Feb. 14, 1933. F. G. CORNELL, JR 1,897,607

LIQUID HEATER AND COOLER

Filed Sept. 16, 1930 2 Sheets-Sheet 1

Fig. 1.

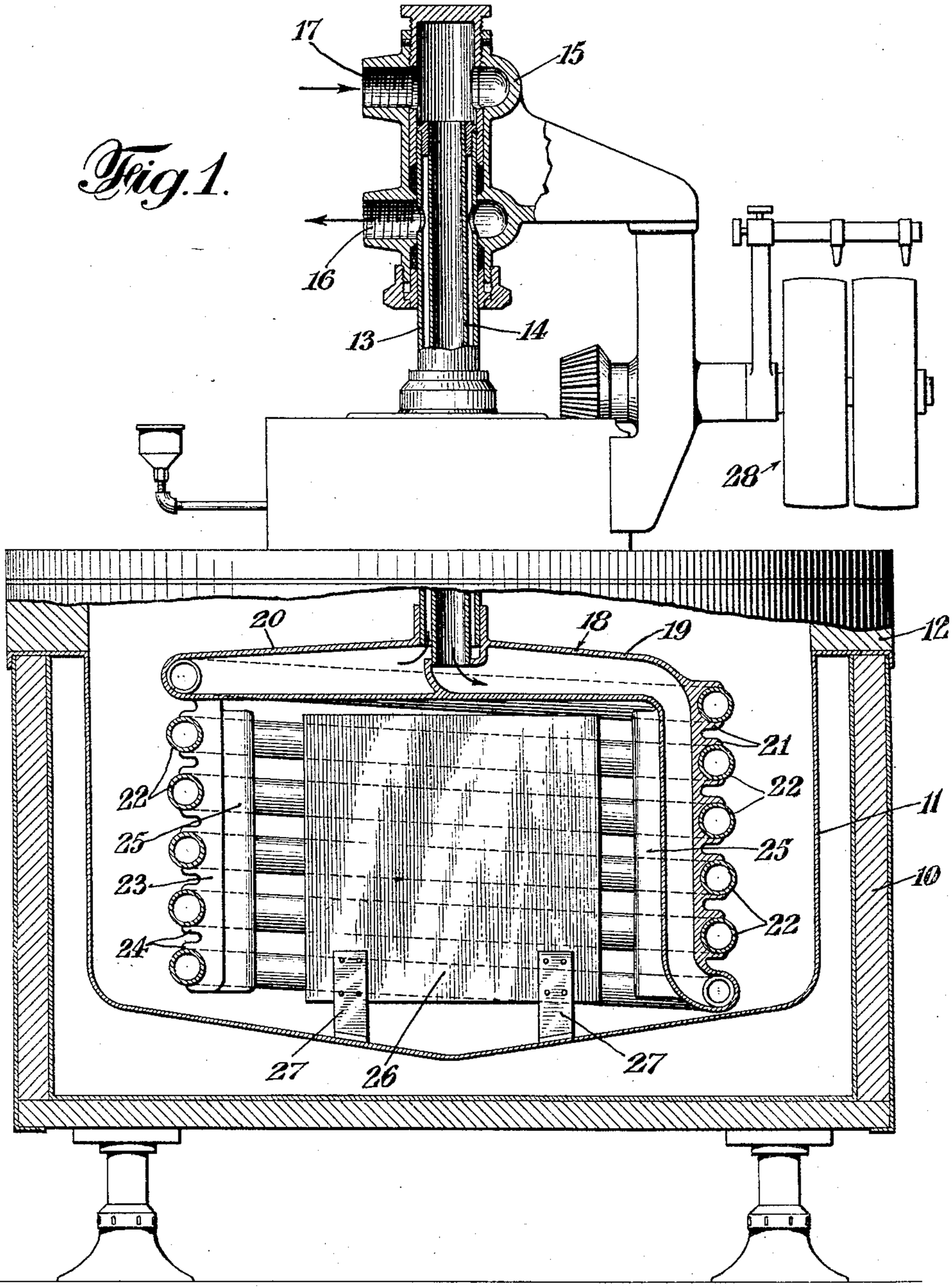

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Fig. 2.

