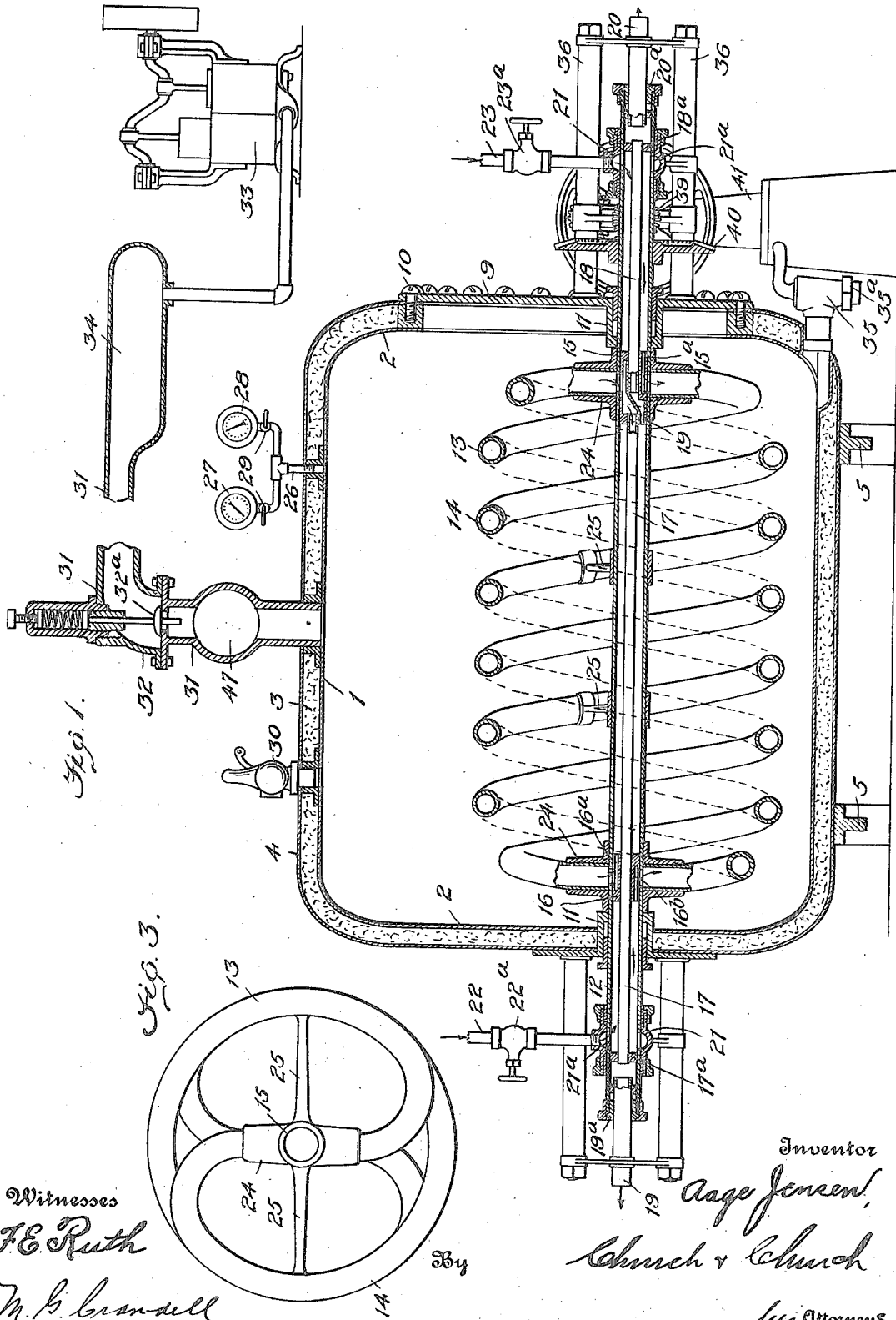


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LIQUID TREATING APPARATUS.
APPLICATION FILED AUG. 16, 1915.

1,213,879.

Patented Jan. 30, 1917.

