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VACUUM DISTILLATION

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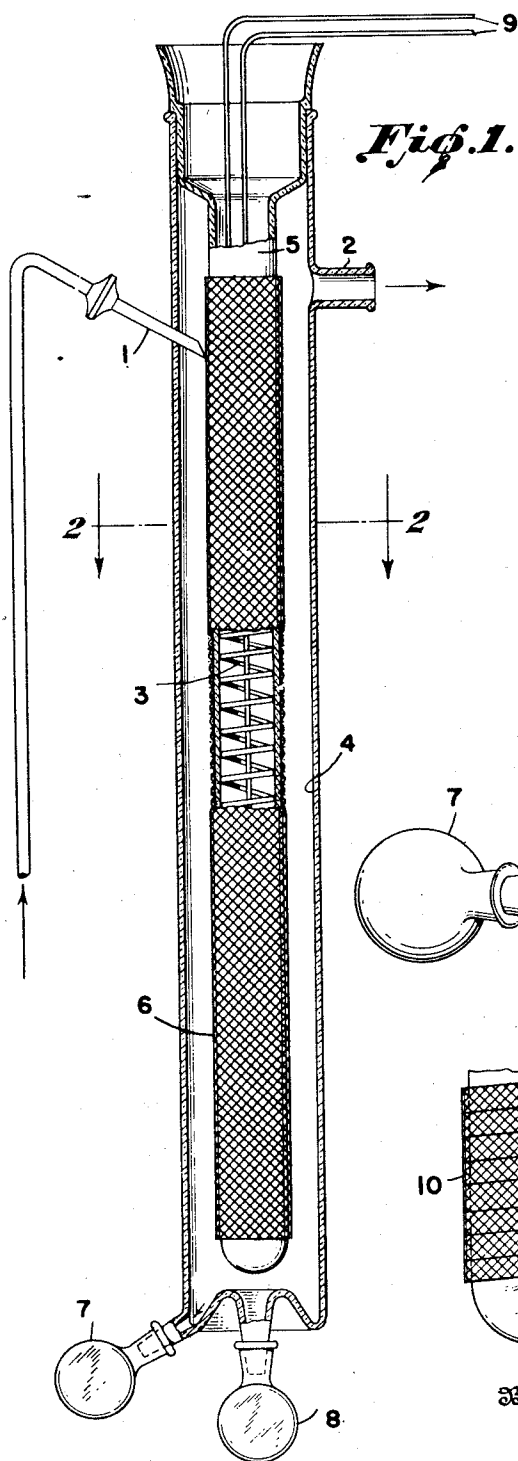


Fig. 1.

Fig. 3.

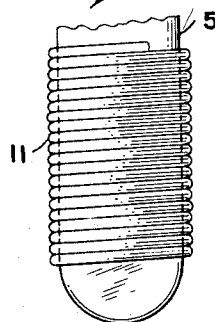


Fig. 2.

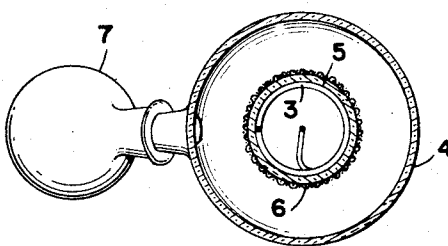
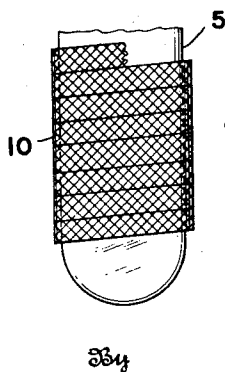


Fig. 4.



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UNITED STATES PATENT OFFICE

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VACUUM DISTILLATION

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4 Claims. (Cl. 202—187)

(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, if patented in any country, may be manufactured and used by or for the Government of the United States of America throughout the world for governmental purposes without the payment to us of any royalty thereon.

