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METHOD AND DEVICE FOR EVAPORATING THE VOLATILE CONSTITUENTS
OF SOLUTIONS, EMULSIONS, AND SUSPENSIONS
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Fig. 1.

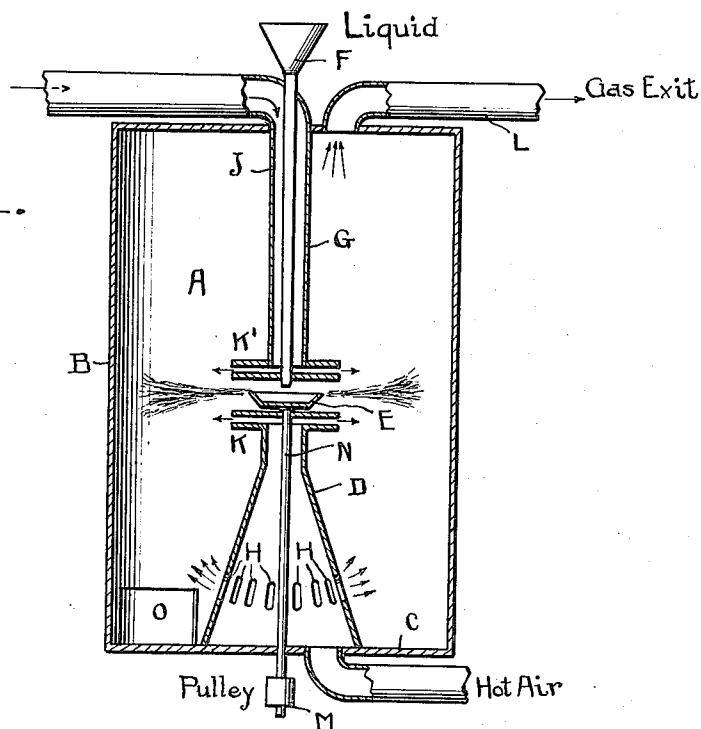


Fig. 2.

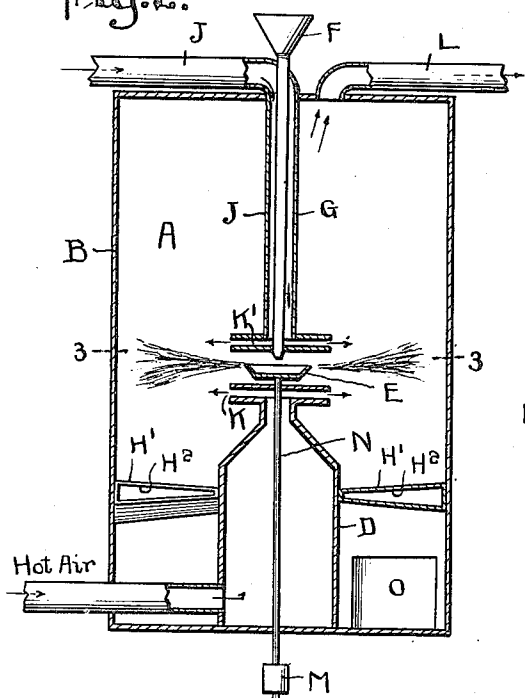
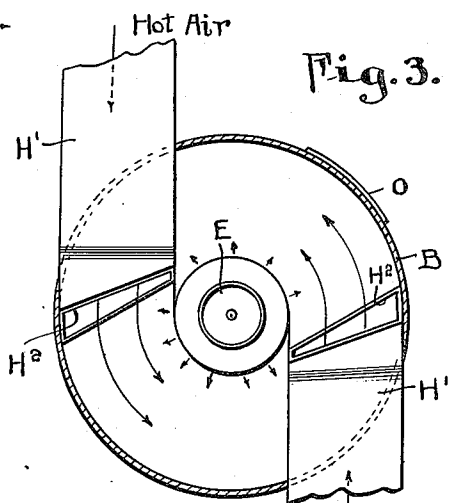


Fig. 3.



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METHOD AND DEVICE FOR EVAPORATING THE VOLATILE CONSTITUENTS OF SOLUTIONS, EMULSIONS, AND SUSPENSIONS.

Application filed April 23, 1924. Serial No. 708,579.

To all whom it may concern:

Be it known that I, FERDINAND WREESMANN, a citizen of Germany, residing at Munich, in the State of Bavaria, Germany, have invented certain new and useful Improvements in or Relating to a Method and Device for Evaporating the Volatile Constituents of Solutions, Emulsions, and Suspensions, of which the following is a specification.

