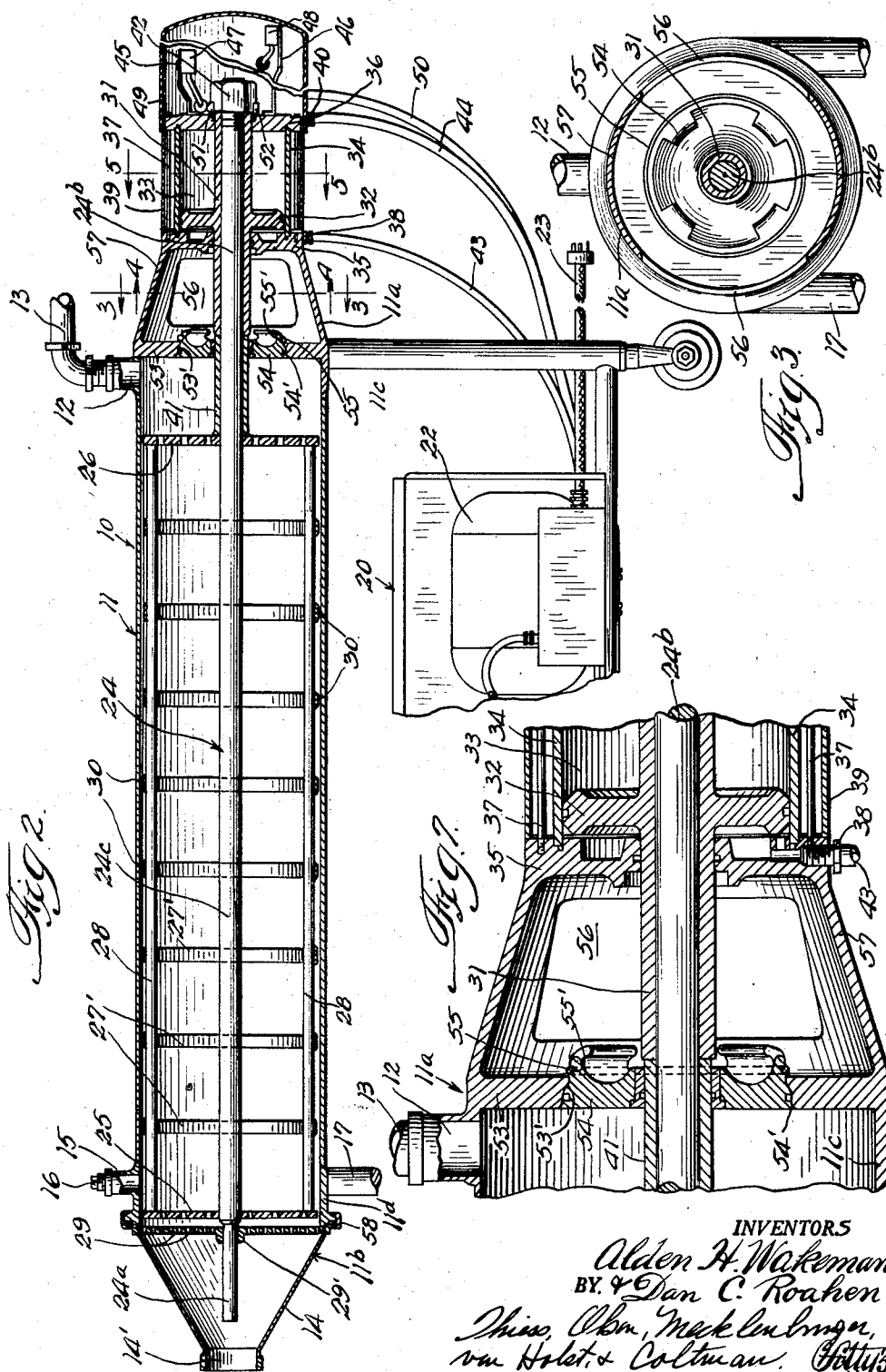
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2,859,018

APPARATUS FOR TREATMENT OF READILY SOLIDIFIABLE LIQUIDS

Filed March 18, 1954

2 Sheets-Sheet 2



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APPARATUS FOR TREATMENT OF READILY SOLIDIFIABLE LIQUIDS

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Application March 18, 1954, Serial No. 417,005

4 Claims. (Cl. 259—4)

This invention relates to an apparatus for the treatment of readily solidifiable liquids during crystallization of the latter.

