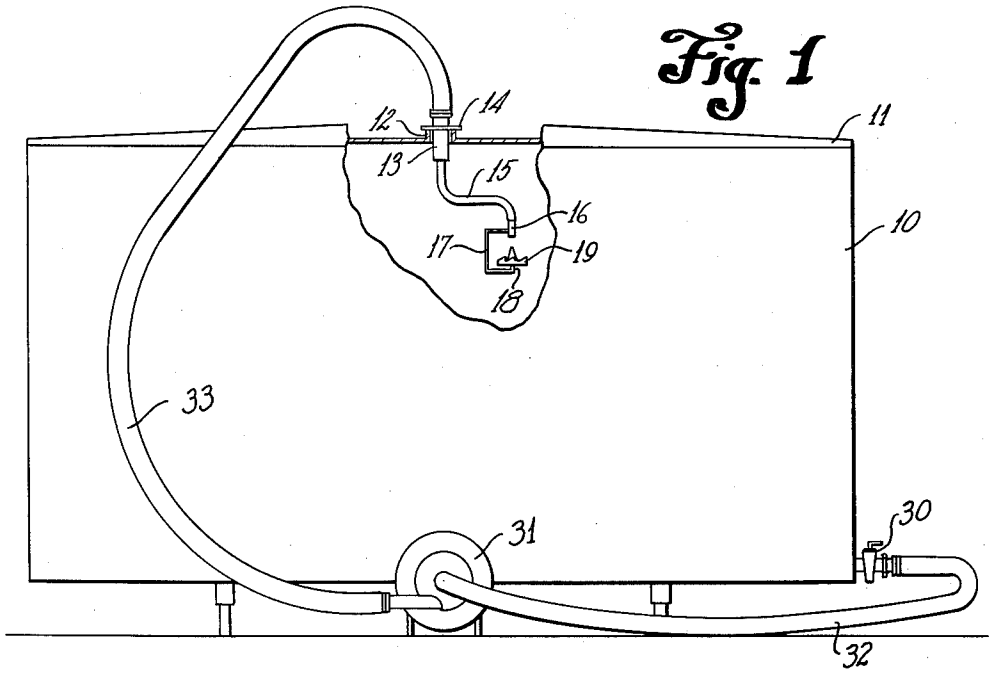
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LIQUID DISTRIBUTION DEVICE