2 SHEETS—SHEET 1.



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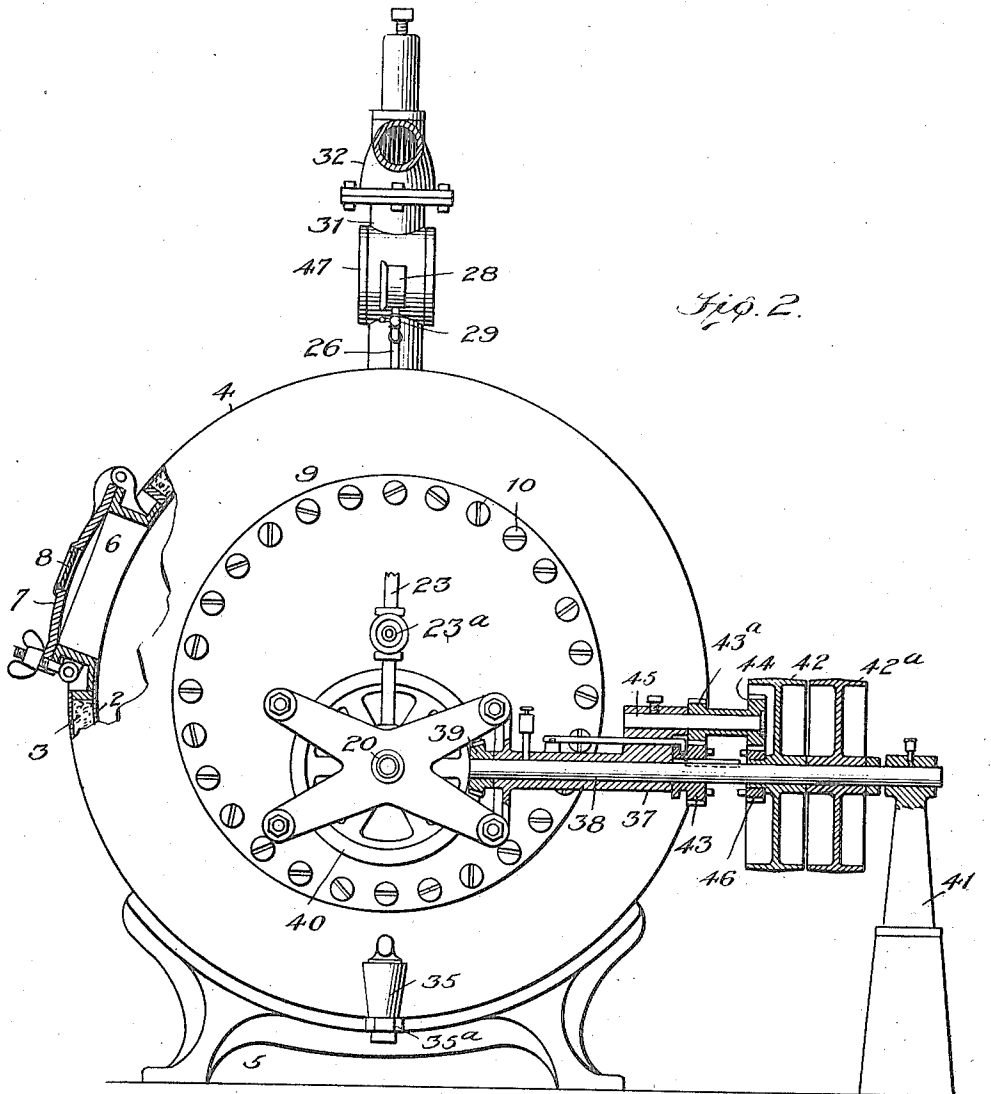


Fig. 2.

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LIQUID-TREATING APPARATUS.

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To all whom it may concern:

Be it known that I, AAGE JENSEN, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Liquid-Treating Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, and to the figures and letters of reference marked thereon.

This invention relates to the treatment of liquids by varying temperature and by changing the atmospheric conditions under which the treatment occurs, as, for example, by producing vacuous conditions or conditions of pressure whereby incorporated air may be extracted and the liquid treated in such wise as to change the temperature rapidly, but without affecting the physical or chemical qualities injuriously.

The form of apparatus adopted for illustrating the invention is one especially designed for the treatment of milk and analogous liquids, either for the purpose of pasteurizing, sterilizing, emulsifying or cooling under either a vacuum or pressure, depending upon the results which it is desired to attain, all as will be hereinafter particularly described.

Referring to the accompanying drawings,—Figure 1 is a section in a vertical plane taken longitudinally through an apparatus embodying the present improvements, certain of the parts being shown in elevation with sections broken away. Fig. 2 is an elevation looking at the right hand end of the apparatus shown in Fig. 1 with portions broken away and in section. Fig. 3 is a detail elevation looking at one end of the agitator alone.