In the processing of many diversified culinary and nonculinary materials, it is desirable and oftentimes essential that the resulting product be possessed of a stable homogeneity and a smooth pleasing texture. Among the materials included within the culinary class are oils, fats, lard, shortenings, greases, margarines, and the like; and those included within the nonculinary class are paraffins, soaps, waxes, and the like. To attain a resulting product possessed of the aforementioned desired characteristics, it is necessary that the crystallization of the resulting product be controlled so that large crystalline masses will not be formed. Furthermore, it is necessary that sufficient crystallization of the product should have occurred during the processing operation so that the resulting product will be in a state of substantially stable homogeneity thereby facilitating storage and packaging of such product.

Various types of apparatus to control the crystallization of a culinary or nonculinary material have heretofore been proposed which, however, have met with but limited success. This limited success is believed due in part to the fact that the material, when passing under pressure through an elongated hollow receiver, undergoes such rapid solidification that extreme difficulty is encountered in forcing the material through the discharge end of the receiver.

A further disadvantage associated with prior apparatus of this type, is that the material, when passing through the receiver during which crystallization occurs, is normally in a substantially quiescent state thereby facilitating rapid growth of large crystalline masses. The material prior to being discharged from the receiver, in most of the prior apparatus, is caused to pass through a foraminous member wherein the formed crystalline masses are broken up. Because of the fact that the material is caused to pass through the foraminous member, the material cannot be permitted to crystallize beyond a certain stage otherwise the foraminous member will be subjected to such strain and pressure that it is likely that either such member or some other part of the apparatus will give way and result in serious damage to the apparatus. To rectify this latter condition, the material is permitted only partially to crystallize prior to being discharged from the receiver through such a foraminous member with the result that the discharged material is in a relatively unstable state, thereby complicating to a considerable degree the subsequent packaging and shaping operations to which the discharge product is subjected. A second proposed way of rectifying to some extent this problem of rapid crystallization was to utilize a pair of meshing gears disposed within the receiver adjacent the foraminous member whereby the crystalline masses, formed while the material was in a quiescent state, were broken up prior to the material passing through such foraminous member. Notwithstanding the utilization of these power-driven gears, which rotated about fixed axes within the receiver, it was

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essential that only partial crystallization of the material occur, otherwise the texture of the resulting emulsified material would be relatively coarse and/or the strain on the gears as well as the foraminous member would be excessive.

Thus, it is an object of this invention to provide an apparatus which will enable a readily solidifiable liquid or material to undergo substantial crystallization thereof before being discharged from the apparatus, without large crystalline masses being formed by the liquid or material within the apparatus which would cause undue strain on any part of the apparatus or which would produce a resulting product possessed of undesirable characteristics.

It is a further object of this invention to produce an apparatus which permits accurate control of crystallization of the material or liquid while the latter is passing through said apparatus.

It is a still further object of this invention to provide an apparatus through which a readily solidifiable material or liquid passes during crystallization thereof while in a state of substantially continuous agitation, thereby facilitating passage of the material or liquid therethrough.

It is a still further object of this invention to provide an apparatus which is sturdy and simple in construction and yet capable of being readily disassembled and assembled to permit cleaning.

Further and additional objects will appear from the description, accompanying drawings, and appended claims.