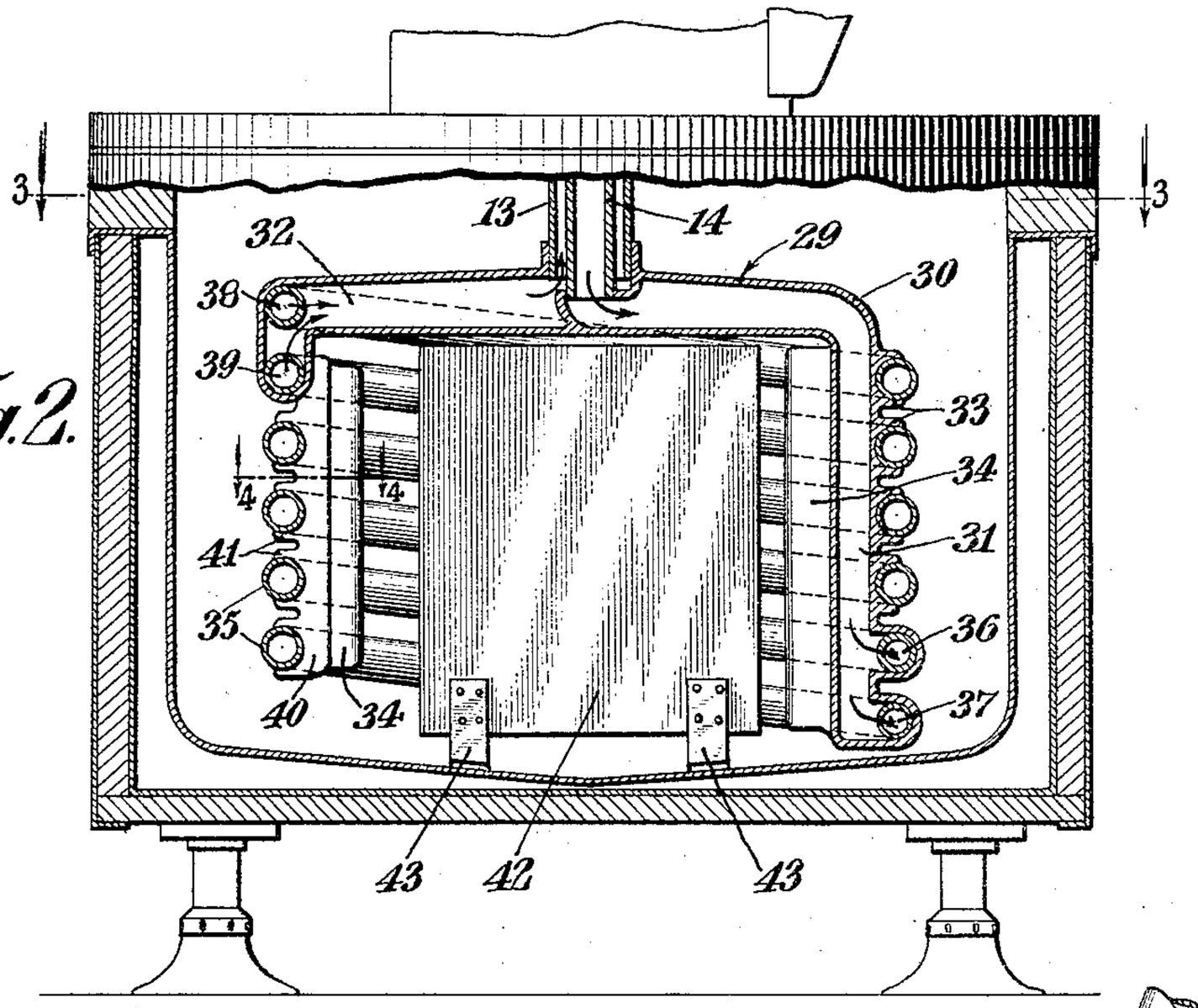


Fig. 4.

