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APPARATUS FOR TREATING LIQUIDS

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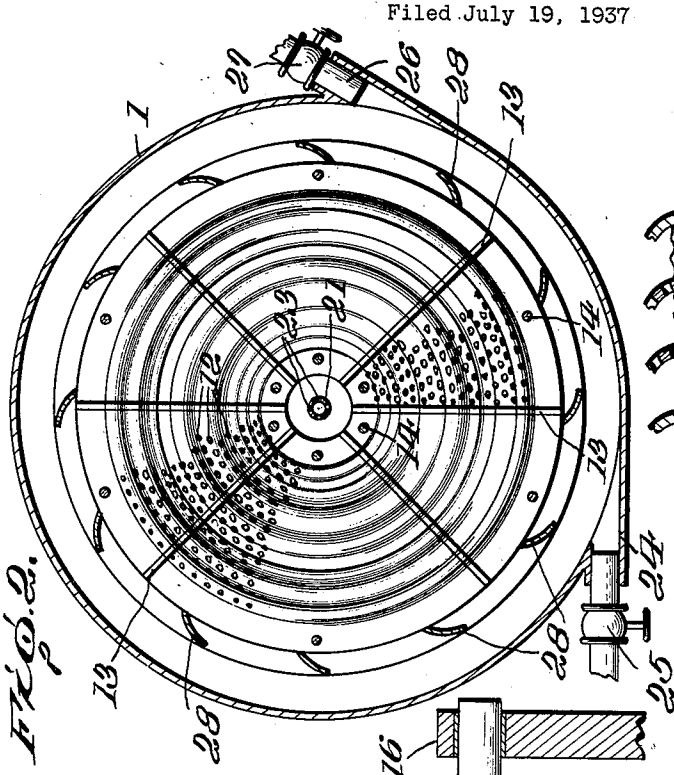


FIG. 2.

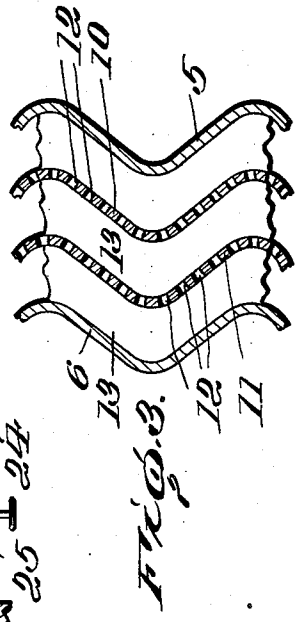


FIG. 3.

