United States Patent [19]

Fryar

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[54] **VACUUM DEAERATOR FOR VISCOUS LIQUIDS**

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[52] **U.S. Cl.** **55/41**; 55/190; 55/203; 233/DIG. 1

[51] **Int. Cl.**..... **B01d 19/00**; B01d 45/00

[58] **Field of Search**..... 55/41, 190, 191, 193, 203; 210/377; 233/21, 31, 32, 37, 43, DIG. 1

[56] **References Cited**

UNITED STATES PATENTS

624,596	5/1899	Williams	233/43
2,060,242	11/1936	Pulley	55/190
2,507,797	5/1950	Martin	55/190 X
2,648,496	8/1953	Cresswell	55/203 X
3,061,438	10/1962	Jacobs et al.	55/41 X
3,283,910	11/1966	Grieselhuber et al.	210/377 X

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[57] **ABSTRACT**

A centrifugal vacuum deaerator including a rotor which comprises a flange adapted to receive the material which is being deaerated after it is accelerated by centrifugal force, said flange being unperforated in the area where the material impinges on said flange, and said flange being distinguished by the absence of any flow-impeding means which would substantially impede the spreading of said material when it is deposited upon said flange.

6 Claims, 3 Drawing Figures

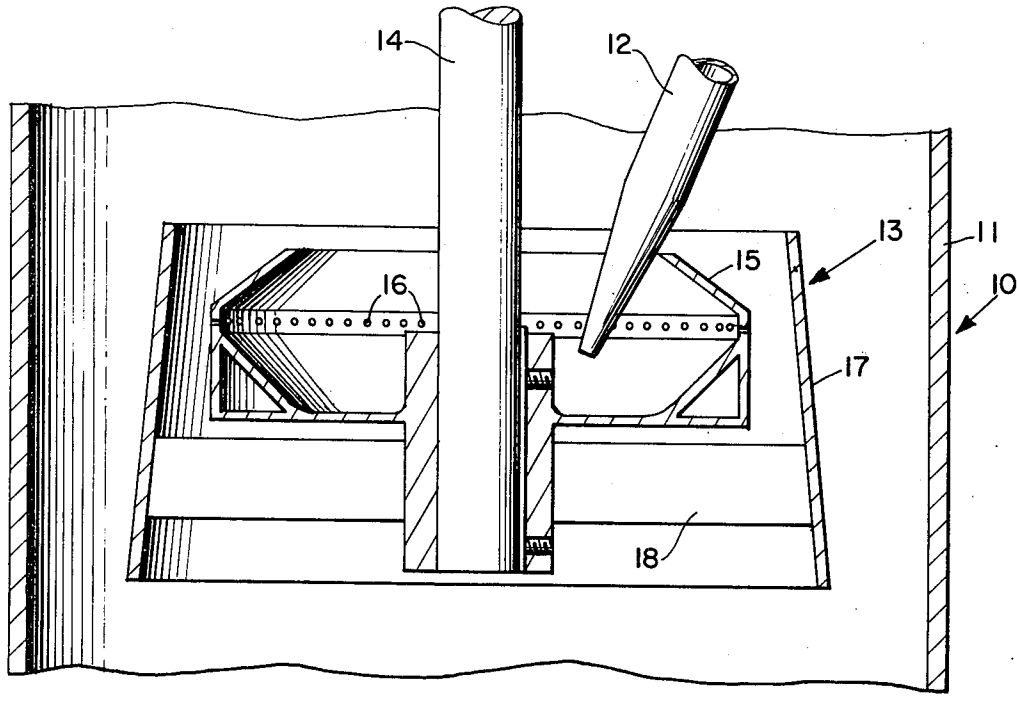


Fig. 1

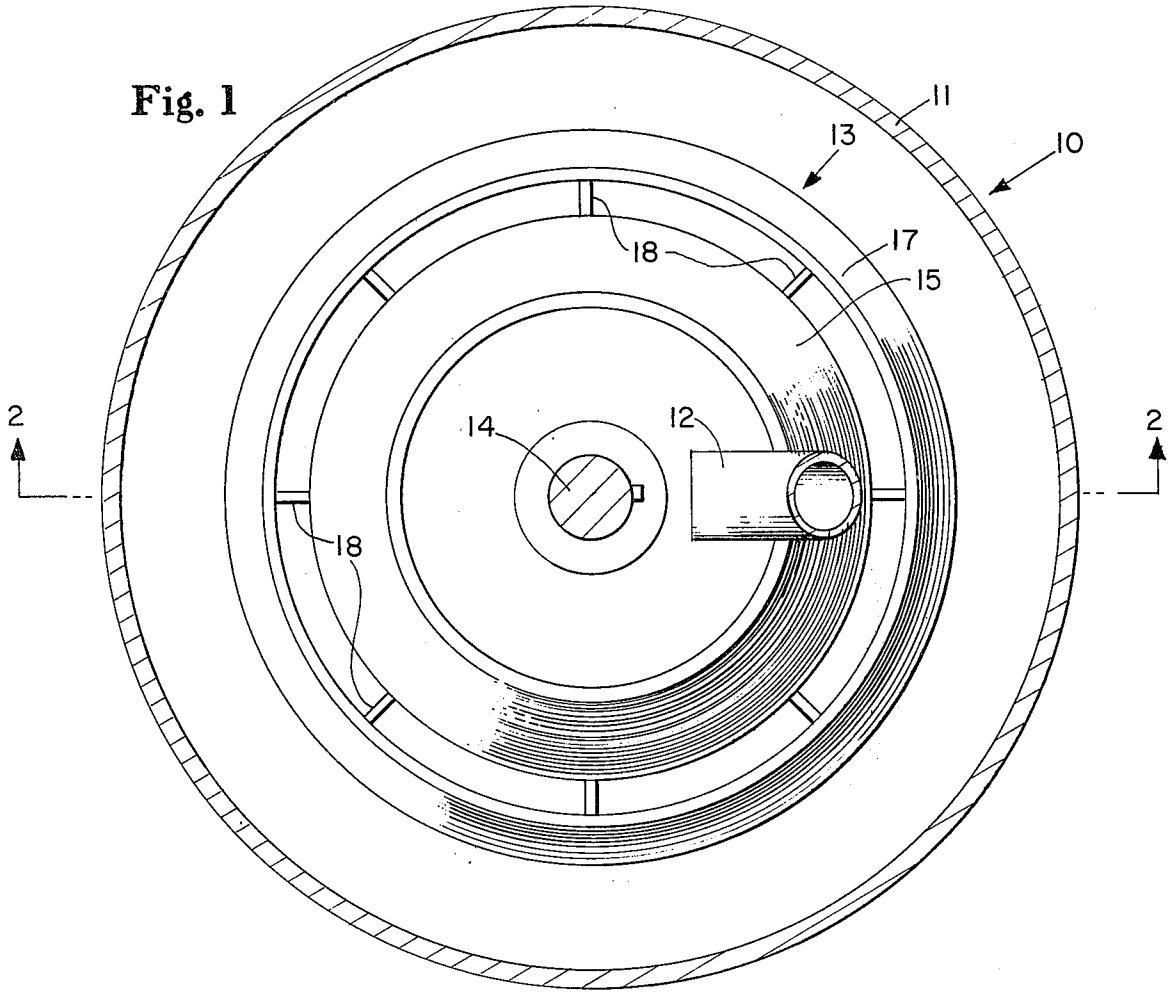
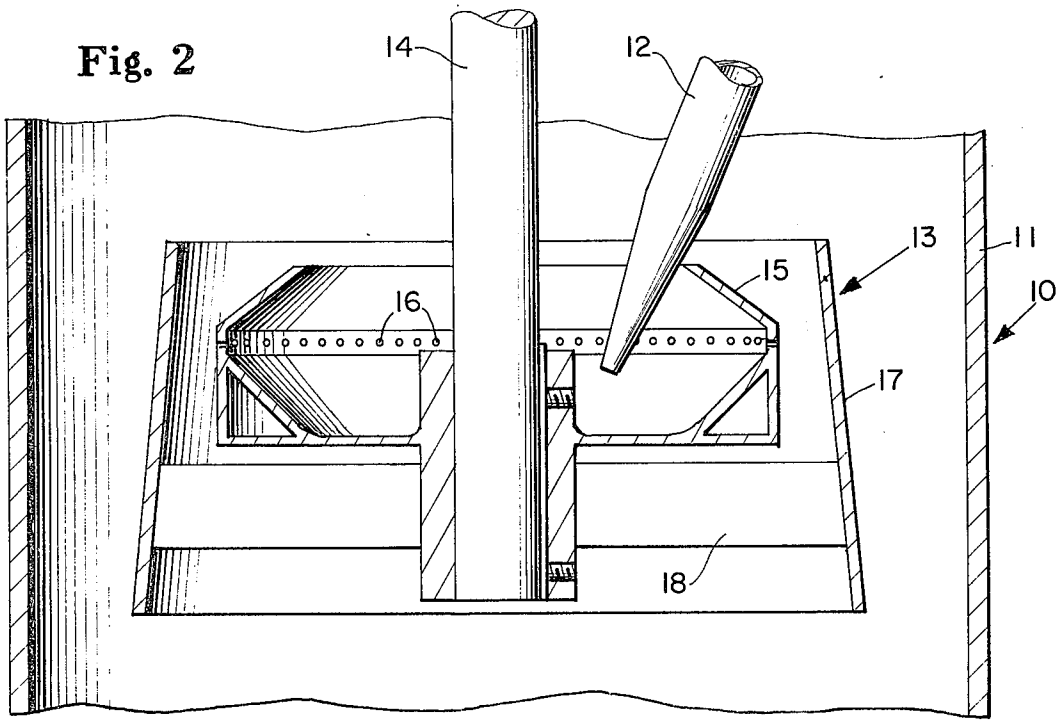