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Fig. 1



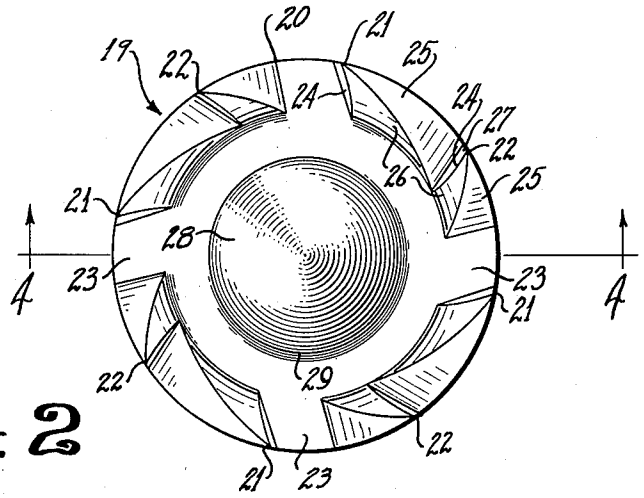


Fig. 2

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Fig. 3

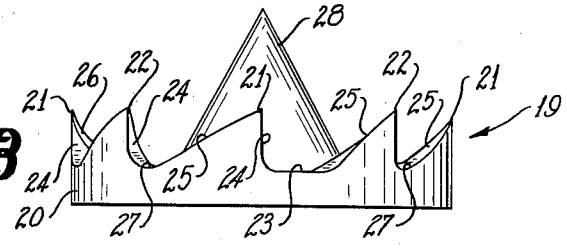


Fig. 4

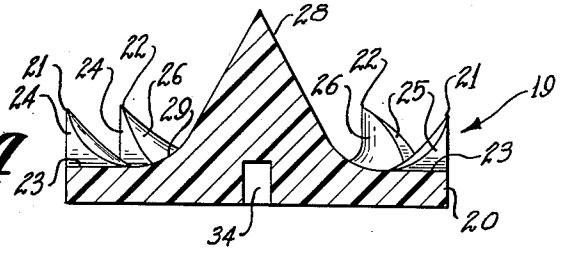
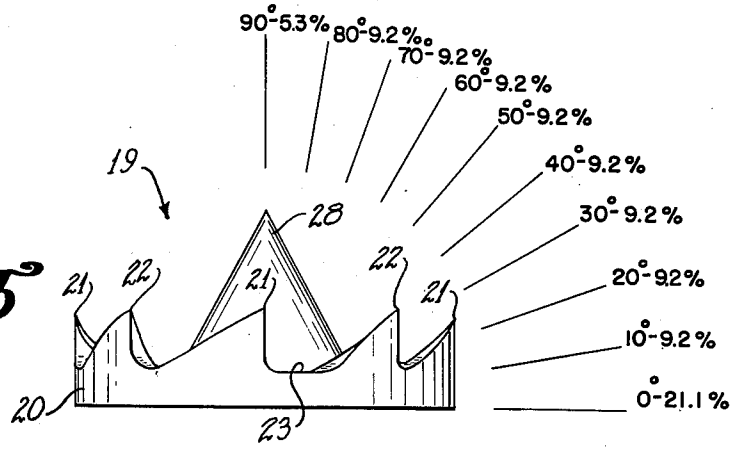


Fig. 5



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LIQUID DISTRIBUTION DEVICE

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5 Claims. (Cl. 239—383)

This invention relates generally to a liquid distribution device which is adapted to be used within a closed tank or the like for cleaning the same. Tanks with which the device of the invention are particularly adaptable for cleaning purposes are, for instance, milk cooling tanks. It is known that tanks used for this purpose demand a high degree of sanitation, but the device of this invention is not limited to a tank for cooling milk. The efficacy of the device may be appreciated in any tank where a high degree of cleaning is necessary and which generally has certain areas within the same in which it has been necessary to resort to manual cleaning, such as by brush.

For purposes of explaining the device of this invention it will be described for use in connection with a milk cooling tank, and which has used in conjunction with the device, a pump capable of propelling a cleaning solution with great force against a rotating spinner disposed within the tank and adjacent the inner surface of the top thereof. The rotating spinner has been devised to provide positive distribution of the cleaning solution against the inside cover of the tank and against all sides thereof. In the heretofore generally utilized practice of cleaning the inner surfaces of tanks it has been generally the universal practice to resort to a manual practice of cleaning any difficult to reach areas such as by the use of a brush.

An object of the invention is to provide a substantially semi-automatic cleaning device for the interior of a closed tank which will effectively clean all surfaces thereof.

Another object is to provide a cleaning device for the interior of a tank which utilizes a rotating spinner for distributing a cleaning solution in predetermined paths and particularly against certain interior surfaces of a tank which have been heretofore generally inaccessible to known practices of cleaning.

A further object is to provide a cleaning device for the interior of tanks which utilizes a rotating spinner for positively changing the direction of flow of a stream of cleaning solution so that the greater portion of the cleaning fluid is directed against the inner surfaces of the tank and the top cover.

A still further object is to provide a cleaning apparatus for a tank where installation is quick and simple, an apparatus which incorporates only one moving part which operates out of contact with the surfaces being cleaned and therefore reduces to zero any possibility of scratching of the tank surfaces and a cleaning apparatus in which the cleaning solution flow is changed substantially from 90° to 180° of the direction of flow of the incoming cleaning solution.

Other objects of the invention will readily appear from a reading of the following description and of the claims in which:

FIG. 1 is a side elevational view of a tank with a part of a side of the tank broken away showing the cleaner of the invention installed therein;

FIG. 2 is a plan view of the rotating element or spinner of the invention;

FIG. 3 is an elevational view of the spinner element of the invention;

FIG. 4 is a view taken on line 4—4 of FIG. 2; and

FIG. 5 is a graphic view of the distribution of water occasioned by the spinner of the invention.

With reference to the drawings, 10 indicates a conventional tank, and a cover 11 which is provided substantially centrally thereof with an upwardly extending flange 12.

A bushing 13, having a thumbscrew 14 is removably secured about the vertical end of preferably a stainless steel conduit or tube 15. The latter element is of angular configuration as best shown in FIG. 1 and has its inner end which is somewhat restricted in diameter from the diameter of the balance of the tube to form a nozzle 16, disposed vertically and downwardly within the tank. The opposite end of the tube is removably secured in the bushing which rests on the cover flange 12.