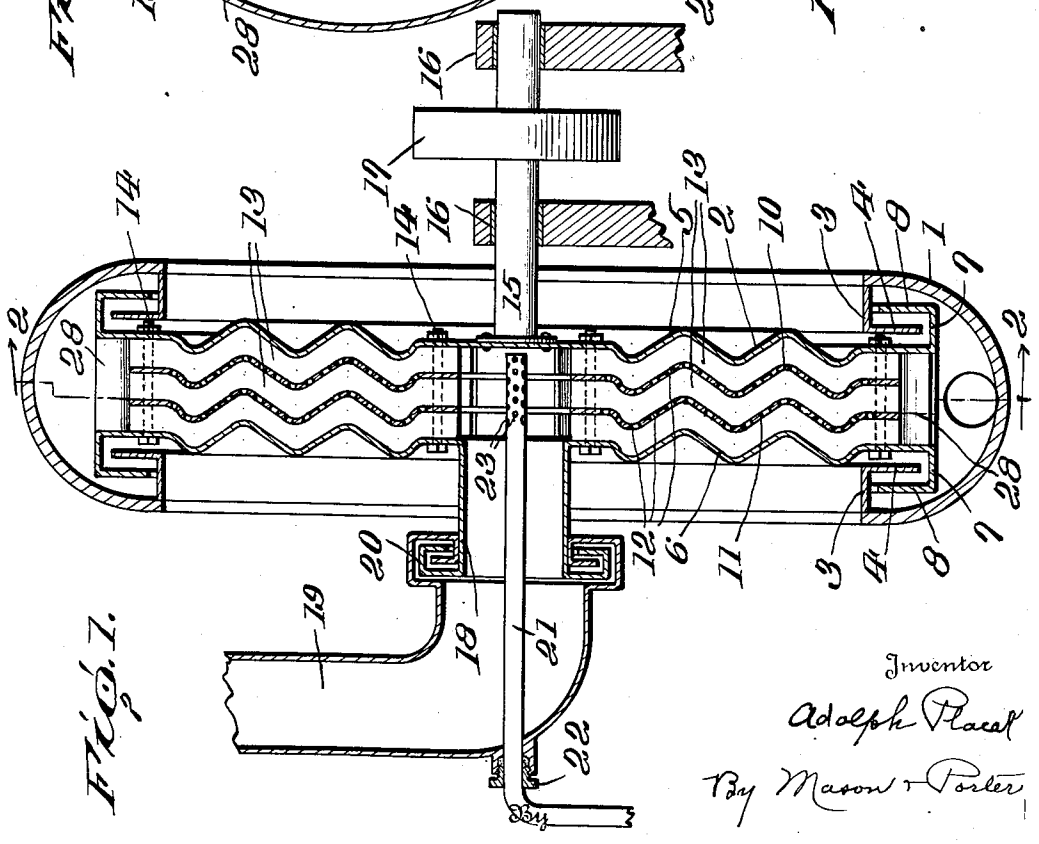


FIG. 1.

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APPARATUS FOR TREATING LIQUIDS

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3 Claims. (Cl. 261—90)

The invention relates to new and useful improvements in an apparatus for efficiently treating liquids with a gaseous medium.

An object of the invention is to provide an apparatus which is simple in construction and which provides for the continuous flow of the liquid to be treated through the apparatus by the action of centrifugal force thereon, and also a continuous flow of a gaseous medium for treating the liquid in a counter-current direction, and wherein means is provided for breaking the flow of the liquid into flowing films and flowing sprays.

Another object of the invention is to provide an apparatus of the above type which includes a rotating drum, provided with means at the center thereof for receiving the liquid to be treated, and provided with means for introducing the treating gaseous medium to said drum at the periphery thereof under conditions which will cause said gaseous medium to flow in a counter direction to the flow of the liquid, and wherein said drum is provided with means for breaking the flow of the liquid into portions consisting of flowing sprays and flowing films.

Another object of the invention is to provide an apparatus of the above type wherein the means for breaking the flow of the liquid is in the form of spaced parallel circular plates provided with concentrically and circumferentially corrugated surfaces, these plates being placed within the mentioned drum perpendicularly and concentrically with reference to the axis of rotation of said drum.

Another object of the invention is to provide said corrugated plates with perforations to effect a further distribution of the liquid into sprays.

A still further object of the invention is to provide said casing with an inlet for the gaseous medium, this inlet being directed tangentially with reference to the periphery of the drum, this periphery being provided with vanes for propelling said drum by incoming gaseous medium.

These and other objects will in part be obvious and will in part be hereinafter more fully disclosed.

In the drawing which illustrates by way of example, the principle of the invention—

Figure 1 is a vertical section through an apparatus constructed in accordance with the invention on the line 1—1 of Fig. 2;

Fig. 2 is a similar view taken substantially on the line 2—2 of Fig. 1, and

Fig. 3 is an enlarged sectional view through the walls of the apparatus showing more clearly the arrangement of the perforations therethrough.