Fig. 2



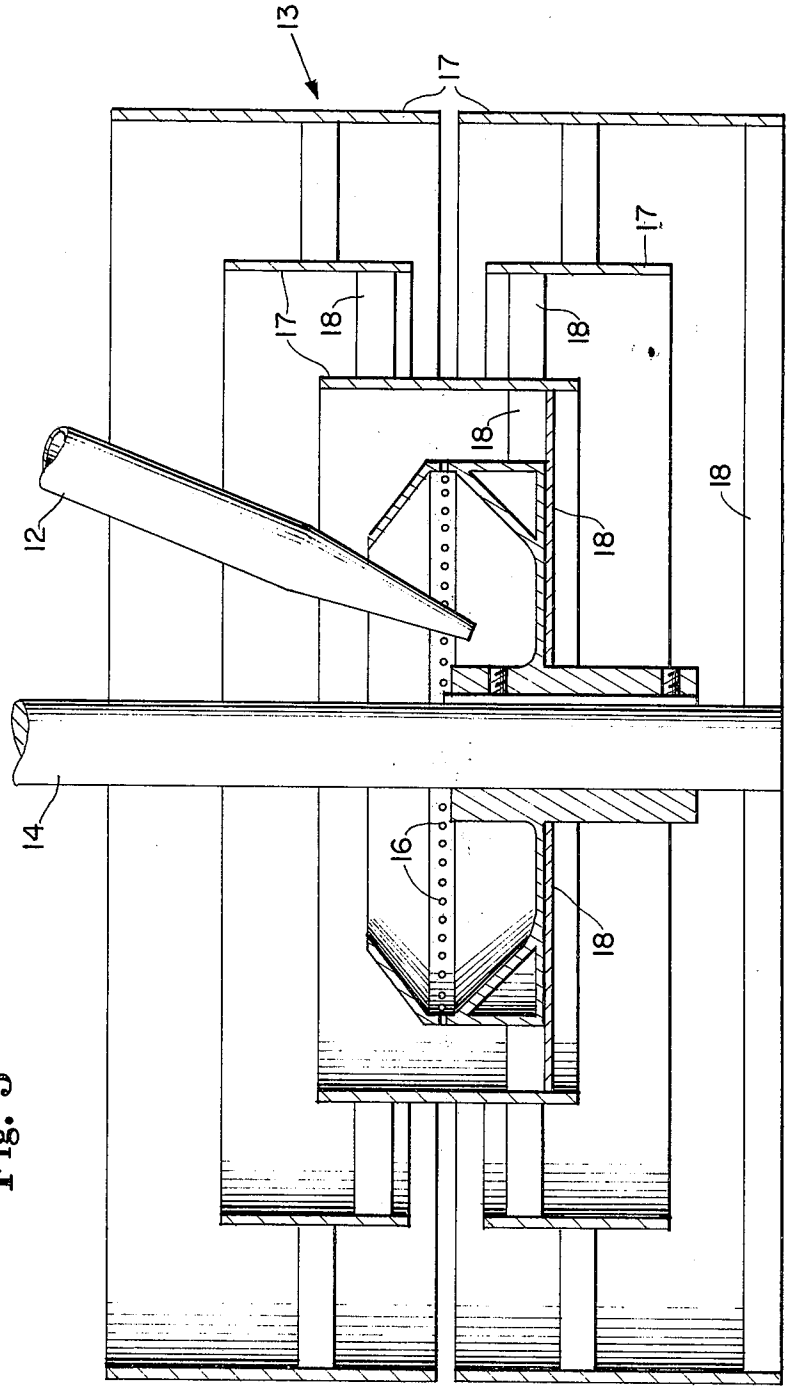


Fig. 3

VACUUM DEAERATOR FOR VISCOUS LIQUIDS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to centrifugal vacuum deaerators to be used for deaerating viscous liquids such as toothpastes and to a process of deaerating said viscous liquids utilizing said deaerator.

2. Prior Art

The concept of deaerating a liquid using centrifugal force to push the liquid through holes is disclosed in Pulley's U.S. Pat. No. 2,060,242, issued Nov. 10, 1936. Similarly, the use of centrifugal force to provide a shearing action at the edge of a plate appears to be disclosed in German Patent 935,534, issued Oct. 27, 1955 which appears to disclose a reservoir of viscous material which discharges over the edge of the reservoir. The use of a plurality of baffle plates containing holes and arranged in concentric arrangement is disclosed in Martin's U.S. Pat. No. 2,507,797, issued May 16, 1950. The concept of creating a thin film in order to degas a viscous composition is disclosed in Heald's U.S. Pat. No. 2,306,265, issued Dec. 22, 1942, and Compa's U.S. Pat. No. 2,420,356, issued May 13, 1947. Other patents using baffles to aid in the deaeration of liquids include Cornell's U.S. Pat. No. 2,785,765, issued Mar. 19, 1957, and Edwards' U.S. Pat. No. 2,922,375, issued Jan. 26, 1960.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter regarded as forming the present invention, it is believed that the present invention will be better understood from the following description taken in connection with the accompanying drawings in which:

