Dec. 13, 1938. W. BAECKLER 2,139,656

FLUID IRRADIATING APPARATUS

Original Filed June 3, 1933 2 Sheets-Sheet 1

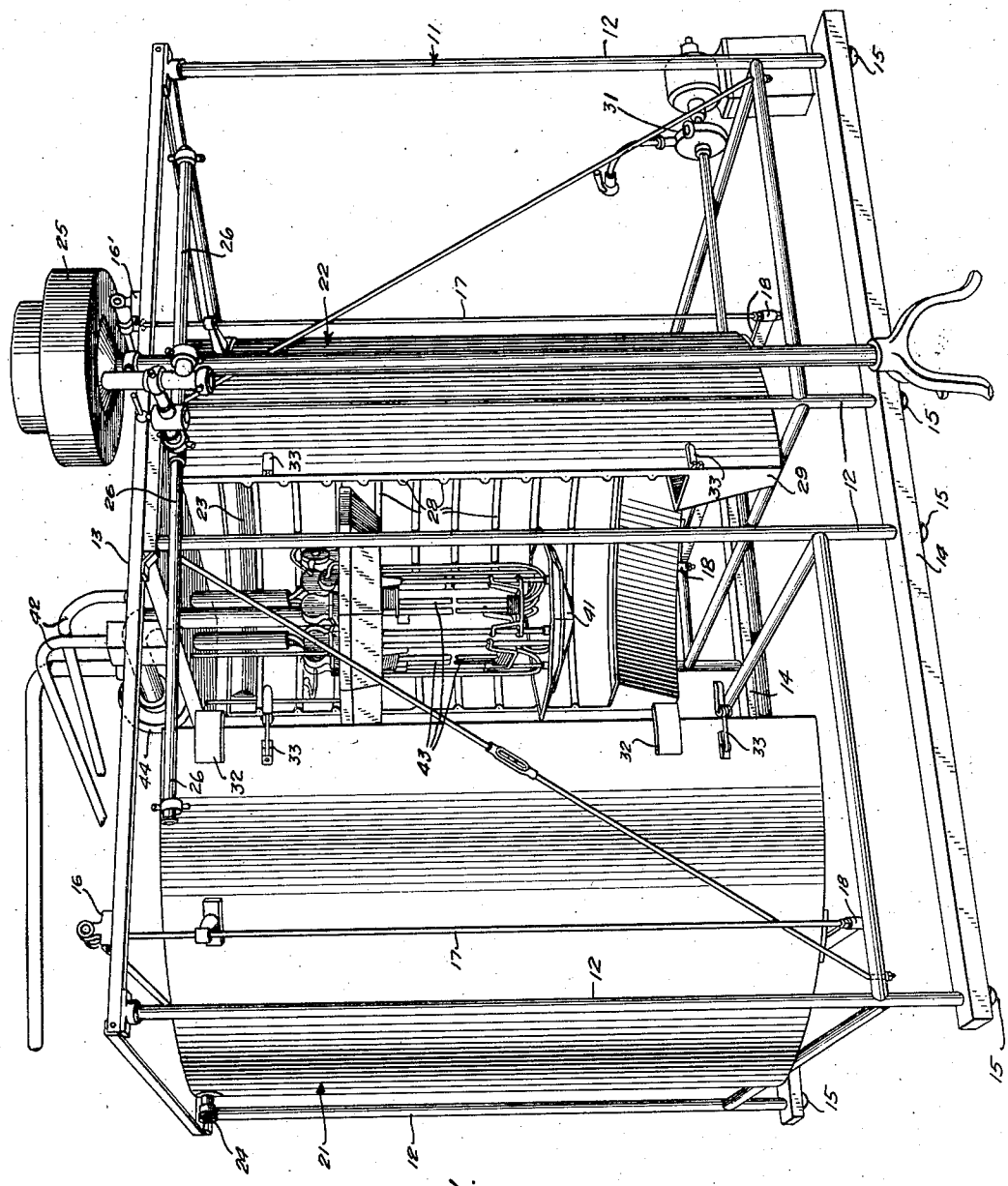

Fig. 1.