The apparatus includes a stationary annular casing 1 in which is journaled a rotatable drum 2. Between the drum and the casing is a hydraulic seal. In the present embodiment of the invention, this hydraulic seal is accomplished by means of annular plates 3, 3 attached to the casing 1, each plate having a flange 4 extending outwardly and in a direction at right angles to the axis of rotation of the drum. The drum includes outer plates 5 and 6, and said outer plates, as shown, are extended laterally as indicated at 7, 7, and thence bent inwardly as indicated at 8, 8. This forms a channel into which the flanges 4, 4 extend. A fluid is placed in the channel and this serves to establish an hydraulic seal between the drum and the casing. The plates 5 and 6 form the walls of the drum. These plates are corrugated so as to provide annular corrugations merging one into the other, so that in radial cross section, the wall is sinuous and curves first in one diretcion and then the other, with one curve leading into the other. These walls 5 and 6, as shown more clearly in Figure 3, are solid and imperforate.

As shown in the present embodiment of the invention, there are intermediate walls 10 and 11 located intermediate the walls 5 and 6. These walls 10 and 11 are likewise formed of thin sheet metal plate and are corrugated so as to provide surfaces which are similarly shaped to the surfaces of the walls 5 and 6. These intermediate walls 10 and 11 are formed with small perforations therethrough as indicated at 12 in Figure 3. The walls are spaced from each other by rods 13. As shown, there are six rods arranged radially of the drum, and these rods are curved to conform to the shaping of the walls. The rods are of uniform thickness, and this provides a space of uniform width between the walls. Bolts 14, 14 extend through the plates forming the outer walls and through the plates forming the intermediate walls and firmly clamp the plates against these spacing rods. Other means, of course, may be used for spacing the walls. It is desirable that the walls shall be uniformly spaced and that there shall be a free passage from the center of the casing to the outer periphery of the drum.

The plate 5 constituting one wall of the drum is rigidly secured to a shaft 15 mounted in bearings 16, 16 in a suitable frame. There are two spaced bearings, and these serve to support the shaft so that it will rotate about a fixed axis. Intermediate the bearings 16, 16 is a pulley 17

by which the shaft may be driven. Inasmuch as the plate 6 constituting the other outer wall and the intermediate plates are all bolted to the plate 5, this produces a rigid drum structure supported by the shaft 15 and rotated thereby. The plate 6 has a pipe 18 secured thereto, and this pipe is connected to a stationary pipe 19 by means of an hydraulic seal 20 which is constructed similar to the hydraulic seal between the drum and the casing 1, and detail description thereof is not thought necessary. There is a pipe 21 which extends through the pipe 19 and is connected thereto by a suitable stuffing box 22, which pipe enters the center of the drum and serves as a means for delivering the liquid to be treated to the drum. Said pipe is provided with a series of perforations 23 and the inner end of the pipe is closed so that the liquid will be delivered into the drum in relatively fine streams. There is a pipe 24 attached to the casing 1 which serves to draw off the treated liquid. This pipe 24 is arranged tangentially to the casing and at the low point of the casing so that the fluid thrown against the wall of the casing by centrifugal force will collect at the bottom of the casing and be forced into the pipe 24. There is a control valve 25 for this pipe. The gaseous medium for treating the liquid is delivered to the casing by means of a pipe 26 having a control valve 27. This pipe is arranged tangentially to the casing, and the gas is admitted through this pipe 26 under pressure.

Located between the plates 5, 6 are vanes 28 which are so disposed that the gas under pressure entering the casing from the pipe 26 strikes these vanes and assists in the rotation of the drum.