Like reference characters in the several figures indicate the same parts.

The container for the liquid to be treated is preferably in the form of a more or less cylindrical shell 1 which is formed with rounded corners between the head portions 2 and the cylindrical portion 1, so as to leave no angles for the accumulation of dirt and to present a surface which may be readily cleansed and freed from any accumulations of any character whatsoever. Surrounding the container 1, is an insulating jacket embodying filling material 3 preferably of a

cellular character and an outer jacket, cover or shield 4, which conforms in contour to the contour of the container 1. The whole structure is mounted on legs or cradles 5, and extending through the walls are suitable openings for pipe connection and for the agitator connection, as will be presently described.

Inasmuch as the container is adapted for use under conditions which require that it shall withstand either internal or external pressure, provision is made for giving access to the interior through a manhole 6, Fig. 2, which is preferably closed by a clamp cover plate 7 having a glass eye 8 therein through which the interior of the container may be observed.

One end of the container is provided with a relatively large removable head 9 clamped in place by set screws 10, and in this head and in the wall of the container opposite the head, there are mounted journal bearings 11, said bearings being preferably located below the longitudinal center of the container. The bearings are adapted for the reception of the trunnions or shaft upon which the agitator or temperature controlling means is located. In the preferred construction a tubular shaft 12 extends through the bearings and projects at opposite ends of the container. Upon the shaft within the container there is mounted an agitator formed by a plurality of spiral pipe coils 13 and 14, respectively, the ends of the independent coils being connected with the shaft and communicating with independent ducts extending longitudinally of the shaft, the arrangement being such that treating medium may be circulated through the coils each independently of the other, whereby the circulating medium may be caused to travel in the same or opposite directions, or whereby a heating medium may be caused to circulate through one coil and a cooling medium made to circulate through the other coil, thereby rendering it unnecessary to make provision for circulating different media through the same duct, as in devices of this character heretofore manufactured. A convenient and simple arrangement for forming the ducts within the tubular shaft consists in providing apertures within the shaft through which the ends of the agitator coils 13 and 14 may communicate with the interior of the shaft and opposite these openings there

are mounted in the shaft headers 15 and 16. The header 15 has a peripheral duct on one side which communicates at 15^a with the tubular shaft at one end of the container and a second peripheral duct which communicates with an interior pipe 17 extending axially through the shaft 12 to the opposite end of the container. One of the ducts in the header communicates with one of the coils, as, for example, the coil 13, and the other duct communicates with the other coil, as, for example, the coil 14. A second pipe 18 connects with the header centrally at one end of the container and a duct from the pipe 18 extends through the header into the intermediate portion of the shaft 12, as shown at 19. The other header 16 is provided with two oppositely located peripheral ducts 16^a and 16^b which communicate respectively with the opposite ends of the coils 13 and 14 and with the tubular shaft 12 on opposite sides of the header. The pipes 17 and 18 extend through filling pieces 17^a and 18^a, respectively, and beyond the filler pieces, the ends of the tubular shaft 12 communicate with fixed pipes 19 and 20, for the exit or admission of treating fluid, said pipes 19 and 20 passing through stuffing boxes and glands 19^a and 20^a, respectively, in the ends of the shaft 12. Surrounding the shaft 12 at each end are stationary boxes 21 provided with packing glands at each end and formed with an interior annular duct with which pipes 22 and 23 communicate, there being suitable peripheral apertures 21^a formed in the pipe to permit of the circulation of treating fluid from the pipes 22 and 23 into the shaft 12.

In the arrangement shown, the pipes 22 and 23 are provided with valves 22^a and 23^a and treating fluid passing in through the pipe 22, for example, circulates through one of the agitator coils and escapes through the pipe 19 at the same end of the container, and treating fluid passing in through the pipe 23 circulates through the other coil of the agitator and escapes through the pipe 20 at that end of the container, thus providing for two independent circulating ducts extending through the agitator and through which the treating fluid may be circulated in opposite directions when an exceedingly uniform treatment of the liquid is desired, or through which the treating fluid may be circulated, for the successive, or, in some instances, simultaneous treatment of the fluid by different media.

The coils of the agitator may be conveniently connected with the shaft 12 by brazing and by connectors 24 which will present a smooth and finished exterior of a character well calculated to prevent the accumulation of dirt in cracks or corners and whereby all possibility of a leakage or

communication between the interior of the container and the ducts for the circulating medium is avoided. To give additional strength to the coils they may be supported by coil supporting arms 25 extending radially from the shaft to the intermediate portions of the coils.