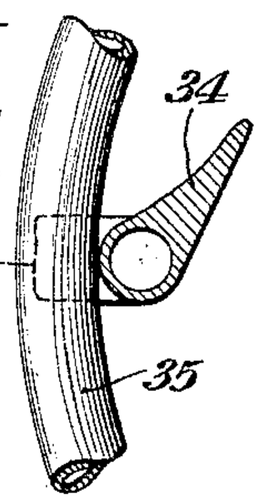
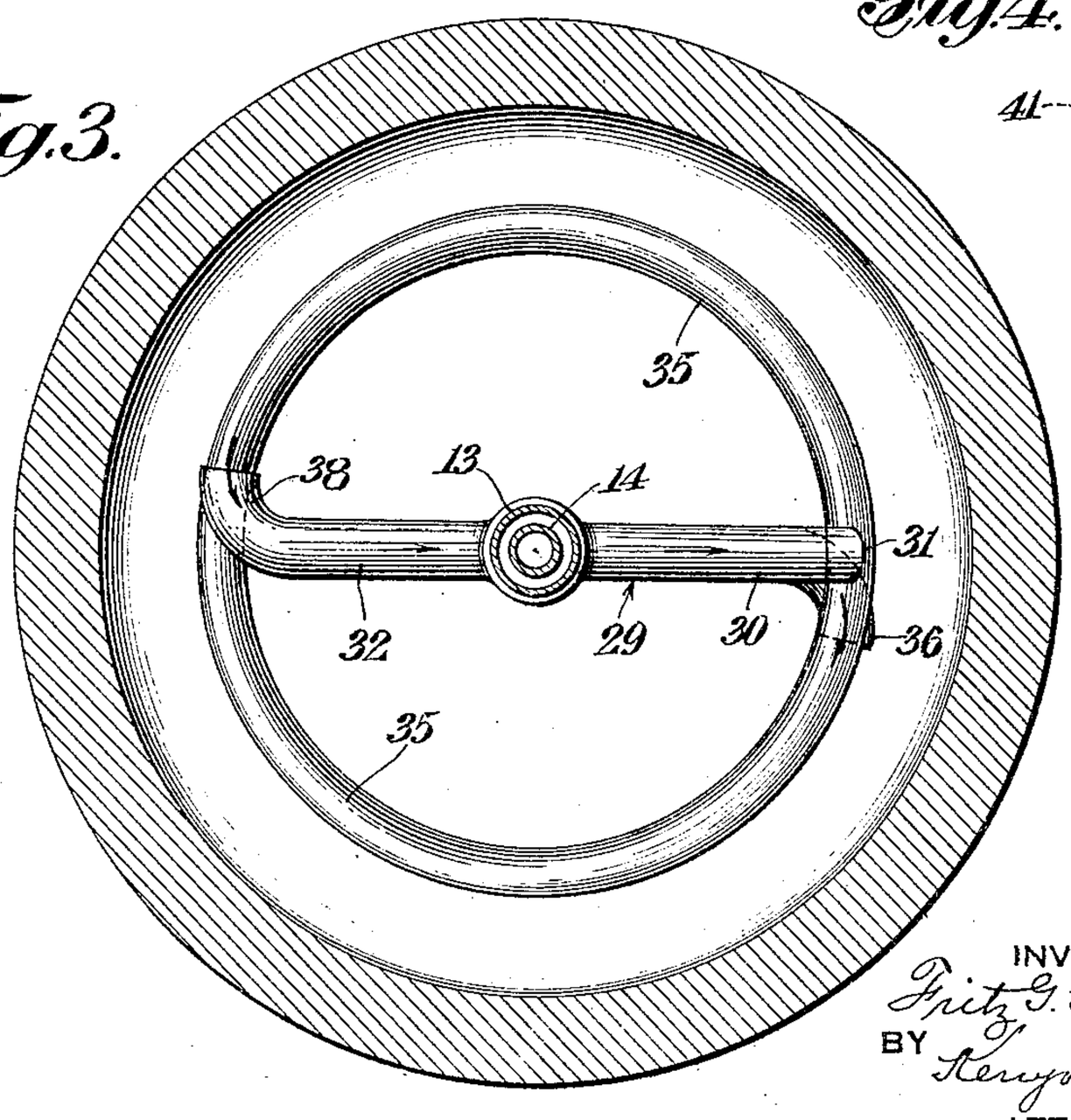


