Feb. 15, 1949. E. C. LATHROP ET AL 2,461,746

AERATOR

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Fig. 2.

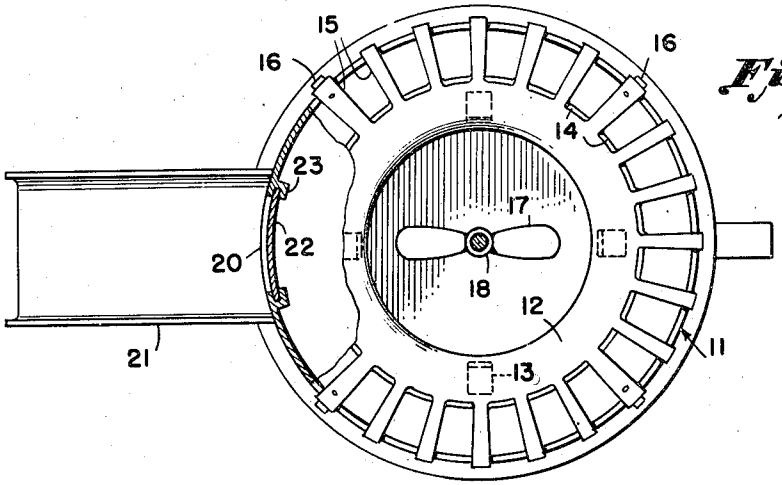
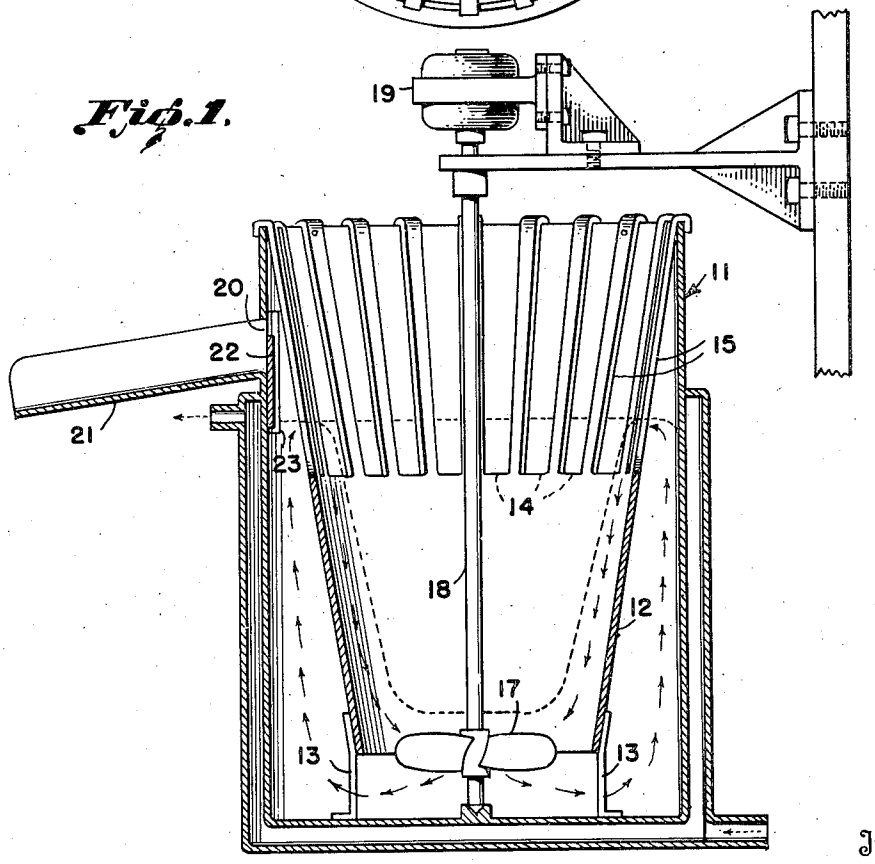


Fig. 1.



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Fig. 3.