In addition to the openings heretofore referred to in the walls of the container, a pipe connection 26 is provided for separate vacuum and pressure gages 27 and 28, either of which may be cut off from communication with the container by stop cocks 29. A safety valve 30 also communicates with the container and at the top of the container there is provided a connection through which the pressure conditions in the container may be controlled. This connection embodies a pipe or duct 31 in which is located a combined vacuum and pressure valve 32 having a spring-pressed, outwardly-opening valve 32^a. Beyond the valve the pipe 31 is in communication with a vacuum pump 33, and it may also communicate with a condensing chamber 34.

At the bottom of the container there is provided a discharge valve 35, preferably having a nipple extremity 35^a whereby a suitable connection may be made for either filling the container or discharging the contents thereof. The shaft 12, it will be understood, passes through suitable packing glands in the ends of the container and motion is imparted to the shaft for rotating the agitator through gearing which is preferably of such character as will permit of varying speeds of rotation. Conveniently, supporting brackets are arranged at each end of the container, said brackets being formed by four rigid rods 36 suitably connected together and adapted to support a bearing 37 for a shaft 38 carrying a pinion 39 meshing with a bevel gear 40 on the shaft 12. The shaft 38 at its outer end is supported in a fixed bearing 41 and intermediate the bearings 37 and 41, it carries pulleys 42 and 42^a, for the application of a suitable driving belt. Both pulleys are normally free on the shaft 38, but the pulley 42 is adapted to be clutched thereto by a sliding pinion 43 which may be moved longitudinally of the shaft into and out of engagement with the pulley 42, and into and out of engagement with a secondary or speed reducing gearing embodying pinions 43^a and 44, journaled on a shaft 45, the pinion 44 being in mesh with a pinion 46 on the pulley. The pinion 43 moves into and out of engagement with the pinion 43^a and into and out of mesh with the clutch face on the pulley. The arrangement is such that at an intermediate point neither pinion is engaged so that the agitator under these conditions is freed from the driving connection, but ordinarily the belt will be shifted

from one of the pulleys to the other, when the movement of the agitator is to be arrested.

The pressure controlling connection 31 is provided below the valve 32 with a glass eye 47 through which the character of the vapor passing off from the contents of the container may be observed.

The apparatus may be utilized for performing various operations in the treatment of liquids. Thus, for pasteurizing and cooling milk and cream, it is placed convenient to the work to be performed and the necessary connections made. After the apparatus is thoroughly cleaned and sterilized, the milk or cream to be pasteurized is placed in the container, either through the manhole opening, or it may be drawn in by suction through the discharge valve 35. The container is filled in accordance with the kind of liquid being treated, and the viscosity of the same, but it is preferably filled to a level that will completely cover the coils of the agitator, whereupon the apparatus is closed tightly and the vacuum pump is set in motion. The air is removed through the connection 31, whereupon the milk or cream will immediately begin to swell or rise, this effect being caused by the expansion of minute particles of air incorporated therein. The expansion will often completely fill the area of the container above the liquid, or the liquid will double its volume, and the operator by observation through the glass eye 47 may observe when vapor or liquid commences to carry over and will regulate the suction of the pump accordingly. The agitator is set in slow motion at first and heating medium, preferably hot water, circulated through the agitator coils. The gage 27 will indicate the vacuum in the container and of course a suitable thermometer will be provided for indicating the temperature. The swelling or foaming will quickly change to a boiling action, the time depending upon the vacuum maintained and the temperature of the liquid. When all the air has been removed, the action of the pump is discontinued, whereupon the valve 32^a will automatically set and close communication with the condenser preventing any back flow or recontamination. The heating continues until a temperature of approximately 142° F. is obtained, at which time the agitation is stopped and the milk held at the desired temperature for about thirty minutes, after which cooling medium is introduced and the agitator again set in motion. When the temperature has been reduced to the desired degree, the operation is completed and the milk or cream may be discharged into any suitable container or bottles, this being performed under vacuum conditions, if desired, so as to keep the product from further exposure.

Should it be desired to completely sterilize the product, then the procedure above outlined is followed, except that the temperature is raised to about 236° F. and held for twenty minutes, it being found that this temperature will destroy all germ life without material change in physical composition, and, with this apparatus, without causing any cooking effect. When temperatures above that of boiling water are desired, the heating medium employed is usually steam, under pressure which is circulated in the agitator coils.