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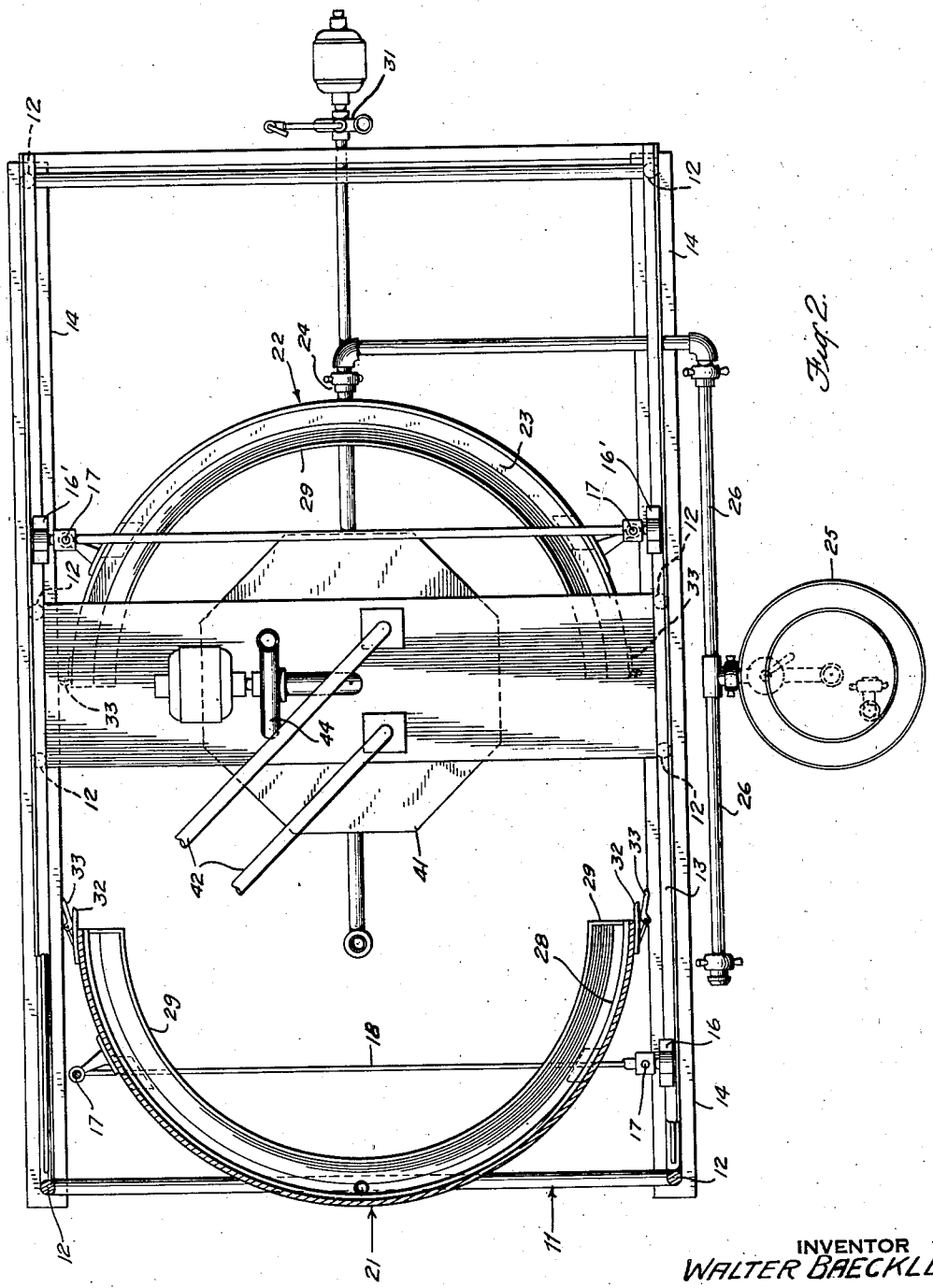

Fig. 2.

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FLUID IRRADIATING APPARATUS

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16 Claims. (Cl. 250—46)

This invention relates to a device for irradiating fluids with radiant energy and especially with the energy radiated by a source such as an electric arc. It is now well established that the radiant energy from the electric arc, properly applied, improves the qualities of various fluids, especially food and pharmaceutical products. This energy includes visible light and also various invisible types of radiant energy such, for example, as that known as ultra-violet radiation. The amount of this ultra-violet radiation can be increased by the proper selection of the electrodes for the arcs. For example it is well known that radiation of milk with ultra-violet energy increases the vitamin content. Although my improved apparatus has been designed especially for use in the irradiation of food products, it is obvious that it may be used for the irradiation of other fluids without departure from my invention. For convenience the invention will be described as adapted to the treatment of milk with the radiation from an electric arc between carbon electrodes having cores containing flame material which will produce relatively large proportions of the radiant energy in the ultra-violet region. However, the invention is not limited to the treatment of milk or to the use of any particular source of radiant energy.