In accordance with one embodiment of this invention, an apparatus for the treatment of a readily solidifiable liquid during crystallization of the latter is provided comprising an elongated tubular receiver into which said liquid under pressure is introduced at one end thereof and discharged therefrom at the opposite end thereof. Mounted in a fixed position within the receiver, adjacent the discharge end thereof, and disposed transversely with respect to the longitudinal axis thereof is a foraminous member through which the liquid is caused to pass. Mounted for reciprocatory movement within the receiver and disposed intermediate the intake end of the receiver and the foraminous member is a liquid-agitating unit. The unit includes a pair of perforated plates disposed in spaced coaxial relation and a plurality of collars positioned intermediate said perforated plates and arranged in spaced coaxial relation; the plates and collars being operatively connected to one another to reciprocate as a unit. The outer periphery of each of the collars is spaced from the interior surface of the receiver and conforms substantially to the contour of said interior surface.

For a more complete understanding of this invention, reference should be made to the drawings wherein:

Figure 1 is a perspective view of the improved apparatus;

Fig. 2 is a side elevational view of the improved apparatus having a portion thereof in vertical section;

Figs. 3, 4, and 5 are sectional views of the improved apparatus taken along lines 3—3, 4—4, and 5—5, respectively, of Fig. 2;

Fig. 6 is a fragmentary perspective view of the liquid-agitating unit shown in partially disassembled relation; and

Fig. 7 is an enlarged fragmentary vertical sectional view of the intake side of the apparatus.

Referring now to the drawings and more particularly to Figs. 1 and 2, an apparatus, hereinafter referred to as a crystallizer 10, is shown for use in the treatment of readily solidifiable liquids or materials during crystallization of the latter. In the manufacture of butter, for example, such an apparatus is positioned between a forming and wrapping machine and a chiller, the latter effecting subcooling of the butterfat prior to crystallization thereof. Neither the chiller or the forming and wrap-

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ping machines are shown in the drawings but the operations of such are believed well known by those skilled in the art. The crystallizer 10 is adapted to effect controlled crystallization of the butterfat so that the product discharged therefrom has a substantially stable homogeneity and smooth pleasing texture as well.

The crystallizer 10 comprises an elongated hollow tubular shaped member 11, an intake end unit 11a secured to one end of member 11, and a discharge end unit 11b secured to the opposite end of said member. The front end of intake end unit 11a, or the side thereof adjacent member 11, is provided with an annular collar 11c which is secured by welding or any other suitable means to the end of the member 11. Annular collar 11c is provided with an intake port 12 through which the material or liquid from the chiller, not shown, is introduced under pressure into the interior of member 11, see Fig. 2. The port 12 is connected to the chiller by a conduit or pipe 13.

The discharge end unit 11b is provided with a removable funnel-shaped axially extending nose portion 14 which terminates in a discharge port 14', the latter being adapted to communicate with a forming and packaging machine, not shown. Unit 11b is also provided with a rearwardly extending annular collar portion 11d which is secured by welding or any other suitable means to the opposite end of member 11. Collar 11d is provided with a port 15 which is normally closed off by a plug 16. The port 15 is open only when the material is being initially introduced into member 11 so as to provide bleeding of any air which might be entrapped within member 11. The tubular member 11 is mounted on a movable upright frame 17, the latter being provided with a rack 18, disposed beneath member 11, on which is mounted the hydraulic mechanism 20 which effects reciprocation of the liquid-agitating means 21, the latter being disposed within member 11 and to be hereinafter discussed. The hydraulic system 20 is power-actuated, in this instance, by an electrical motor 22 provided with a suitable electrical lead 23 which may be readily connected to any suitable source of electrical energy.