Secured as by welding to the restricted tube end or nozzle 16 of the tube is an angular bracket 17 as best seen in FIG. 1. The opposite end 18 of the bracket is disposed vertically and is provided with a reduced end which serves as a pivot upon which a plastic spinner 19 rotates to distribute a cleaning solution to the interior surfaces of the side walls and cover of the tank. It is to be noted that the material from which the tube 15 and bracket 17 are fabricated are preferably stainless steel thus affording sanitary properties to the structure.

A plastic spinner 19, which enjoys the quality of being very sanitary, is of particular importance in that it is the spinner which positively changes the direction of flow of the incoming cleaning solution and directs the same to various areas of the interior surface of the tank. With reference to FIGS. 2–4, spinner 19 is circular and is provided in the center of its body 20 with a recess 34 which fits over the reduced vertically disposed lower end of bracket 17.

The body 20 of the spinner 19 is provided with a plurality of vertically disposed angular teeth. The teeth which are preferably of an even number, comprise a plurality of teeth 21 of a larger size than an equal number of smaller teeth 22 and are alternately disposed circumferentially along the upper surface of the spinner body with a flat distribution surface 23 disposed between each alternate pair of teeth.

Each tooth of the spinner which is triangular in shape as best seen in FIG. 3, has a vertically disposed driving or trailing edge 24 and an angularly disposed leading edge 25, each of the latter extending upwardly from the body 20 of the spinner and toward the trailing edge to the tip of the tooth. The leading edge of each tooth constitutes a flat substantially triangular leading surface which, when the spinner is rotating, throws a portion of the cleaning solution upwardly and centrifugally outwardly towards the inside surfaces of the sides of the tank. The angle of leading edge 25 with the horizontal plane of the body 20 is smaller for the larger teeth than for the smaller teeth so that the teeth 21 and 22 are all of substantially the same height.

The inner surfaces 26 of the teeth are concave in curvature and represent corresponding portions of a sphere having its center located on the vertical axis of the spinner above the latter and extend upwardly from an area of merger with the upper surface of the body 20 of the spinner to the tip of the tooth, thereby resulting in teeth which have an inner concave surface of substantially triangular shape. These surfaces 26 are of extreme importance in the distribution of the cleaning solution inasmuch as it is these surfaces which direct a portion of the flow of the solution upwardly so that it may reach the inner surface of the cover.

It will be seen from the above description of the teeth that each tooth is formed so that it has a driving or trailing edge 24, an inner concave, water-directing surface 26, and a flat triangular leading surface 25. A plurality of the inner concave surfaces 26 of the larger teeth are of greater surface area than the corresponding surfaces of

the smaller teeth. Likewise, a plurality of the flat triangular leading surfaces **25** of the larger teeth are of greater surface area than the corresponding surface area of the smaller teeth. The individual area of the driving surface **24** of all the teeth are substantially equal.

The spinner **19** is preferably formed of molded plastic material such as Teflon. The upper surface of the spinner is provided centrally with a cone **28** having its base **29** blending or merging into the hereinbefore mentioned horizontal upper body surface. The apex of the cone **28** lies on the central vertical axis of the body **20** and is at a substantial height above body **20**. It will be appreciated that the cleaning solution which is forced through the nozzle **16** of the tube **15** will be directed downwardly and radially outward by the cone, and will follow the merging surfaces from the base of the cone outwardly to a reverse upwardly direction along the concave surfaces **26**.

As stated above, a flat distribution surface **23** is disposed between each alternate pair of teeth. This distribution surface is of substantial width compared to the angularly disposed flat surfaces **27** between each remaining alternate pair of teeth. The distribution paths, both narrow and wide, which represent the flow of cleaning fluid horizontally and substantially radially outward from the upper surface of the body **20** are defined by the flat surfaces **23** of the body. Additional distribution paths represent the flow of cleaning fluid along the surfaces **25** and **26** which extend from the base of each tooth to the tip thereof. These latter paths vary in angular direction of flow to provide the desired impingement upon the inner surface of the cover and side walls of the tank.

It will thus be appreciated, as will be seen with reference to the water distribution pattern shown in FIG. 5, that the cleaning solution, which is of high velocity will be directed substantially outwardly, substantially vertically, and also angularly upwardly from the rotating spinner. The cutting action of the angular leading edges **25** of both the small and large teeth provide criss-crossing torrents of solution. The pattern of liquid distribution shown in FIG. 5 may be regarded as typical for the type of spinner of the invention and shows the approximate percentage of liquid distributed at varying degrees extending from a horizontal to a vertical position.