FIG. **1** is a sectional plan view of the deaerator of this invention;

FIG. **2** is a fragmentary sectional elevation of the deaerator taken along the line **2—2** in FIG. **1**; and

FIG. **3** is a sectional elevation view of a deaerator having a rotor with multiple perpendicular flanges.

SUMMARY OF THE INVENTION

The present invention relates to a centrifugal vacuum deaerator comprising a rotor which comprises a flange positioned to receive the material to be deaerated after it is accelerated by centrifugal force, said flange being distinguished by being unperforated in the area where the material impinges, and said flange being further distinguished by the absence of any flow-impeding means which would impede the spreading of said material into a thin film when it is deposited on said flange and the presence of an edge on said flange over which said thin film of said material can be sheared by centrifugal force.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, and particularly to FIG. **1** thereof, a centrifugal vacuum deaerator **10** is illustrated. The deaerator comprises enclosed chamber **11** which may or may not be mounted on a base. The chamber **11** is connected to a source of vacuum (not shown) which permits one to create a vacuum of from about 10 to about 30 inches of Hg, preferably from about 10 to about 20 inches of Hg, inside the chamber **11** and maintain said vacuum. The primary reason for the vacuum inside chamber **11** is to avoid retrapping air. Inlet means **12** are provided whereby the product to be deaerated can be introduced into the vacuum chamber **11**.