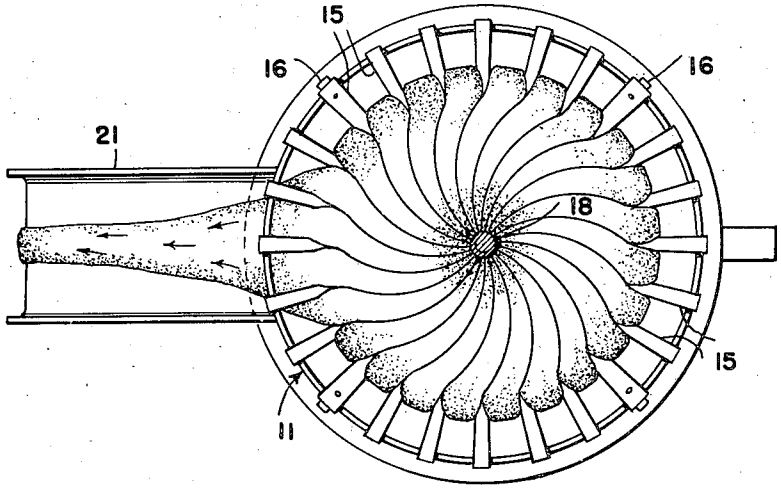
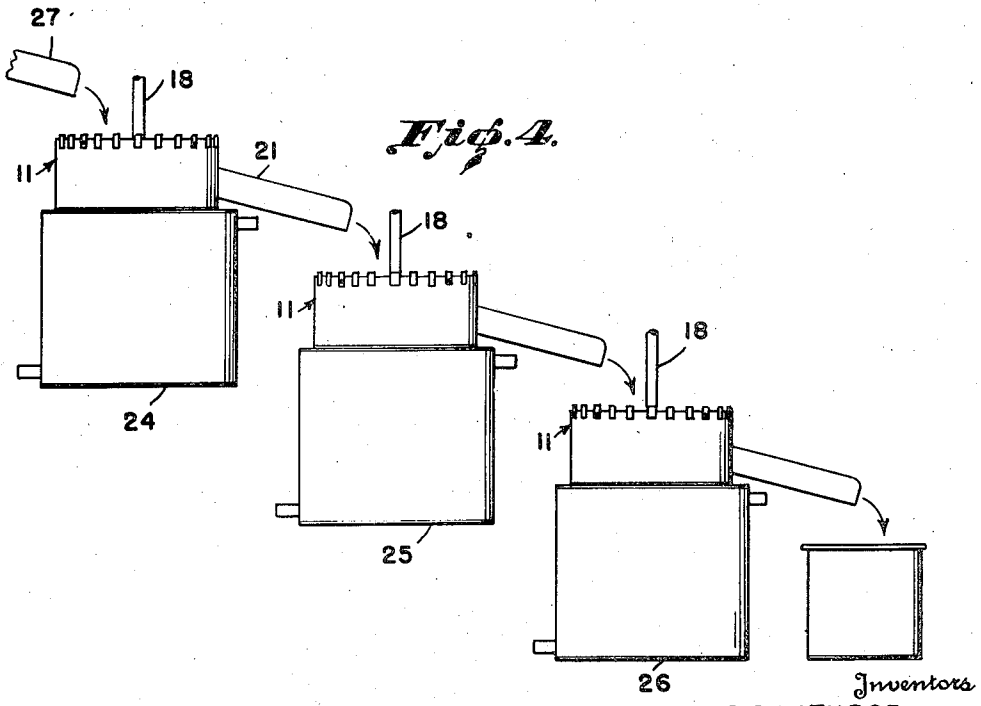


Fig. 4.



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Patented Feb. 15, 1949 2,461,746

UNITED STATES PATENT OFFICE

2,461,746

AERATOR

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Application January 15, 1946, Serial No. 641,357

1 Claim. (Cl. 259—43)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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This application is made under the act of March 3, 1883, as amended by the act of April 30, 1928, and the invention herein described and claimed, if patented, may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment to us of any royalty thereon.

This invention relates to an apparatus for incorporating into viscous materials finely divided air cells and is more particularly concerned with incorporation of air cells which are microscopic in size.