An outlet valve **30** is provided at the bottom of the tank and is connected to a pump **31** of suitable capacity by a suction hose **32**. The outlet of the pump is connected to the upper end of the tube **15** by any suitable hose **33**. It is preferable to use plastic hose, which is sanitary, one such hose being known as Tygon.

A suitable procedure to follow to wash out a tank which has just been drained of milk is to immediately rinse the tank with warm water. The pump suction hose **32** is then connected to the tank outlet valve **30** and the tube **15**; and spinner **19** and hose **33** between the tube and pump are installed. The tank is then partially filled with hot water, approximately 2 gallons of water to every 100 gallons of tank capacity and a suitable amount of non-foaming detergent is added. The pump is then run for a suitable length of time, approximately 10 to 15 minutes. The tank is then drained of the cleaning solution and rinse water introduced which may be recirculated by the pump and spinner mechanism. The suction hose **32** may be then disconnected permitting the contents of the tank to drain with a final step of rinsing only the bottom of the tank.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. A liquid distribution device for use in directing streams of cleaning solution in predetermined paths against the inner side surfaces of a tank and the inner surface of a cover for said tank and which is adapted to receive a cleaning solution from a high capacity pump associated with the distribution device and the tank, comprising a tubular member having one end thereof extending upwardly through a bushing disposed over an aperture in the tank cover, said tubular member depending vertically from said bushing and having an opposite end of restricted diameter disposed in juxtaposed parallel alignment with said first end and having its restricted diameter depending toward the interior of the tank, a bracket secured at one end thereof to the restricted end of the tubular member and having its opposite end disposed in vertical alignment with the restricted end of said tubular member, said opposite end of the bracket being adapted to receive a circular rotating liquid distribution spinner, said spinner having a circular body with a centrally disposed conical member extending upwardly from said body, an aperture in the bottom surface of the body extending upwardly to the interior of the cone, said body aperture and conical member having a common vertical axis and being disposed directly beneath and in alignment with the vertical axis of the restricted end of the tube, and a plurality of circumferentially spaced liquid distribution teeth vertically disposed from the upper surface of said body and adapted to direct streams of liquid horizontally against the inside surfaces of the walls of a tank and vertically against the inside surface of the cover for the tank.

2. A liquid distribution device for use in directing streams of cleaning solution in predetermined paths against the inner side surfaces of a tank and the inner surface of a cover for said tank and which is adapted to receive a cleaning solution from a high capacity pump associated with the distribution device and the tank, comprising a tubular member having one end thereof extending upwardly through a bushing disposed over an aperture in the tank cover, said tubular member depending vertically from said bushing and having an opposite end of restricted diameter disposed in juxtaposed parallel alignment with said first end and having its restricted diameter depending toward the interior of the tank, a bracket secured at one end thereof to the restricted end of the tubular member and having its opposite end disposed in vertical alignment with the restricted end of said tubular member, said opposite end of the bracket being adapted to receive a circular rotating liquid distribution spinner, said spinner having a circular body with a centrally disposed conical member extending upwardly from said body, an aperture in the bottom surface of the body extending upwardly to the interior of the cone, said body aperture and conical member having a common vertical axis and being disposed directly beneath and in alignment with the vertical axis of the restricted end of the tube, and a plurality of circumferentially spaced liquid distribution teeth vertically disposed from the upper surface of said body, said teeth having inner liquid distribution surfaces that are concave and represent portions of a sphere having its center on the vertical axis of the cone, angularly disposed flat triangular distribution side surfaces and flat triangular driving surfaces vertically disposed with relation to the horizontal upper surface of the cone, said inner and side surfaces of said spinner adapted to direct cleaning fluid vertically and angularly upwardly respectively against the inner surface of a cover for the tank and against the inner surfaces of the sides thereof.