The present invention relates to an improvement in a method and apparatus (as hereinafter more fully set forth and claimed) for evaporating the volatile constituents of solutions, emulsions and suspensions, whereby the liquid material to be treated is finely atomized in an evaporating chamber of circular or polygonal cross-section, and during suspension in the air is subjected to treatment with a gaseous desiccating agent, in order, by partial extraction of the volatile constituents, to concentrate the material in question, or to dry the same by complete evaporation. Hot air is in most cases a suitable agent to employ as the drying or desiccating agent; other gases however, are suitable, provided that the same be capable of taking up moisture. The desiccating process being greatly facilitated the larger the area of the liquid under treatment, it is important that said liquid be atomized as finely as possible at the commencement of the desiccating process, and maintained in such condition. The atomization is preferably effected in such a manner as to form a substantially horizontal layer of fine liquid particles.

The object of the present invention is to effect the complete or partial drying in a uniform and economical manner. In my process, a relatively small part of the desiccating agent, which, however, is sufficient to control the spread of the atomized material and to take an active part in the desiccation, is introduced parallel thereto, and in the same direction of flow, whilst the larger amount of desiccating agent is introduced in a different direction of flow from the direction of flow of the particles of the atomized material in a manner so as to penetrate same. Two differently directed currents of desiccating agent are therefore employed.

This is attained by the fact that the liquid material is atomized in a horizontal or ap-

proximately horizontal plane in all directions from a centrally (or approximately centrally) located point in an evaporating chamber of circular or polygonal cross-section, by means of a centrifugal device, while just below the point from which the atomization of the liquid is effected a small portion of the desiccating agent is likewise spread out in all directions in the form of a horizontal layer, substantially parallel the layer of atomized liquid particles. A further minor portion of the desiccating agent is also preferably introduced in the same manner above the layer of atomized liquid particles, so that the latter layer is spread out between two parallel moving layers of desiccating agent. The major portion of the desiccating agent, however, is introduced further down and from underneath, for example at a centrally located tower-like device erected in the evaporating chamber, and directed energetically against the layer of atomized liquid particles, so that this greater portion of the desiccating agent meets the layer of liquid particles, from below at about a right angle to the direction of travel of the liquid particles, and is capable of penetrating the same over the whole or approximately the whole area of the said layer. The discharge of the used desiccating gas, laden with the evaporated volatile constituents of the treated liquid, is effected at the upper part of the desiccating chamber.

The advantages of this method consist in the fact that the amounts of desiccating agent introduced parallel to the atomized liquid immediately come into contact therewith, to ensure a uniform spread or expansion of same, to prevent, by the enclosure of the layer of liquid particles, any disturbing action by air eddies, and also to partly effect desiccation. In addition thereto, by the parallel flow of the desiccating agent, any individual particles which deviate from the prescribed path and are mostly larger in size, are blown back again into the correct course. By this, uniform expansion of the atomized material, assisted by the parallel flow of the desiccating agent is secured, without danger of re-uniting of individual particles, which otherwise might be caused by air eddies and irregular size of the particles of liquid. By the uniform spread of the atomized liquid, the desiccation and penetration

thereof by the main portion of the desiccating agent introduced from underneath, is carried out effectively, so that the desiccation may be principally effected by the current of gaseous fluid meeting the liquid particles at right angles to their direction of travel. In addition, the flow of the desiccating agent provides a uniform and supporting basis for the layer of atomized liquid particles, so that a break therein is not likely to occur.

The introduction of the greater portion of the desiccating agent from below and against the layer of atomized liquid particles may also be effected in many other ways than that above described. A very favourable method of introduction for the main portion of the desiccating agent is to effect same from below the layer of liquid particles (and below the horizontally directed small supporting radial currents of air) in the form of a helically flowing air current or currents, substantially filling the whole cross-section of the evaporating chamber, and rising helically against the layer of atomized material, subsequently being conducted off from the evaporating chamber above the atomized material after the penetration thereof. This latter mode of introducing the drying gases is claimed by itself in a copending application Ser. No. 708,304, filed April 22, 1924.

The two forms of embodiment described by way of example in the above, are illustrated in the accompanying drawings.

Fig. 1 shows a vertical section of a plant comprising a circular evaporating chamber, in which the main portion of the desiccating agent is passed from a centrally located point of introduction through the evaporating chamber in such manner that same meets and penetrates from underneath, practically the whole area of the layer of atomized liquid particles, and practically at right angles to the direction of travel of said particles.

