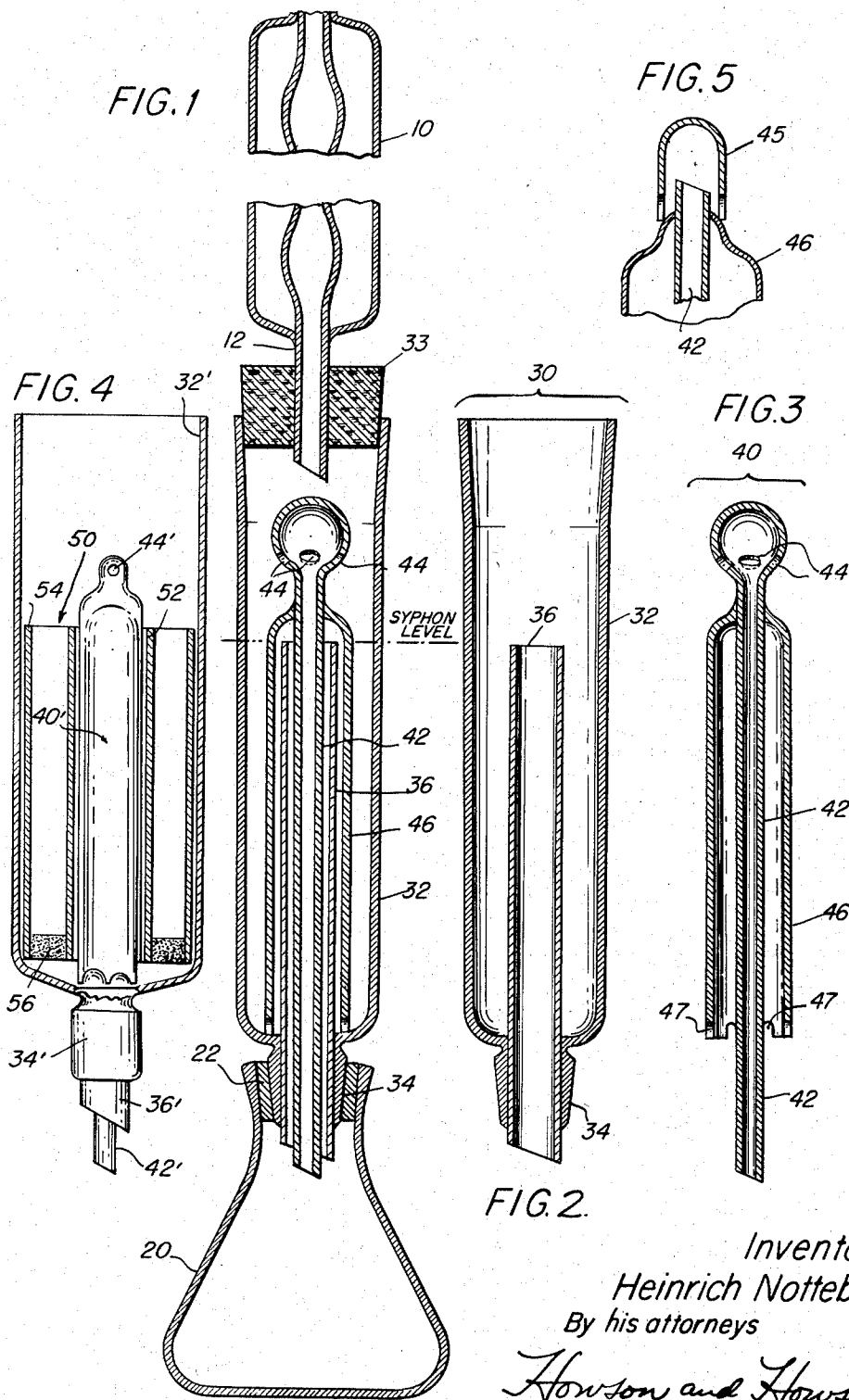


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SIMPLIFIED EXTRACTOR APPARATUS

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SIMPLIFIED EXTRACTOR APPARATUS

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This invention relates to apparatus for extracting soluble substances from materials by automatically repeating periodically a process of subjecting the material, from which a solute is to be extracted, to the action of a solvent which has been purified by distillation in the apparatus in the course of each repetition.

Such apparatus commonly consists of a condenser part, an extractor part and a flask or container part, all most commonly made of glass.

More particularly, this invention is concerned with simplification of the structure of the extractor part of such apparatus.

The apparatus as heretofore made for the same use was of complicated form and configuration and was difficult to make and to clean; and by reason of its shape and the fragility of its branches and the material of which it was made, it was easily damaged and broken.

Therefore, an object of the invention is to provide a simplified and more rugged extractor for use in apparatus of the aforesaid type.

Another object is to provide a simplified and rugged extractor apparatus in which the outer wall protects and shields the remainder which is inside.