3. A liquid distribution device for use in directing streams of cleaning solution in predetermined paths against the inner side surfaces of a tank and the inner surface of a cover for said tank and which is adapted to receive a cleaning solution from a high capacity pump associated with the distribution device and the tank, comprising a tubular member having one end thereof extending upwardly through a bushing disposed over an aperture in the tank cover, said tubular member depending vertically from said bushing and having an opposite end of restricted diameter disposed in juxtaposed parallel

alignment with said first end and having its restricted diameter depending toward the interior of the tank, a bracket secured at one end thereof to the restricted end of the tubular member and having its opposite end disposed in vertical alignment with the restricted end of said tubular member, said opposite end of the bracket being adapted to receive a circular rotating liquid distribution spinner, said spinner having a circular body with a centrally disposed conical member extending upwardly from said body, an aperture in the bottom surface of the body extending upwardly to the interior of the cone and receiving said bracket to support said spinner for rotation, said body aperture and conical member having a common vertical axis and being disposed directly beneath and in alignment with the vertical axis of the restricted end of the tube, a plurality of circumferentially spaced liquid distribution teeth vertically disposed from the upper surface of said body, certain of said teeth being of greater surface area than the surface area of the remainder of said teeth and being alternately disposed with respect thereto, a plurality of equally spaced flat liquid distribution surfaces between alternate pairs of the teeth for directing streams of cleaning fluid substantially horizontally from the spinner to the inner side surfaces of the tank, all of said teeth having inner liquid distribution surfaces that are concave and represent portions of a sphere having its center on the vertical axis of the cone, angularly flat triangular distribution side surfaces and flat triangular driving surfaces vertically disposed with relation to the horizontal upper surface of the cone, said flat, concave, and flat triangular distribution surfaces of said teeth being adapted to direct streams of cleaning solution substantially horizontally against the side surfaces of a tank and vertically against the inner surface of the cover of the tank.

4. A liquid distribution device for use in directing streams of cleaning solution in predetermined paths against the inner side surfaces of a tank and the inner surface of a cover for said tank and which is adapted to receive a cleaning solution from a high capacity pump associated with the distribution device and the tank, comprising a tubular member having one end thereof extending upwardly through a bushing disposed over an aperture in the tank cover, said tubular member depending vertically from said bushing and having an opposite end of restricted diameter disposed in juxtaposed parallel alignment with said first end and having its restricted diameter depending toward the interior of the tank, a bracket secured at one end thereof to the restricted end of the tubular member and having its opposite end disposed in vertical alignment with the restricted end of said tubular member, said opposite end of the bracket being adapted to receive a circular rotating liquid distribution spinner, said spinner having a circular body with a centrally disposed conical member extending upwardly from said body, an aperture in the bottom surface of the body extending upwardly to the interior of the cone, said body aperture and conical member having a common vertical axis and being disposed directly beneath and in

alignment with the vertical axis of the restricted end of the tube, and a plurality of circumferentially spaced liquid distribution teeth vertically disposed from the upper surface of said body, certain of said teeth being of greater surface area than the surface area of the remainder of said teeth and being alternately disposed with respect to one another, a plurality of equally spaced flat liquid distribution surfaces between alternate pairs of the teeth for directing streams of cleaning fluid substantially horizontally from the spinner to the inner side surfaces of the tank, all of said teeth having inner liquid distribution surfaces that are spherical with relation to the vertical axis of the cone, angularly flat triangular distribution side surfaces and flat triangular driving surfaces vertically disposed with relation to the horizontal upper surface of the cone, a plurality of equally spaced angular distribution surfaces disposed between remaining alternate pairs of the teeth, all of said surfaces being coplanar with the upper surface of the spinner body, said teeth having inner surfaces that are spherical with relation to the vertical axis of the cone, and flat substantially triangular side surfaces one of said side surface of each tooth being adapted to distribute fluid angularly upwardly against the inside surfaces of a tank the remaining side surface of each said tooth being a driving surface for rotation of said spinner, said flat surfaces, triangular side surfaces and said inner concave surfaces being adapted to direct streams of fluid against the inner surfaces of a tank and against the inner surface of a tank cover through a substantially semi-circular arc.

5. In apparatus of the class described, a free floating rotating spinner for distributing liquid from a nozzle directed axially thereagainst, comprising a circular body having a conical central axial member facing the nozzle and splitting the stream of liquid therefrom, and a plurality of circumferentially spaced liquid distributing teeth radially upwardly disposed from said conical member and having trailing edges disposed to drive the spinner by the outward flow of liquid impinging upon said edges and having other surfaces disposed to direct liquid in a predetermined distribution pattern, said latter surfaces comprising a plurality of flat substantially triangular leading surfaces to direct a portion of liquid upwardly and centrifugally outwardly and a plurality of concave triangular distribution surfaces disposed to direct a portion of liquid vertically upward from the body of the spinner.

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