Fig. 3.



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UNITED STATES PATENT OFFICE

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LIQUID HEATER AND COOLER

Application filed September 16, 1930. Serial No. 482,290.

This invention relates to liquid heaters and coolers and more particularly to apparatus for heating or cooling liquid dairy products in which cooling or heating fluid is circulated through a coil rotated in the product to be heated or cooled.

An object of this invention is an apparatus of this type in which a very positive circulation and rapid heating or cooling of the dairy product is effected without detrimentally affecting the body of the product being treated.

An apparatus embodying the invention comprises a vat in which is rotatably suspended a vertical helical coil into which projects a vertical baffle plate, the lower end thereof being spaced from the bottom of the vat. The liquid dairy product to be treated is charged into the vat and the coil is rotated while heating or cooling fluid is caused to circulate through the coil. The incoming cooling or heating fluid is led to the bottom of the coil by a conduit arranged near the inner wall of the coil and clear of the baffle. The coil is rotated with respect to its pitch in such direction that the coil tends to prevent the introduction of air into the liquid. Also, one or more fins are provided on the inner wall of the coil to direct liquid from the interior of the coil between the turns thereof into the space between the outer wall of the coil and the vat wall.

In such apparatus, the baffle plate prevents swirling of the liquid within the coil, thereby preventing the formation of a vortex in the liquid. Positive circulation is produced in the body of liquid inside the coil and the fins cause an outward flow of liquid between the coil turns, thus increasing circulation. The circulation thus produced causes rapid and quick contact of the liquid product with the surface of the coil, thereby resulting in very rapid heating or cooling of the products to be treated. The increased circulation obtained by use of the baffle plate makes possible more rapid and uniform cooling or heating of the liquid for any given rotational speed of the coil and thus makes possible an increase in heating or cooling efficiency, without subjecting the fat globules to any increase of concussion.

Other objects, novel features and advantages of this invention will be apparent from the following specification and accompanying drawings, wherein:

Fig. 1 is an elevation partly in section of one embodiment of the invention.

Fig. 2 is a partial view similar to Fig. 1 of a modified form of the invention.

Fig. 3 is a section on the line 3—3 of Fig. 2, and

Fig. 4 is a fragmentary section on the line 4—4 of Fig. 2.

Referring now more especially to Fig. 1, 10 is a frame or support within which is contained a vat 11 having a cover 12. A tubular shaft 13 is rotatably supported by the cover 12 and within the tubular shaft 13 is arranged a tube 14. Both the tubular shaft 13 and the tube 14 project into the head of a bracket 15 which is supported by the cover 12. The bracket 15 is provided with an outlet port 16 communicating with the annular space between the tube 14 and the tubular shaft 13 and with an inlet port 17 communicating with the upper end of the tube 14.

The lower ends of the shaft 13 and tube 14 are threaded into sockets in a casting 18 having radially extending hollow arms 19 and 20 and the arm 19 is provided with a vertical extension, this vertical extension being provided with pairs of lugs 21. The interior of arm 20 communicates with the annular space between the shaft 13 and tube 14 and the interior of the arm 19 communicates with the lower end of the tube 14. A helical coil of pipe 22 is attached at its lower end to the lower end of the extension of the arm 19 and is attached at its upper end to the outer end of the arm 20, the turns of the coil being received between the lugs 21 which serve to space the turns properly and support the coil. Preferably a vertical bar 23 is carried by arm 20 and is provided with lugs 24 which further serve to properly space the turns and support the coil. The vertical portion of the arm 19 and bar 23 are preferably provided with inwardly projecting fins

25 which extend generally in the direction of rotation of the coil.