In co-pending applications Serial No. 499,508 (Pat. No. 2,433,849) and Serial No. 503,002 (Pat. No. 247,699), filed August 21, 1943, and September 18, 1943, respectively, there are disclosed methods of preparing plastic compositions of matter for use as cork substitutes. In the course of preparing such compositions of matter, an aqueous mixture of a proteinaceous material, a plasticizer therefor, and finely divided particles of a pithy substance are mixed together. This composition is viscous and usually has a density of about 1.12 to 1.14. This material is then subjected to aeration for the purpose of incorporating therein a sufficient quantity of air in the form of microscopic air cells similar to those found in natural cork. The air is usually incorporated in this composition in an amount to reduce the density to about 0.6 to 0.8.

We have found that when small batches of the viscous material are used, it is not difficult to incorporate the required amount of air in the form of microscopic cells. For example, quantities of about 600 cc. are not difficult to handle for this purpose using commercially available devices, such as ordinary kitchen food mixers. However, when larger quantities of the material are to be aerated, such devices are not satisfactory. They are deficient to the extent that the necessary amount of air cannot be introduced or, if introduced, a large number of air cells are above microscopic size. Such conditions make it impossible to manufacture a proper cork substitute since the larger air cells weaken the structural strength of the final product at the points where they may exist. Material of this kind cannot be used, for example, in fabricating crown seal discs and gaskets since the presence of large cells of air, by weakening the structural strength, will tend to produce leakage under pressure, especially under the pressures usually employed in carbonated beverages and the like.

Although it is possible to use conventional apparatus for preparing satisfactory compositions of matter in accordance with the inventions referred to, such apparatus can only be used on a small scale, such as is indicated above. Such small scale production, however, is impractical for commercial purposes where it is necessary to

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make large quantities of the material. Accordingly, it is the object of this invention to provide an apparatus which can be used to incorporate in a liquid composition of the type mentioned the required amount of air in the form of microscopic air cells for commercial uses.

It is a further object of this invention to provide apparatus of the type mentioned which will permit the carrying out of the aeration process in a continuous manner.

A still further object of this invention is to provide an apparatus of the type mentioned which is very rapid in its operation.

We have found that, in order to obtain the required type of aeration, it is necessary that the material to be aerated be so agitated in a container as to provide a deep, wide vortex just above the impeller blades used to agitate and circulate the material. We have also found that it is necssary for the apparatus to be so arranged that the material is circulated in a vertical path upward along the sides of the container and then permitted to cascade downwardly into the vortex in a plurality of folds. This action prevents violent agitation of the material at surfaces that are in contact with outside air and results in the incorporation of the desired microscopic air cells without occlusion of the undesirable large air cells.

In the accompanying drawing, there is illustrated a preferred embodiment of this invention which incorporates the principles described above. This drawing, together with the following description, will explain this invention more fully, and further objects and advantages thereof will be apparent.

In the drawing:

Figure 1 is a sectional view in elevation of a preferred embodiment of this invention.

Figure 2 is a plan view of the embodiment illustrated in Figure 1, partly broken away.

Figure 3 is another plan view similar to Figure 2 showing the pattern of the material while being aerated.

Figure 4 is a diagrammatic elevational view of a plurality of the devices illustrated in the previous figures, showing how they may be arranged in series to provide a continuous operation.

Referring with more particularity to the drawing in which like numerals designate like parts, the numeral 11 designates a cylindrical container which may be of any desired size. Within the container, there is disposed a partition member or sleeve 12 which may be in the form of an inverted hollow truncated cone, supported above the bottom of the container by means of spaced legs 13. The lower portion of the member 12 is imperforate, while the upper portion is slotted to provide a plurality of weirs 14. The strips 15

divide the weirs 14, extend to the top of the container 11, and are secured to the top by any suitable means such as by crimping over the edge. At intervals, bolts 16 may be used to provide a more secure seating.

At the bottom of the member 12, there is disposed an impeller blade 17, having a contour which upon rotation will cause liquid material above it to be forced downward. The impeller 17 is secured to the bottom of a vertical shaft 18 which extends upward and is connected to the power take-off of a motor 19 operating preferably at a speed of 1800 R. P. M. or more. In order to avoid vibration, the motor is supported independently of the container, as shown.