Where the container is employed as a fermenting or ripening tank, milk may be treated, for example, in accordance with the above procedure as to temperature, depending upon the character of ferment used, the mother culture is then introduced at the desired temperature, and that temperature is maintained for the length of time necessary for the mother culture to incubate. When the proper degree of acid development has been attained, the agitator is set in slow motion and cooling medium is introduced into the agitator coils. After the temperature has been lowered considerably the gear is shifted to increase the speed of rotation of the agitator and this agitation at the higher speed will result in a complete emulsification and a product which does not readily separate when left standing for long periods of time.

By the provision of an agitator formed of coils of pipe which receive the incoming treating fluid at the end of the container, nearest that to which the treating fluid passes through the wall of the container, the treating fluid, when in its hottest condition, acts on the liquid being treated only through walls which are in constant motion, and as a consequence no part of the fluid being treated rests in contact with such walls at the hottest point, for a sufficient length of time to permit of a cooking action, and by providing independent ducts in the agitator through which the treating medium may be circulated in opposite directions, the whole liquid being treated may not only be quickly raised to a uniform temperature, but it will be maintained at a uniform temperature, a result which is difficult of attainment where a single coil is employed receiving the treating fluid at the highest temperature at one end and discharging it at lowest temperature at the opposite end. The coils not only agitate the liquid angularly but give it a progressive movement longitudinally of the container, thus insuring an internal circulation in the container which brings every particle of the liquid into intimate relation to the coils at some point and insures an effective action, with the possibility of changing temperature with great rapidity.

In some instances it is found desirable to

employ the independent ducts in the agitator for the circulation of different treating fluids, as, for example, hot water for heating and brine for cooling, and in such cases the provision of independent ducts is of great advantage, inasmuch as connections do not have to be changed and the corrosion and destruction of the walls of the duct will occur with much less rapidity than is the case where first one medium and then another is passed through the same.

What is claimed is:

1. In an apparatus for treating liquids, the combination with a container, of an agitator embodying a plurality of independent ducts extending through the same, shaft connections at opposite ends of the agitator journaled in the container walls, independent ducts in each shaft connection communicating respectively with the independent ducts in the agitator, independent treating fluid supply means communicating with said ducts respectively, whereby treating fluids may be circulated through the independent ducts in the agitator independently in either direction, and means for rotating the agitator.

2. In an apparatus for treating liquids, the combination with a container, of an agitator embodying a plurality of independent spiral ducts, shaft connections at opposite ends of the agitator journaled in the container walls, independent ducts in each shaft connection communicating respectively with the spiral ducts of the agitator, independent treating fluid supply means communicating with said ducts respectively, whereby treating fluids may be circulated through the coils independently in either direction, and means for rotating the agitator.

3. In an apparatus for treating liquids, the combination with a container, of an agitator embodying a shaft journaled in the container walls and having a plurality of independent ducts in each end thereof, a plurality of coils forming an agitator having

their ends connected with the shaft and communicating respectively with the ducts in opposite ends of the shaft, a plurality of independent treating fluid supply means communicating with the ducts respectively in the opposite end of the agitator shaft, whereby treating fluid may be circulated through the coils independently in either direction, and means for rotating the agitator.

4. In an apparatus for treating liquids, the combination with a container, of an agitator within the container embodying a plurality of independent ducts, a tubular shaft on which the agitator is mounted journaled in the walls of the container, headers mounted within the shaft and having ducts therein, communicating with the shaft on opposite sides of the headers, said ducts being in communication with the ducts in the agitator, and independent ducts within the ends of the shaft communicating with the ducts in the headers whereby independent communicating circulating ducts are formed extending out at the ends of the shaft and through the independent ducts of the agitator, and independent fluid treating supply means communicating respectively with the ducts in the ends of the shaft.

5. In an apparatus for treating liquids, the combination with a closed container, of a tubular shaft journaled in the walls of the container and having ducts in its opposite ends exterior of the container, independent tubular coils mounted on the shaft within the container and communicating respectively with the ducts in the respective ends of the shaft, means for exhausting air from the container, means for rotating the shaft, independent treating liquid supply means communicating with the ducts in the shaft ends, and means for admitting and discharging liquid to be treated, substantially as described.

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