The liquid-agitating means 21, as seen more clearly in Figs. 2 and 6, comprises an elongated shaft 24 axially disposed within member 11 and having one end 24a thereof terminating within the discharge end unit 11b adjacent the discharge port 14'. Mounted on shaft 24 by welding or any other suitable means is a pair of axially spaced perforated plates 25 and 26 which, as seen in Fig. 2 are disposed between intake port 12 and discharge port 14'. The outer diameters of these plates are slightly less than the diameter of the interior of the member 11 so as to permit reciprocatory movement of the plates within member 11. Positioned intermediate plates 25 and 26 and in equally spaced coaxial relation with respect to one another are a plurality of annular members or rings 27 which are interconnected to one another by a plurality of elongated connecting rods 28. The rods are arranged symmetrically about shaft 24 and are secured at opposite ends by welding or any other suitable means to the opposing faces of axially spaced plates 25 and 26. The interior annular surface 27' of each of the rings, in turn, is likewise secured by welding or any other suitable means to rods 28. The outside diameters of each ring 27 is less than the outside diameter of the plates 25 or 26 and is such as to produce a clearance 30 between the interior surface of member 11 and the outer periphery of rings 27. The rings 27 function as agitators and prevent build-up or the formation of any large crystalline masses of liquid or material along the interior surface of member 11 while the liquid or material is passing under pressure through the crystallizer 10. The discharge end unit 11b is provided with a foraminous or perforated member 29 which is clamped in position between nose portion 14 and collar portion 11d, when the crystallizer is in assembled relation. Mem-

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ber 29 is provided with an enlarged center bearing boss 29' which accommodates and supports one end 24a of shaft 24. The size, number, and positioning of the apertures formed about the center boss 29' of member 29 may be the same or different than the apertures formed about the center of perforated plates 25 and 26. Thus, the emulsifying effect of the perforated plates on the liquid or material passing through the crystallizer may be varied if so desired.

The number of perforated plates 25 and 26 affixed to shaft 24 and the number of rings 27 disposed between the perforated plates may be increased or decreased depending upon the character of the liquid or material passing through the crystallizer and the texture of the resulting product desired. Furthermore, the axial length of the tubular member 11 may also be increased or decreased depending on the characteristic of the liquid or material being treated.

The liquid-agitating means 21, as heretofore mentioned, is caused, in this instance, to reciprocate in a direction axially of member 11 by the hydraulic mechanism 20. The effect of this reciprocation is that the material, while passing through the crystallizer is in a state of continuous agitation and thus rapid solidification or build-up of large crystalline masses is avoided.

The liquid-agitating means 21 comprises also a piston sleeve member 31, which encompasses the end 24b of shaft 24, and a laterally extending annular flange 32 mounted substantially centrally of member 31 and which functions as a piston head. The flange 32 is disposed within a cylindrically shaped compartment 33 which is formed of a cylindrical casing 34 having an axial length substantially the same as the length of the full stroke of the reciprocating shaft 24. Casing 34 is closed off at one end by an end plate 35 which forms an integral part of end unit 11a. The opposite end of casing 34 is closed off by a closure plate 36. Both plates 35 and 36 are provided with center apertures for accommodating and supporting piston sleeve member 31 and permit relative reciprocatory movement of the latter. Casing 34 and plates 35 and 36 are held in assembled relation by means of a plurality of tie bolts 37 which are symmetrically arranged about the outside of casing 34 and extend through suitable openings formed in plate 36 and are threaded into end plate 35 of unit 11a. The tie bolts 37 are, in this instance, concealed from view by an outside shield 39 which is concentrically positioned with respect to casing 34. Intake and discharge ports 38 and 40 for plates 35 and 36, respectively, are provided for permitting the flow of the hydraulic fluid into and out of compartment 33 to effect reciprocation of flange 32. Suitable conduits 43 and 44 are provided for ports 38 and 40, respectively, which communicate with the hydraulic mechanism 20 mounted on frame rack 18. Encompassing shaft 24 and disposed intermediate foraminous plate 26 and the end of sleeve member 31 is a spacer element 41 which, in this instance, is secured at one end by welding or any other suitable means directly to plate 26. Member 31 and spacer element 41 are locked in abutting endwise relation with respect to one another by an enlarged nut 42 which is threaded into the terminal end 24b of shaft 24.