This invention deals with a novel method for effecting low pressure evaporation and an apparatus therefor.

More particularly, the invention deals with vacuum distillation in which a film of liquid is caused to move adjacent to a relatively cool condensing surface in a rarified atmosphere. The film and the condensing surfaces are separated by substantially unobstructed space, the film being heated by contact with an evaporation surface.

An object of this invention is to provide an improved method and apparatus for effecting vacuum distillation whereby the efficiency of the process is increased and the cost of the process is considerably decreased.

Another object of the invention is to provide a novel and advantageous means for distributing the film of distilland over an evaporation surface in vacuum stills.

In the past, vacuum stills have been provided with central members, such as domes or columns, over which the distilland descends. Other stills have been employed in which the distilland is caused to move over a flat evaporation surface adjacent to a flat condensation surface. These prior columns or surfaces of other configuration are usually made of glass or of some inert material presenting a relatively smooth surface over which the distilland flows and from which vapors of the distillate may leave to condense upon the condensation surfaces. These evaporation surfaces are of varying shape and size, one of the simplest being the outer surface of a hollow cylinder.

In order to increase the sojourn of the distilland and to prevent channeling, it has been proposed to provide the surfaces of evaporation, such as a column, with a glass coil or to fabricate it in such a manner as to provide a winding or tenuous path for the distilland. It has been further suggested to alter the shape and character of the surface in other ways, such as cutting grooves and roughening the surface of the evaporation column. It has further been suggested to provide the evaporation surface with

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interrupted bands or a helically wound strip of metal gauze.

These prior devices and methods are attended by many disadvantages. Residues of a gummy or tarry nature tend to accumulate upon the evaporation surface. Any roughening or unevenness of the surface, such as are caused by grooves and the like, make the surface extremely difficult to clean. Distillands vary in their surface and flow characteristics and any one particular surface is not universally satisfactory. Special fabrication or surfacing increases the cost materially and in the majority of cases reduces the strength of the apparatus. Bands or strips of metal gauze permit fouling of the evaporation surface in the exposed portions, and the distilland tends to accumulate a small but nevertheless objectionable amount of metallic ions from the gauze. In the case of edible oils this metal content hastens flavor deterioration of the oil. The gummy or tarry residue which accumulates on the gauze requires drastic solvent action for removal, which tends to attack the gauze itself.

According to this invention, the evaporation surface is fabricated of a relatively smooth and strong material and over this surface is placed a flexible and pliable substantially complete yet permeable covering of inert material, such as fiberglass cloth, which serves to distribute the distilland and to retain substantially all tarry or gummy residue.

This covering substantially prevents the surface itself from collecting residue material and the still is therefore extremely easy to keep clean. In the usual high vacuum still the inert distributing material may be installed merely by drawing a mesh tube or sleeve of fiberglass or asbestos cloth over the column. The still may be substantially cleared of the fouling matter by merely removing and cleaning the covering sleeve. This sleeve is easy to remove and may be cleaned by immersing or washing in a cleaning medium. The cost is relatively very low compared with the special means of distributing the distilland over the evaporation surface used in the past.

The use of a permeable covering in accordance with this invention accomplishes efficient distribution of the distilland over the evaporating surface without weakening it or introducing foreign material into the distilland. Moreover, a distinct advantage gained by the use of fiber glass or asbestos cloth is the inertness of the material to the very strong acid cleaning solu-

tions which are usually necessary to remove accumulated residues.

Another advantage of our invention is the fact that the capacity of any particular still may be varied between wide limits by varying the specific type of liquid distributor placed upon the evaporation surface. For instance, it may vary from a relatively thin coarsely woven mesh to a relatively thick retentive covering.

For a clearer understanding of the invention, reference is made to the accompanying drawing.

Figure 1 is a vertical view, partly in section, of one form of the invention;

Figure 2 is a cross-section of Figure 1 on line 2—2;

Figure 3 is a vertical view of a modified form of the covering, employing a spirally wound fiber glass or asbestos thread.