The drum with its corrugated plates is rotated at a high velocity. The liquid medium to be treated is passed into the apparatus through the pipe 21 and is distributed on to the plates of the rotating drum. The centrifugal force incident to the rapid rotation of the drum causes the liquid to spread into films on the surface of the plates 5, 6, 10 and 11, and the liquid will be caused to flow toward the outer periphery of the drum. The liquid will flow along the surfaces of the plates in film, and at the turning points of the corrugations will leave the surface in sprays in a paraboloid motion to the internal surface. Said liquid will also flow along the surfaces of the intermediate plates or walls in the same manner, leaving said surfaces in the form of sprays and some of the liquid will pass through the perforations to the other surface of the plate and in sprays cross to the opposite plate. The liquid when it reaches the periphery of the drum is collected in the stationary casing 1 and withdrawn therefrom through the drain pipe 24. The vapor or other gaseous medium which is introduced into the casing through the pipe 26 flows under pressure in a counter-current direction to the flow of the liquid. This gaseous medium will divide into layers and pass in a wave-like motion between the plates from the periphery thereof to the center of the drum. The wall of each layer is determined by the surface of the plates between which the layer of gas is passing. At the center of the drum, the gaseous medium is taken off through the pipe 18 and the pipe 19.

This dividing of the gaseous medium into layers having a wave-like motion and the distributing of the liquid into films contacting with the surface of the layers of gaseous medium and into sprays traversing said sprays of gaseous medium, brings about a very efficient contact between the gaseous medium and the liquid to be treated. The liquid not only flows along the surface of the layers of the gas, but as noted above, will separate from the plates in sprays, crossing a layer, and will pass from one layer into the next adjacent layer. Such a treating of liquids by gaseous medium is only possible when the gaseous medium is in a wave-like motion, and the liquid is forced to partly flow longitudinally and partly transversely to the direction of said wave-like motion, and also partly in films contacting with the surfaces of the wave-like moving layers of gaseous medium and partly in sprays crossing said layers.

While the drum is shown as rotating about a horizontal axis, it will be understood that the axis may be vertical or otherwise arranged without affecting the operation of the apparatus and the carrying out of the process.

It is obvious that many changes in the details of construction of the apparatus may be made without departing from the spirit of the invention as set forth in the appended claims, and that the process may be carried out in other forms of apparatus than in the one illustrated.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is—

1. An apparatus for treating liquids with a gaseous medium comprising a rotatable drum, means for supplying the liquid to be treated to said drum centrally thereof whereby it is carried through and discharged at the periphery of the drum by centrifugal force, means for supplying the gaseous treating medium under pressure at the periphery of the drum and for removing the same at the center of the drum, said drum including outer walls having annular corrugations and intermediate walls having annular corrugations, all of said corrugations being concentric to the axis of rotation and similarly shaped and disposed so that in radial cross section through the drum the walls are wavelike, curving first in one direction and then the other from the center of the drum to the periphery thereof, said intermediate walls having small perforations therethrough through which the liquid flowing in films along the surface of the intermediate walls will pass through said walls.

2. An apparatus for treating liquids with a gaseous medium comprising a rotatable drum provided at its periphery with propelling vanes, means for supplying the liquid to be treated to said drum centrally thereof whereby it is carried through and discharged at the periphery of the drum by centrifugal force, and means for introducing the gaseous treating medium under pressure in tangential direction to the periphery of the drum and removing the same at the center of the drum, said drum including outer walls having annular carrugations and intermediate walls having annular corrugations, all of said corrugations being similarly shaped and disposed so that in radial cross section through the drums the walls are wavelike, curving first in one direction and then the other from the center of the drum to the periphery thereof.

3. An apparatus for treating liquids with a gaseous medium comprising a rotatable drum provided at its periphery with propelling vanes, means for supplying the liquid to be treated to said drum centrally thereof whereby it is carried through and discharged at the periphery of the

drum by centrifugal force, and means for introducing the gaseous treating medium under pressure in tangential direction to the periphery of the drum and removing the same at the center of the drum, said drum including outer walls having annular corrugations and intermediate walls having annular corrugations, all of said corrugations being similarly shaped and disposed so that in radial cross section through the drums the walls are wavelike, curving first in one direction and then the other from the center of the drum to the periphery thereof, said intermediate walls having small perforations therethrough through which the liquid flowing in films along the surface of the intermediate walls will pass through said walls.

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