Extending axially and outwardly from plate 36 are two brackets 45 and 46 disposed, in this instance, on opposite sides of nut 42. The brackets are adapted to support micro switches 47 and 48, respectively, which, in turn, are adapted to control the direction of movement of shaft 24. Micro switch 47 is mounted on bracket 45 which is the shorter of the two brackets and is actuated by a nub 51 formed on the periphery of nut 42 when the shaft approaches its left-hand terminal position. The other micro switch 48 is mounted on the bracket 46 which is the longer of the two brackets and is actuated by a second nub 52 formed on nut 42 when the shaft 24 approaches its right-hand terminal position. The micro

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switches 47 and 48 and the respective brackets 45 and 46, as well as nut 42, are all enclosed within a protective domelike housing 49 which is secured to the outer periphery of plate 36. The micro switches are connected by suitable electrical leads 50 to the hydraulic mechanism 20.

End unit 11a is provided with a partition 53 which is spaced axially from plate 35 and is adapted to close off the intake end of cylindrical member 11. Partition 53 is provided with an enlarged center opening 53' which permits access to the interior of member 11 when a cover 54, which normally closes off opening 53', is removed therefrom. Cover 54, in turn, is provided with a center opening through which spacer sleeve 41 extends and is free to reciprocate relative thereto. Suitable packing material is provided between cover opening and sleeve 41 so as to prevent leakage of the material or liquid contained within cylinder member 11a. Cover 54 is provided with an outwardly extending flange portion 54', which is disposed adjacent the interior of member 11 and which has a diameter greater than partition opening 53', so that cover 54 cannot move axially to the right beyond partition 53. The remainder of cover 54 is of less diameter than opening 53' and is free to move axially to the left from partition 53, when the cover is unlocked. Cover 54 is held against axial movement in a direction to the left, as viewed in Fig. 2, by a lock ring 55 which is disposed within an annular groove 55' formed within the exposed portion of the cover protruding from partition opening 53'. The lock ring 55, when seated within groove 55', contacts the exposed circumjacent portion of partition 53 and has an outside diameter greater than opening 53'. Openings 56 are provided on opposite sides of the portion 57 of end unit 11a interconnecting partition 53 and plate 35 so as to permit access to the locking ring 55 and the cover 54.

In disassembling the crystallizer for purposes of cleaning, the funnel-shaped nose portion 14 is first removed from the remainder of end unit 11b by removing a locking ring 58 therefrom. Foraminous plate 29, subsequent to portion 14 being removed, may likewise be removed endwise from shaft end 24a. Lock ring 55 is then removed from cover 54 to permit the latter to move axially to the left. Housing or dome-shaped cover 49 is removed from plate 36 whereupon the lock nut 42 is exposed so as to permit it to be unthreaded from shaft end 24b. Upon the nut 42 being removed from shaft 24, the shaft including the spacer sleeve 41, cover 54, foraminous plates 25 and 26, and rings 27 may be moved axially to the left until they are all free and clear of cylindrical member 11 and the remainder of end unit 11b. To reassemble the crystallizer, the aforementioned steps are followed in reverse.

Thus, it will be seen that an apparatus has been provided which effects continuous agitation of the material while passing therethrough so as to prevent the build-up of large crystalline masses of material within the unit and at the same time control the rate of crystallization of the material. By reason of the controlled crystallization, a resulting product is obtained which has a stable homogeneity and a smooth pleasing texture. The apparatus, in addition, is adapted for treatment of both culinary or nonculinary materials and liquids.

While a particular embodiment of this invention is shown above, it will be understood, of course, that the invention is not to be limited thereto, since many modifications may be made, and it is contemplated, therefore, by the appended claims, to cover any such modifications as fall within the true spirit and scope of this invention.