On one side of container 11, there is provided an opening 20 communicating with a downwardly sloping trough 21. On the inside of container 11, adjacent the opening 20, there is disposed a slidable gate 22 in vertical guides 23, which may be secured in different vertical positions to adjust the maximum height of liquid in the container and thereby vary the overflow of the liquid into the trough 21.

In using the device, the impeller 17 is started by actuating the motor 19, and the material to be aerated is then poured into container 11 in an amount such that the material is forced upward between the member 12 and the sides of the container 11 and flows inwardly, whereupon it is divided into a number of small streams by the strips 15 and cascades over the weirs 14 in a smooth and uniform manner. As the cascading streams descend, they converge, enfold air, and finally merge at the center of the vortex where they are pulled into the mass below the impeller, whereupon the cycle is repeated. This action is characteristically gentle and devoid of violence along the surfaces of the material which at any particular instance may be exposed to the atmosphere. This avoids the occlusion of undesirable large bubbles or air.

As this action is maintained and air becomes incorporated in the liquid, the density of the material decreases and the volume increases. This increase in volume has the effect of increasing the height of the vortex above the plane of the impeller blade 17. The greater this height the less efficient is the aeration. In order to maintain the efficiency which is obtained by a low vortex, it is necessary to discharge some of the material from the container. This is accomplished by adjusting the height of the gate 22 to obtain an overflow of the excess material until a proper level of the vortex is obtained. In operating the apparatus in a batch process, the overflow material is collected for incorporation in subsequent batches. The material remaining in the device is continued to be agitated until a predetermined density is obtained.

In order to avoid inefficiency resulting from the removal of partly aerated material as described above in the batch process, a series of such apparatus may be arranged, such as illustrated in Figure 4, whereby the overflow trough 21 of the first unit 24 is directed to a second unit 25 whose overflow trough is in turn directed to a third stage or unit 26. Additional units may be used as desired, the three shown in the drawing being sufficient to illustrate the principle. With this series of apparatus, each stage of aeration is controlled so that a predetermined drop in density is obtained in each unit. For example, in the arrangement illustrated in Figure 4, let it be assumed that the initial material entered the first stage 24 from the inlet 27 at a density of 1.125 and that it is desired that the final material emerging from the last stage 26 have a density of 0.750. The operating conditions are then adjusted so that each stage will decrease the density by ⅓ the difference between 1.125 and 0.750, or 0.125. This is accomplished by adjusting the height of the gate 22 in each unit so that the material begins to discharge from each container when the density in the container has attained a predetermined value. The material then discharges continuously from each container at the predetermined density.

When the run is first started, it is necessary to charge the first unit 24, as explained above in connection with the batch process, without introducing any fresh material until the overflow begins at the predetermined density, say 1.000. When this overflow begins, fresh material is led into the unit by means of inlet 27 in an amount equivalent, on a weight basis, to that which is being discharged into the second unit 25. When sufficient material has overflowed from the first unit 24 into the second unit, its impeller is started, and a similar operation takes place as in the case of the first unit 24. The overflow from this unit will now have a smaller density, say, of 0.875, which is directed into the final stage 26, and when sufficient material has collected in this unit, its impeller is started. The overflow from the final stage gives a product having the desired density of 0.750.

This invention can be used to incorporate microscopic air cells in various viscous materials, such as starch paste, proteinaceous materials, synthetic resins, Vinylite resin, and rubber latex.

Having thus described our invention, we claim:

Aerator apparatus comprising a vessel, a circular partition coaxially disposed in said vessel, means for supporting said partition in said vessel above the bottom thereof, the lower section of said partition being imperforate and the upper section comprising a plurality of weirs, said weirs being separated from each other by vertical strips, said strips being narrow relative to the width of the weirs, said vessel having an overflow aperture near the top, a gate adjacent said aperture, and means for securing said gate in different positions relative to said aperture, and means for agitating an impelling flow of fluid material downward at the bottom of said partition.

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SAMUEL I. ARONOVSKY.

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Certificate of Correction

Patent No. 2,461,746. February 15, 1949.

ELBERT C. LATHROP ET AL.

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 1, line 15, for "No. 247,699" read *No. 2,427,699*; column 3, line 42, for the words "or air" read *of air*;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 8th day of November, A. D. 1949.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.