A vertical baffle plate 26 is supported from the bottom of the vat by straps 27. The bottom edge of this plate is spaced slightly from the bottom of the vat. The baffle plate extends upwardly toward the top of the coil and its side edges are spaced somewhat from the inner wall of the coil.

Suitable driving means including pulleys 28 are provided for effecting rotation of the coil. These driving means are not disclosed in detail as they constitute no part of the present invention.

Referring now more especially to the modification disclosed in Figs. 2 to 4 inclusive, the shaft 13 and tube 14 are threaded into a casting 29 having a horizontal tubular arm 30 with a vertically extending portion 31 and having a horizontal tubular arm 32. The tubular arm 30 communicates with tube 14, while the tubular arm 32 communicates with the annular space between the shaft 13 and tube 14. The vertical portion 31 of the arm 30 is provided with lugs 33 and an inwardly extending fin 34. Each of a pair of helical pipe coils 35 is connected with the vertical portion 31 of arm 30 at 36 and 37 respectively. Each coil has its upper end connected to the end of an arm 32 at 38 and 39 respectively. The turns of the coils are received between the lugs 33, thereby maintaining the turns in proper spaced relation and supporting the coil, and a vertical bar 40 is also preferably employed with lugs 41 thereon which further serve to space and support the coils. The bar 40 may also be provided with a fin 34.

A baffle plate 42 is supported from the bottom of the vat by straps 43 with its lower end spaced from the bottom of the vat. This baffle extends upwardly toward the top of the coil and its edges are spaced somewhat from the inner wall of the coil.

In using this apparatus, the dairy product to be treated is charged into the vat 11. Cooling or heating fluid is then introduced into the coil through the inlet 17 and is discharged through the outlet 16. The cooling or heating fluid is thus caused to flow upwardly through the coil while the latter is being rotated in the product being cooled or heated. The coil is rotated in such a direction that it tends to avoid introducing air into the liquid. The inwardly extending fin causes flow of liquid through the turns of the coil from the space inside the coil to the space outside the same. Also, the baffle plate prevents the formation of a vortex in the liquid and causes vertical circulation of the same within the coil. The provision of a space between the bottom of the baffle and the vat promotes circulation within the coil. With the arrangement above described, rapid and uniform circulation of the liquid is effected, thus producing uniform and rapid contact of the liquid with the surface of the coils, with the result that uniform and rapid cooling or heating of the liquid is effected. The increased circulation thus effected makes possible more rapid heating or cooling of liquid than heretofore without increase in the rotational speed of the coil, thereby avoiding increased concussion which would be harmful to the fat globules. This coil arrangement in a square vat also is very effective as it produces increased circulation along that portion of the container wall nearest the coil and increased vertical circulation in the areas adjacent the corners of the vat.

It is of course understood that various modifications may be made in the structure above described, without in any way departing from the spirit of the invention as defined in the appended claims.

I claim:

1. An apparatus of the character described comprising a vat, a helical coil supported in said vat, a vertical stationary baffle plate supported by said vat within said coil, means to rotate said coil around said baffle plate, and means to circulate fluid through said coil.

2. An apparatus of the character described comprising a vat, a helical coil rotatably supported in said vat by a shaft exterior of said helical coil, a stationary vertically extending baffle plate supported by said vat within said coil, means to rotate said coil, and means to circulate fluid therethrough.

3. In a device of the character described comprising a vat, a helical coil rotatably supported in said vat, a stationary vertical baffle plate supported by said vat within said coil and having its lower edge spaced from the bottom of said vat, means to rotate said coil around said baffle plate and means to circulate fluid through said coil.