Figure 4 illustrates another modification, comprising a spirally wound strip of fiber glass gauze.

Figure 1 illustrates a high vacuum still consisting of a tubular condensing surface 4 inside which is disposed a vaporizing surface 5. Distilland enters through feed inlet 1 and is fed upon the evaporating surface which is heated internally by means of electrical resistance unit 3. The evaporation surface is covered by a liquid distributor 6 consisting of a mesh sleeve of woven fiber glass which distributes the distilland evenly as it descends over the evaporation surface. The uncondensed vapors are drawn off through outlet 2 while the condensed vapors collect on surface 4 and drain into distillate receiver 7. The undistilled residue collects in receiver 8.

While fiber glass cloth is preferred as the material for fashioning the tube or seamless sleeve 6 because of its inertness, flexibility, durability, and ease of removal, we may also use asbestos cloth.

In place of the sleeve 6 we may use a spirally wound thread 11 of glass or asbestos, as indicated in Figure 3.

In Figure 4 is shown a spirally wound gauze strip 10 woven of glass or asbestos thread. The adjacent turns of the strip overlap or are closely contiguous, to cover the evaporating surface 5.

Strip 10 and thread 11 may be removably fastened in place by any conventional means, such as fastening clamps or rings.

The evaporation surface has been illustrated in one of its simpler forms, such as that of a vertical cylinder. It may also be a vertical series of bulbous members. The column may be corrugated vertically or horizontally. It may be an upright or inverted truncatoconical or conical member, or it may be a plane surface. The surface may be fixed relative to the condensing surface, or it may be rotatable.

The means for supplying heat to the evaporation surface may be any of the usual means, such as liquid boiling under reflux, heat exchange fluid under circulation, and the like.

The apparatus and process of this invention are not limited to high vacuum distillation but may be applied to any process for distilling in which a materially reduced pressure is used. However, it is particularly advantageous in connection with the molecular distillation where the pressure is .01 mm. of mercury or lower and has been found to give excellent results in removing odorous constituents from vegetable oils.

In high vacuum or molecular distillation the pressure and the distance between the condensing

surface and the surface of the distilland should vary in inverse proportion to each other. In general, due to practical difficulties, the condensing surface should not be more than one inch from the film of distilland.

Due to the flexibility and pliability of the material used to cover the evaporation surface it may easily be made to conform to the shape of that surface. When the distributor becomes fouled or when a distilland of a different character is to be distilled, the distributor is simply removed and cleaned or a fresh one substituted.

Having thus described our invention, we claim:

1. A still comprising in combination a condensing surface and a tubular, smooth, heated evaporation surface spaced from the condensing surface, said evaporation surface having tightly fitted thereon a readily removable, flexible, pliable, and permeable covering sleeve of inert, acid-resistant, non-metallic, mesh fabric of mineral matter, to distribute the distilland supplied to the heated evaporation surface and to retain substantially all tarry and gummy residue formed at the evaporation surface and thus prevent the evaporation surface itself from collecting the said residue material, and means to supply distilland to the heated evaporation surface.

2. In a short-path high vacuum still having a tubular distilland evaporating surface and heating means for said surface, and also having a condensing surface; the improvement comprising a flexible, detachable, pliable, inert, non-metallic, covering tubular sleeve of fiber glass mesh fabric fitting upon and in contact with and substantially coextensive with the said heated evaporating surface, to distribute distilland supplied to the heated evaporation surface and to retain substantially all tarry and gummy residue formed at the evaporation surface and thus prevent the evaporation surface itself from collecting the said residue material and means to supply distilland to the heated distilling surface.

3. The apparatus of claim 1 in which the sleeve is made of woven fiber glass cloth.

4. The apparatus of claim 1 in which the sleeve is made of asbestos fiber cloth.

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