An object of my invention is to produce an irradiating device which shall be efficient in the utilization of the radiant energy. Another object of my invention is to provide means whereby the fluid to be treated will be handled in a sanitary manner throughout. A still further object of my invention is to provide means whereby the losses of the fluid treated are reduced to a minimum and in which there is no contamination with ash from the arc.

These and other objects of my invention will be evident from the accompanying description having reference to the annexed drawings in which

Figure 1 is a perspective view of a device illustrating one embodiment of my invention, and

Figure 2 is a plan view of the device, partly in section.

In the drawings the cylindrical chamber in which the irradiation is carried out is shown with one-half in normal operating position and with the other half in the position for cleaning. During operation the halves of the cylinder are drawn together and for best cleaning both halves would be moved to their extreme outward position.

In the embodiments shown there is a frame member 11 which includes vertical portions 12, top portions 13 and bottom portions 14. Instead of providing bottom portions I may, if I so desire, secure the lower ends of the vertical pieces 12 directly to a floor or other suitable foundation. When bottom pieces 14 are utilized they should be raised, as by the casters 15, so that water can be flushed over the floor beneath them, thus preventing the accumulation of any material in which bacteria could multiply. The upper members 13 serve as a track for carriages 16, 16'. Vertical tie rods 17 extend downwardly from the carriages and serve to support yokes 18. Mounted on the yokes 18 are semi-cylindrical members 21 and 22.

These members 21 and 22 serve as guides over which the milk or other liquid to be irradiated flows downwardly in a thin film. These semi-cylinders are provided at their top with distributing members 23 which are supplied with milk through a coupling 24. The milk is supplied from any suitable source, as a tank 25. However, in permanent installations a permanent tank would generally be used. The milk to be treated from whatever source supplied is continued to a header 26 where it divides, flowing to the distributors 23 through the coupling 24. As shown in the drawings one connection is in place while the other is removed. While it would be possible to provide flexible connections between the header 26 and the coupling 24, it is considered better practice to use rigid connections which are disconnected during cleaning. This is not an inconvenience, since in well managed dairies all joints are broken daily for the purpose of cleaning the entire operating system.

The milk flows down from the distributor 23 in small closely adjacent streams which coalesce to form a film. This film is very thin and the entire film is subjected to the radiant energy. The interior of the semi-cylinders is provided with a number of ridges or baffles 28. These serve two purposes, they mix the milk in the film so that the portion of the film which is at one time nearest the wall of the cylinder, at other times is in other positions. A more important function of these ridges or baffles is to slow down the speed of the milk as it falls, thus maintaining a continuous film instead of a number of small streams. The milk starts down the inside surface at a definite rate in the form of a film. If there were no baffles the milk would attain a speed such as to break up the film and cause the milk to flow in small streams.

When the milk reaches the bottom of the semi-cylinders it is caught in aprons 29 from which it

is removed in any suitable manner, as by a pump 31. Although flexible connections could be provided between the pump 31 and the aprons 29 I prefer to provide rigid connections which are broken during the cleaning operation.

It is to be understood that during the irradiation process the two halves of the cylinder are in juxtaposition. They are aligned by guide members 32 and held together by clamps 33. When it is desired to clean the irradiation device the supply of milk is shut off, the rigid connections are broken, the clamps 33 are loosened and the halves of the cylinder are slid apart, the carriages 16 and 16' sliding outwardly on the upper track-like member 13. After this operation the arc lamp is readily available for retrimming and other adjustment, and the interior of the cylinder may be easily and efficiently cleaned.

The source of ultra-violet energy is an arc lamp 41, which may be of any well known type. Current is supplied to the arc lamp through conductors enclosed in conduits 42. The electrodes 43 may be of varying compositions. Excellent results have been obtained from the use of carbon electrodes containing cores having as flame material therein at least two of the metals iron, manganese, chromium and titanium as described in United States Patent No. 1,920,255, issued on the application of C. E. Greider. In the type of arc lamp shown each lamp is provided with two upper and two lower carbons. These are energized alternately so that the arc is first between one upper and lower carbon and then between the other pair. This shifting occurs at intervals of 25 to 30 minutes. In this way an arc is burning between one pair of carbons in each lamp at all times. The electrodes are fed toward each other by motors in any suitable manner. Above the arc lamp is an exhaust fan 44 for removing the fumes emitted by the arc. Any ash from the carbon electrodes falls to the floor beneath the lamps without contaminating the milk or other substance being treated.

Accordingly it will be seen that I have invented a device which may be maintained in extremely sanitary condition and which permits of ready retrimming of the arc lamp without excess head room. Heretofore it has been considered necessary to have the source of ultra-violet radiated energy movable upwardly for trimming and to get it clear of the cylinder. The cylinder could then be tipped for the purpose of cleaning. With my improved device the source of radiant energy is stationary and less head room is required. Moreover the supporting frame can be made lighter than is possible when the entire cylinder is to be tilted and cleaned in that position. By the provision of ridges or baffles on the interior of the cylinder the liquid being irradiated is maintained in a thin film.