4. An apparatus of the character described comprising a vat, a helical coil rotatably supported in said vat open at one end for the reception of a baffle, a stationary baffle plate supported by said vat within said coil, and means to circulate fluid through said coil.

5. In a device of the character described comprising a vat, a helical coil rotatably supported in said vat, a stationary vertical baffle plate supported from the floor of said vat within said coil and having its lower edge spaced from the floor of the vat, and a vertical fin carried by said coil.

6. In a device of the character described comprising a vat, a helical coil rotatably supported in said vat, a stationary vertical baffle plate supported from the floor of the vat within said coil and having its lower edge spaced from the floor of the vat, a vertical fin carried by said coil and extending inwardly thereof.

7. An apparatus of the character described

comprising a vat, a helical coil supported in said vat, a stationary vertical baffle plate supported by said vat within said coil, a vertical fin carried by said coil and extending inwardly thereof, means to rotate said coil around said baffle plate, and means to circulate fluid through the coil.

8. In a device of the character described, a vat, a support rotatably mounted within said vat and comprising a pair of tubular horizontal arms, one of said arms having a tubular vertical extension, a helical coil having its lower end connected to the lower end of said vertical extension and its upper end to the outer end of the other arm, and conduits communicating with said arms for circulating liquid through said coil.

9. In a device of the character described, a vat, a support rotatably mounted within said vat and comprising a pair of tubular horizontal arms, one of said arms having a tubular vertical extension, a helical coil having its lower end connected to the lower end of said vertical extension and its upper end to the outer end of the other arm, lugs projecting from said extension and supporting the turns of the coil, and conduits communicating with said arms for circulating liquid through said coil.

10. In a device of the character described, a vat, a support rotatably mounted within said vat and comprising a pair of tubular horizontal arms, one of said arms having a tubular vertical extension, the other of said arms carrying a vertical bar, a helical coil having its lower end connected to the lower end of said vertical extension and its upper end to the outer end of the other arm, lugs projecting from said extension and said bar supporting the turns of said coil, and conduits communicating with said arms for circulating liquid through said coil.

11. In a device of the character described, a vat, a support rotatably mounted within said vat and comprising a pair of tubular horizontal arms, one of said arms having a tubular vertical extension, a helical coil having its lower end connected to the lower end of said vertical extension and its upper end to the outer end of the other arm, conduits communicating with said arms for circulating liquid through said coil and a vertical inwardly extending fin carried by said extension.

12. In a device of the character described, a vat, a support rotatably mounted within said vat and comprising a pair of tubular horizontal arms, one of said arms having a tubular vertical extension, the other of said arms carrying a vertical bar, a helical coil having its lower end connected to the lower end of said vertical extension and its upper end to the outer end of the other arm, conduits communicating with said arms for circulating liquid through said coil, and vertically extending fins carried by said extension and said bar.

13. In a device of the character described, a vat, a support rotatably mounted within said vat and comprising a pair of tubular horizontal arms, one of said arms having a tubular vertical extension, a helical coil having its lower end connected to the lower end of said vertical extension and its upper end to the outer end of the other arm, conduits communicating with said arms for circulating liquid through said coil, and a vertical baffle plate arranged within said coil.

14. In a device of the character described, a vat, a support rotatably mounted within said vat and comprising a pair of tubular horizontal arms, one of said arms having a tubular vertical extension, a helical coil having its lower end connected to the lower end of said vertical extension and its upper end to the outer end of the other arm, lugs projecting from said extension and supporting the turns of the coil, conduits communicating with said arms for circulating liquid through said coil, and a vertical baffle plate arranged within said coil.

15. In a device of the character described, a vat, a support rotatably mounted within said vat and comprising a pair of tubular horizontal arms, one of said arms having a tubular vertical extension, a helical coil having its lower end connected to the lower end of said vertical extension and its upper end to the outer end of the other arm, conduits communicating with said arms for circulating liquid through said coil, a vertical inwardly extending fin carried by said extension, and a vertical baffle plate arranged within said coil.