We claim:

1. An apparatus for treatment of a readily solidifiable liquid during crystallization of the latter, comprising an elongated tubular receiver into which the liquid under pressure is introduced at one end thereof and discharged therefrom at the opposite end thereof, the opposing end

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portions of said tubular receiver being removable to permit cleaning of the interior of said receiver, a foraminous member mounted in a fixed position within said receiver adjacent the discharge end thereof, and liquid-agitating means mounted for reciprocatory movement within said receiver to prevent build-up of large liquid crystalline masses while the liquid is passing through said receiver; said means including a pair of relatively spaced coaxially arranged perforated plates disposed intermediate the liquid-intake end and said foraminous member, and a plurality of relatively spaced coaxially arranged rings disposed intermediate said perforated plates and having the outer peripheries thereof spaced from the interior surface of said receiver, said plates and rings being interconnected to one another for reciprocatory movement as a unit.

2. An apparatus for treatment of a readily solidifiable liquid during crystallization of the latter, comprising an elongated hollow receiver through which the liquid under pressure continuously passes, liquid inlet means mounted on said receiver, liquid outlet means mounted on said receiver and disposed in longitudinally spaced relation with respect to said inlet means, and liquid-agitating means disposed within said receiver intermediate the longitudinal extremities thereof and movable only longitudinally thereof to prevent build-up of large crystalline masses on the interior of said receiver while the liquid is passing therethrough; said means including a plurality of longitudinally spaced interconnected perforated sections having the peripheries thereof juxtaposed the interior surface of said receiver, the spacing between said perforated sections being a fixed dimension, said means, when actuated in one relative direction, moving longitudinally of said receiver from substantially one of said extremities to the other.

3. An apparatus for treatment of a readily solidifiable liquid during crystallization of the latter, comprising an elongated tubular receiver into which the liquid under pressure is introduced at one end thereof and discharged therefrom at the opposite end thereof, one end portion of said receiver being removable to permit cleaning of said receiver interior, a foraminous member through which the liquid passes removably mounted within said receiver interior juxtaposed the discharge end of the receiver and positioned substantially normal to the direction of liquid flow, and liquid-agitating means mounted within said receiver for reciprocatory movement between a position adjacent said foraminous member and a position adjacent the liquid intake end of the receiver to prevent build-up of large liquid crystalline masses within said receiver; said means including a pair of longitudinally spaced perforated plates disposed in substantially parallel relation with respect to said foraminous member, and a ring disposed intermediate said plates and in spaced axial alignment therewith, said plates and ring being interconnected to one another for movement as a unit and having the peripheries thereof juxtaposed and conforming substantially to the contour of said receiver interior surface.

4. An apparatus for treatment of a readily solidifiable liquid during crystallization of the latter, comprising an elongated hollow receiver into which the liquid under pressure is continuously introduced at one end thereof and continuously discharged therefrom at the opposite end thereof, said receiver having the discharge end thereof removable to permit cleaning of the interior of said receiver, and a liquid-agitating member mounted for reciprocatory movement only within said receiver to prevent build-up of large liquid crystalline masses while the liquid is passing through said receiver; said member including an elongated power-actuated shaft disposed coaxially with the longitudinal axis of said receiver, perforated means mounted in fixed position on said shaft for movement therewith and disposed intermediate the liquid intake and discharge ends of said receiver, and scraper ring means carried by said shaft and movable therewith, the outer periphery of said scraper means conforming sub-

stantially to the configuration of the interior surface of said receiver, said scraper ring means cooperating with the interior surface of said receiver to prevent the formation of liquid crystalline masses thereon; said member, when actuated in one relative direction, moving longitudinally of said receiver from substantially one of said extremities to the other.

References Cited in the file of this patent

UNITED STATES PATENTS

665,876 Carter Jan. 15, 1901

1,467,448
1,522,386
1,708,729
2,115,056
2,147,603
2,189,255
2,460,004
2,555,756
2,667,407
2,730,338

5

10

Page Sept. 11, 1923
Parsons et al. Jan. 6, 1925
Klein Apr. 9, 1929
Wynn Apr. 26, 1938
Hoppenstand Feb. 14, 1939
Smith et al. Feb. 6, 1940
Green et al. Jan. 25, 1949
Muehlhaus et al. June 5, 1951
Frenske et al. Jan. 26, 1954
Gregorius Jan. 10, 1956