Inlet **12** is positioned so as to enable the product to be introduced into the rotor assembly **13** which comprises a shaft **14**. To the shaft **14** is attached either unitarily or removably a bowl **15** which receives the material to be deaerated. The bowl **15** has sides adapted to retain the material to be deaerated when the bowl is rotated by a power means coupled to the shaft **14**. The sides of the bowl **15** contain a series of small holes **16** which are from about 1/64 inch to about ¼ inch in diameter, preferably from about 1/16 inch to about ⅛inch in diameter.

The rotor also comprises a flange **17** which in FIG. **1** is a tapered straight flange which receives the material to be deaerated as it is accelerated through the holes **16**. When the material to be deaerated impinges on the flange **17**, it is moved by centrifugal force down the flange, around the braces **18** which hold the flange **17** in proper position with respect to the shaft **14**, to the bottom edge of the flange **17** where centrifugal force again accelerates the material to be deaerated, thereby throwing it against the side of the chamber **11** from whence it falls by gravity to the bottom of chamber **11**. The deaerated material can be removed in any convenient manner, e.g., continuously removed through a hole (not shown) at the bottom of the chamber **11**. It will be evident from FIG. **3** that a similar mode of operation is envisioned for this embodiment which simply provides multiple flanges. In FIG. **3**, like reference numerals denote similar structural aspects to those of the apparatus of FIG. **1**.

The process of this invention is distinguished by making use of centrifugal force to create a thin film which is then sheared over an edge which is preferably sharp, but which can also be rounded. The preferred embodiment of the process of this invention also includes a step in which the fluid to be deaerated is thrown through holes by centrifugal force. This step gets rid of the largest bubbles. The material then impinges against the flange where it is spread into a very thin film which permits the escape of small bubbles, and finally, when the thin film of the viscous liquid reaches the edge of the flange, it is sheared which elongates and ruptures the walls of even smaller bubbles.

The rotor speed can be varied widely depending upon the strength of the materials used in the fabrication of the deaerator. Rotor speeds of from about 500 to about 10,000 RPM can be used. Slower rotor speeds will normally be used with larger rotors, for example, rotors having an OD of about two feet, and faster rotor speeds will normally be used with smaller rotors, i.e., those with an OD of about one-half of a foot.

As previously indicated and as shown in FIG. **3**, a series of flanges provides even greater deaeration.

The advantages of the process of the present invention include simplicity, economy and ease of maintenance, especially cleaning. The process also deaerates well at low vacuums (10–20 in. of Hg) which decreases the loss of volatile material from the viscous liquid. The process can be used over a wide temperature range and can be either a batch or continuous process.

What is claimed is:

1. A centrifugal vacuum deaerator comprising an enclosed chamber connected to a source of vacuum for

creating a vacuum within said chamber, and a rotor disposed within said chamber, said rotor comprising a flange positioned to receive the material to be deaerated after it is accelerated by centrifugal force, said flange being distinguished by being unperforated in the area where the material impinges, and said flange being further distinguished by the absence of any flow-impeding means which would substantially impede the spreading of said material into a thin film when it is deposited on said flange, and the presence of an edge on said flange over which said thin film of said material can be sheared by centrifugal force.

2. The deaerator of claim **1** wherein the rotor additionally comprises a centrally mounted bowl having a plurality of small apertures around its circumference, said bowl being adapted to receive the material to be deaerated and in spaced relationship to said flange, whereby when the rotor is rotated, centrifugal force accelerates said material through said apertures to impinge upon said flange.

3. The deaerator of claim **2** wherein said aperature has a diameter of from about 1/64 inch to about ¼ inch.

4. A method of deaerating a viscous liquid comprising the step of centrifuging said liquid in a bowl having a plurality of holes of a diameter of from about 1/64 to ¼ inch in its sides, thereby causing said liquid to be forced through said holes in the form of droplets and to impinge upon a flange which is rotating coaxially and outwardly of said bowl and which is characterized by the absence of any flow-impeding means, whereby the liquid is formed into a thin film which spreads over said flange and which is sheared as it passes over the edge of said flange, said method being conducted under a pressure of from about 10 to about 30 inches of mercury.

5. The process of claim **4** wherein the holes in the bowl are from about 1/16 to about ⅛ inch in diameter.

6. The process of claim **5** wherein the pressure is from about 10 to about 20 inches of mercury.

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