16. In a device of the character described, a vat, a support rotatably mounted in said vat and comprising a pair of tubular horizontal arms, one of said arms having a tubular vertical extension, a pair of coils having their lower ends connected to the lower end of said extension and their upper ends to the outer ends of the other arm, and conduits communicating with said arms for circulating fluid through said coils.

17. In a device of the character described, a vat, a support rotatably mounted in said vat and comprising a pair of tubular horizontal arms, one of said arms having a tubular vertical extension, a pair of coils having their lower ends connected to the lower end of said extension and their upper ends to the outer end of the other arm, conduits communicating with said arms for circulating fluid through said coils, and a vertical baffle plate arranged within said coils.

18. In a device of the character described, a vat, a support rotatably mounted in said vat and comprising a pair of tubular horizontal arms, one of said arms having a tubular vertical extension, a pair of coils having

their lower ends connected to the lower end of said extension and their upper ends to the outer end of the other arm, conduits communicating with said arms for circulating fluid through said coils, a vertical baffle plate arranged within said coils, and vertically inwardly extending fins carried by said vertical extension.

19. In a device of the character described, a vat, a support rotatably mounted in said vat and comprising a pair of tubular horizontal arms, one of said arms having a tubular vertical extension, a pair of coils having their lower ends connected to the lower end of said extension and their upper ends to the outer end of the other arm, conduits communicating with said arms for circulating fluid through said coils, a vertical baffle plate arranged within said coils, and lugs projecting from said extension and supporting said coils.

20. In a device of the character described, a vat, a support rotatably mounted in said vat and comprising a pair of tubular horizontal arms, one of said arms having a tubular vertical extension, a pair of coils having their lower ends connected to the lower end of said extension and their upper ends to the outer end of the other arm, conduits communicating with said arms for circulating fluid through said coils, a vertical baffle plate arranged within said coils, vertically inwardly extending fins carried by said vertical extension, and lugs projecting from said extension and supporting said coils.

21. In a device of the character described comprising a vat, a helical coil rotatably supported in said vat, a stationary baffle plate attached to said vat in spaced relation thereto and extending into said coil, and a fin extending from said coil.

22. A device of the character described comprising a vat, a support rotatably mounted within said vat and comprising a pair of tubular arms, one of said arms having a tubular extension, a helical coil having one end connected to the end of said extension and its other end to the outer end of said other arm, and conduits communicating with said arms for circulating fluid through said coil.

23. A device of the character described comprising a vat, a support rotatably mounted within said vat and comprising a pair of tubular arms, one of said arms having a tubular extension, a helical coil having one end connected to the end of said extension and its other end to the outer end of said other arm, conduits communicating with said arms for circulating fluid through said coil, and a stationary baffle plate supported by said vat in spaced relation to the surface thereof and extending into said coil.

24. A device of the character described comprising a vat, a support rotatably mounted within said vat and comprising a pair of tubular arms, one of said arms having a tubular extension, a helical coil having one end connected to the end of said extension and its other end to the outer end of said other arm, conduits communicating with said arms for circulating fluid through said coil, a stationary baffle plate supported by said vat in spaced relation to the surface thereof and extending into said coil, a fin extending from said coil and means for rotating said coil around said baffle plate.

25. An apparatus of the character described comprising a vat, a helical coil rotatably supported in said vat and being open at one end for the reception of a baffle, a baffle plate supported by said vat within said coil in spaced relation to the surface of the vat, and means to circulate fluid through said coil.

26. In a device of the character described, a vat, a support rotatably mounted within said vat and comprising a pair of tubular arms, an open end helical coil suspended from said support coaxial therewith and having its ends in communication with the ends of said arms, and conduits coaxial with said support communicating with said arms for circulating fluid through said coil.

In testimony whereof, I have signed my name to this specification.

FRITZ G. CORNELL, JR.