Fig. 2 shows a vertical, and Fig. 3 a horizontal section on line III—III, of a modified form.

In the apparatus shown especially in Fig. 1, A indicates a cylindrical evaporation chamber with a wall B and bottom C. On the centre of the bottom is provided a tower-like device D, carrying the centrifugal atomizer E, from which the liquid is atomized horizontally in all directions. The introduction of the liquid to the centrifugal device is effected through the hopper F and the feed pipe G. The main portion of the desiccating agent passes into the evaporation chamber through the apertures H, which are arranged in a row around the device D. The smaller amount of desiccating agent, which spreads out parallel to the horizontal layer of atomized material is fed into the evaporating chamber through the annular slots K and K¹; reaching said slots K through the tower D, and the slots K¹ through the

pipe J. The desiccating agent laden with the evaporated volatile constituents of the treated material is conducted off through L at or near the top of the evaporation chamber.

The dish E acting as a centrifugal atomizer is rotated at high speed in any suitable manner, say by a belt on the pulley M carried by shaft N. At O is shown a suitable door through which the dried material can be removed from the bottom of the evaporating chamber.

In the modification shown in Figs. 2 and 3, is a desiccating plant, in which the greater portion of the desiccating agent rises in a helical course against the layer of atomized liquid, filling the horizontal cross-section of the evaporating chamber. The general construction of the evaporating chamber, the arrangement of the centrifugal device, the introduction of the smaller amount of desiccating agent and the expulsion of the used desiccating agent are essentially the same as in Fig. 1. On the other hand the introduction of the major portion of desiccating agent is effected through the flat supply connections H¹ with the slotted outlet openings H². According to this mode of introduction the major part of the desiccating agent will enter in layers performing a helical course, filling the entire horizontal cross-section of the evaporating chamber. On account of the cylindrical form of the chamber, and the fact that the exhaust openings are arranged at the top thereof, the desiccating agent is compelled to rise in a helical course. The arrows in Fig. 3 show the directions of flow of the various streams of desiccating agent. The arrows at K and K¹ show both the direction of flow of the atomized material, and of the small amount of desiccating agent conducted parallel thereto, whereby it will be particularly noticeable that this direction allows the atomized material to meet the circulating layers comprising the main portion of the desiccating agent, at right angles.

What is claimed as new, and desired to be secured by Letters Patent is:—

1. A method of evaporating the volatile portions of liquid materials which comprises centrifugally atomizing the liquid in all horizontal directions from the center in an evaporating chamber, into an approximately horizontal layer of liquid particles, introducing a small portion of the desiccating agent in the form of a horizontal layer closely above and parallel to the layer of atomized liquid particles, leading the major portion of the desiccating agent in an upward direction against the layer of atomized liquid particles, and causing the same to penetrate said layer, and drawing off the used desiccating agent from above the said layer of liquid particles.

2. In an apparatus for evaporating the volatile constituents of liquids by means of a gaseous desiccating agent, the combination of an evaporating chamber of substantially circular cross-section, means for introducing the liquid to be atomized and an atomizer arranged substantially in the vertical axis of the evaporating chamber adapted to convert the atomized liquid into a substantially horizontal layer of liquid particles, and means for introducing portions of the desiccating agent in the form of layers parallel to and close to the layer of atomized liquid particles, and means near the bottom of the chamber for introducing another portion of the desiccating agent against the underside of the layer of atomized liquid particles.

3. In an apparatus for evaporating the volatile constituents of liquids by means of a gaseous desiccating agent, the combination of an evaporating chamber having a substantially circular cross-section, an atomizing device located substantially in the vertical axis of the evaporating chamber adapted for converting the atomized liquid

into a substantially horizontal layer of liquid particles, means for introducing a portion of the desiccating agent in the form of a horizontal layer above the atomized layer of liquid particles, a substantially cylindrical column mounted centrally in the lower part of the evaporating chamber, supporting the atomizing device, means for introducing and spreading out another portion of the desiccating agent in a horizontal layer beneath the atomized layer of liquid particles, and supply passages for supplying another portion of the desiccating agent, the same having upwardly inclined apertures between said column and the walls of the evaporating chamber, such last mentioned supply passages arranged tangentially for introducing the desiccating agent in the form of a rising helical current against the layer of atomized liquid particles.

In testimony whereof I have affixed my signature in the presence of two witnesses.

FERDINAND WREESMANN.

Witnesses:

WLAD. ENDERS,
ROGER S. AUSPACE.