Still another important feature of my invention is the fact that by having the source of radiant energy completely surrounded by the fluid to be irradiated none of the energy is wasted and the device is thus rendered very efficient.

I claim:

1. An apparatus for irradiating liquids comprising a supporting frame work including a pair of track members supported thereby; a lamp supporting member extending substantially between said track members at right angles thereto; a pair of semi-cylindrical shell members provided with substantially horizontal baffles on their inner surface; carriage members engaging said track members and operatively connected to said shells to support the same for movement toward and away from each other to form a split cylinder with a vertical axis, said shells including liquid distributing means at the top thereof and liquid collecting means at the bottom thereof; and a source of ultraviolet energy supported by said lamp supporting member between the shells.

2. An apparatus as claimed in claim 1 which is provided with a reservoir and means adapted to operatively connect said reservoir with said liquid distributing means when the shells are in closed position.

3. An irradiating apparatus comprising a substantially cylindrical treating chamber having at least one interior surface adapted for the irradiation of a liquid while in thin flow and while said liquid is traversing said chamber; a source of ultraviolet radiation within said chamber; and supporting means for said chamber; said chamber comprising a plurality of arcuate sections of a cylinder, at least one of said sections being movable towards said source of ultraviolet radiation to form a closed cylinder wall and away from said source to open said cylinder wall to permit access to the inside of said cylinder and to the said interior surface.

4. An irradiating apparatus for treating liquid comprising a substantially cylindrical treating chamber having an interior surface adapted to define one surface of said liquid and particularly adapted for exposing to ultraviolet radiation a thin flow of said liquid while the latter is traversing said chamber longitudinally; a source of ultraviolet radiation within said chamber; and supporting means for said chambers; said interior surface of said chamber including a plurality of circumferentially extending means for modifying the speed and direction of flow of said liquid and for mixing the liquid, whereby newly formed liquid surfaces are constantly exposed to radiation from said source; said chamber comprising a plurality of arcuate sections of a cylinder, at least one of said sections being movable away from said source to open said chamber and expose the interior surface of the chamber which has been in contact with the liquid being treated, for direct cleaning of said surface without moving said source relative to said supporting means.

5. An irradiating apparatus for treating liquid comprising a treating chamber having at least one substantially cylindrical interior surface particularly adapted for maintaining a thin flow of said liquid for exposure to ultraviolet radiation while said liquid is traversing said chamber longitudinally; a source of ultraviolet radiation within said chamber; and a frame supporting said chamber and said source; said interior surface including a plurality of means for changing the velocity of said liquid and for mixing the liquid, whereby newly formed liquid surfaces are constantly exposed to radiation from said source; said chamber comprising at least two sections movable away from said source to open said chamber and expose the interior surface of the chamber which has been in contact with the liquid being treated, for direct cleaning of said surface without moving said source relative to said frame; said frame comprising at least one support member for each movable section, each support being operatively connected to at least one movable section for suspending and guiding said section for movement away from and toward said source.

6. An irradiating apparatus for treating liquid comprising a treating chamber having a substan-

tially cylindrical interior surface adapted to define one surface of said liquid and particularly adapted for exposing to ultraviolet radiation a thin flow of said liquid while the latter is traversing said chamber longitudinally; a source of ultraviolet radiation within said chamber; and supporting means for said chamber; said interior surface of said chamber including means for modifying the speed and direction of flow of said liquid and for mixing the liquid, whereby newly formed liquid surfaces are constantly exposed to radiation from said source; said chamber comprising a plurality of sections, said sections being movable away from said source to expose the interior surface of the chamber which has been in contact with the liquid being treated, for direct cleaning of said surface without moving said source relative to said supporting means; said supporting means including additional means operatively connected to said sections for suspending and guiding the sections during movement of the latter away from and toward said source.

7. An irradiating apparatus for treating liquids comprising a treating chamber containing at least one vertically disposed substantially cylindrical surface adapted to define one surface of a liquid falling through said chamber and particularly adapted to maintain a thin flow of the liquid exposed to ultraviolet radiation while said liquid is falling through said chamber; a source of ultraviolet radiation disposed at about the axis of said cylindrical surface; and supporting means for said chamber; said surface including a plurality of circumferentially extending means for modifying the speed and direction of flow of said liquid and for mixing the liquid, whereby newly formed liquid surfaces are constantly exposed to radiation from said source; said chamber comprising a plurality of sections, at least one of said sections being movable away from said source to open said chamber for direct access to said surface without moving said source relative to said supporting means; said supporting means including at least one guiding member operatively connected to one of said sections for guiding said section during movement in a horizontal direction away from and toward said source.

8. In apparatus for irradiating fluids, the combination of a casing comprising separable sections having interior surfaces which together provide a substantially tubular surface; means adjacent one end of said sections for discharging fluid in contact with the interior surfaces of said sections; means adjacent the other end of said sections for collecting fluid which has flowed in contact with surfaces of said sections; a source of radiant energy within said casing and disposed substantially centrally relatively to said tubular surface; and supporting means for said sections so constructed and arranged that one of said sections is separable from the other section a sufficient distance to permit access to the interior surfaces of said sections to clean the same.

9. In apparatus for irradiating fluids, the combination of a vertically disposed casing comprising horizontally separable sections jointly providing a substantially tubular interior surface for said casing; means adjacent the upper end of each of said sections for discharging streams of fluid onto the interior surfaces thereof; means adjacent the lower end of each of said sections for collecting fluid which has run down over the surfaces of said sections; a source of radiant energy within said casing and disposed substantially centrally relatively to said tubular surface; horizontally disposed guiding means; and means for independently and movably mounting said sections upon said guiding means, whereby said sections are separable a sufficient distance to permit access to said source of radiant energy to repair and adjust the latter and also to permit access, for cleansing purposes, to the interior surfaces of said sections and to such discharging and collecting means.

10. Apparatus for irradiating fluids as claimed in claim 9, in which said source of radiant energy comprises a stationary arc lamp; and said casing is normally open to the atmosphere both at its top and at its bottom to permit the circulaion of air therethrough.

11. Apparatus for irradiating fluids as claimed in claim 9, in which said source of radiant energy comprises an electric arc lamp, and in combination with means for withdrawing air and fumes from within said casing.

12. Apparatus for irradiating liquids as claimed in claim 9, in which said guiding means comprises horizontal rails; said source of radiant energy is normally fixed relatively to said rails; and said means for independently and movably mounting said sections comprising carriages severally secured to said sections and adapted to travel along said rails toward and away from said source of energy.

13. Apparatus for irradiating fluids as claimed in claim 9, in combination with a single reservoir for the fluid to be irradiated; conduits severally connecting said reservoir to each of said means for discharging fluid onto the interior surface of each section; and a single means communicating with the several fluid collecting means to withdraw and mix the fluid which has run over the several sections.

14. Apparatus for irradiating fluids as claimed in claim 9, in which each of said sections has spaced ridges extending transversely of its interior surface between such discharging means and such collecting means.

15. A portable apparatus for irradiating liquids, comprising the combination of a movable frame having substantially horizontal members constituting rails; a pair of movable casing sections cooperating to form a vertical and substantially cylindrical chamber normally open to the atmosphere both at its bottom and at its top, each of said sections having a vertical and substantially semi-cylindrical interior surface; means adjacent the upper ends of said sections for discharging liquid onto the interior surfaces of said sections; means adjacent the lower ends of said sections for collecting liquid which has run down along said surfaces; a source of radiant energy mounted on said frame and centrally within said chamber; and carriages severally supporting said sections and adapted to travel along said rails toward and away from one another, whereby said sections may be set in cooperating relation to form said chamber and enclose said source of energy and whereby said sections may be separated a sufficient distance to permit access to said source of energy to repair and adjust the same and also to permit access to said interior surfaces to clean the same.

16. A portable apparatus for irradiating liquids, comprising the combination of a frame movably supported upon casters or the like and having horizontal members constituting rails; a pair of movable casing sections cooperating to form a vertical and substantially cylindrical chamber normally open to the atmosphere both at its bottom and at its top, each of said sections having a

vertical and substantially semi-cylindrical interior surface; means mounted on each section adjacent its upper end for discharging liquid onto its interior surface; means mounted on each section adjacent its lower end for collecting liquid which has run down along its interior surface; an electric arc lamp mounted on said frame and centrally within said chamber; means, mounted on said frame, for withdrawing foreign matter from said chamber and for causing a circulation of air upwardly therethrough; and carriages severally supporting said sections independently of one another, said carriages being adapted to travel on and horizontally along said rails toward and away from one another, whereby said sections may be set in cooperating relation to form said chamber and enclose said arc lamp and whereby said sections may be moved a substantial distance apart to permit access to said arc lamp to trim and adjust the same and also to permit access, for cleansing purposes, to said interior surfaces and to the liquid discharging and collecting means.

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