Another object is to provide a separate container within such extractor, for the material to be processed. A related object is to provide a filtering means in said separate container whereby the solution may be filtered before being siphoned therefrom.

Other objects and advantages will become apparent as the invention is described in connection with the accompanying drawing.

In the drawing:

Fig. 1 is a vertical section view through apparatus embodying the invention.

Figs. 2 and 3 are vertical section views of the main components of the extractor, removed from the apparatus.

Fig. 4 is a vertical section view of a form of the invention having a separate container therein.

Fig. 5 is a broken detail view showing in vertical section, a different form of the upper end of the inner member of the extractor.

Referring to the drawing, the apparatus to which the invention is applied comprises a reflux condenser 10 and a flask or container 20, both of conventional and common form as heretofore found in the well known Soxhlet extractor. Connecting the condenser and flask is my improved simplified extractor. As shown in Figs. 1-3, the extractor comprises two main components, designated generally by numerals 30 and 40. The outer component 30 comprises a large outer tube 32 open at the top to receive a perforated cork or stopper 33 through the perforation of which the lower end of tube 12 of the condenser extends. The bottom of the outer tube 32 is reduced to a neck or nipple 34 which is received in the perforation of a perforated stopper 22 in the neck of the flask 20.

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Concentric with the outer tube 32 and extending up about two thirds of the way to the top of said outer tube to a level at which it is desired that solvent and extracted substance dissolved therein shall start to siphon out is discharge tube 36. Its upper end is open while its lower end fits within the neck 34 of the outer tube 32 and is cemented, welded or otherwise made integral with the neck or fitted tightly therein.

Insertable in and removable from the outer tube assembly is the second or inserted component, designated generally by the numeral 40, consisting of a vapor tube 42 and outside it a siphon tube 46 which is concentric with and attached to the vapor tube 42. When the vapor tube 42 is inserted in the discharge tube 36, it extends the length of the tube 36 and into the top part of the flask 20. The top of the vapor tube 42 is rounded-off and closed except for four small radial circumferentially spaced holes 44 to allow escape of vapor flowing up the tube 42 from the flask 20.

In order to increase the efficiency of the vapor tube, it may be widened at its tip to form a sphere by reason of which the openings may be more numerous or larger, or both, than if the cylindrical upper end of the vapor tube were merely rounded-off without enlargement.

The siphon tube 46 depends from the vapor tube 42 from a point below holes 44. The diameter of the outer siphon tube 46 is greater than that of the discharge tube 36 so that the tube 46 may fit over and around the tube 36.

Thus, as the inner component 40 is inserted in the outer component 30, the vapor tube 42 enters the tube 36 while the outer siphon tube 46 slides over and surrounds said tube 36.

The lower end of the outer-siphon tube 46 does not contact the lower end of the tube 32 throughout its entire periphery, but is provided with openings in the form of cuts or recesses 47, or it may be obliquely cut at its end, to permit the flow of liquid from outside to inside the tube 36.

From the foregoing, the operation may be understood. As the solvent is heated in the flask 20, the volatilized vapor passes up through the vapor tube 42 and out through the openings 44 in the tip thereof. The vapor then may pass up through the tube 12 of the condenser 10 and be condensed on the condenser walls. The condensed liquid solvent will then drip down from the end of the condenser conducting tube 12 into the space between the outermost tube 32 and the outer wall of the tube 46. The solvent will collect at the bottom of the tube or container 32 and will extract soluble material from whatever substance is therein. As the volume of the solvent increases, its level rises to the top of the discharge tube 36. When it reaches the top thereof, it will start to flow thereover into the narrow space between the discharge tube 36 and the vapor tube 42, starting the siphon action. Since this space communicates with the flask, the solution will be discharged into the flask 20 from the bottom of the tube 36.

Thereafter, the solvent will be vaporized again and its vapors will pass up through the vapor tube 42 and eventually into the condenser 10 to be condensed and again delivered to the apparatus to automatically repeat the cycle. The solvent in the flask thereby becomes enriched with each repetition of the cycle until all soluble matter has been extracted or until the operator believes that a practical end has been reached.

It will be obvious from the foregoing description and by reference to Figs. 2 and 3 of the drawing that the apparatus can be very easily cleaned by separating the two main components shown in Figs. 2 and 3. When so separated, a brush can be inserted into all portions of the

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two components and can effectively and thoroughly clean every surface thereof. Moreover, the outer wall of component 30 forms a protection for the discharge tube 36 therein at all times. It also forms a protection for the assembly 40 when it is inserted. Thus, the component 40 cannot be touched accidentally and break in part thereto regardless of how fragile it may be.

Beside the foregoing advantages, the form of the elements which make each of the two main components is simple since they are for the most part cylindrical and easily fabricated and joined.

All of the foregoing advantages may be achieved in variations of the invention as illustrated in Figs. 4 and 5.

It may be desirable in some instances to provide a separate holder within the apparatus for the material from which some soluble substance is to be extracted.

Apparatus including such a holder is illustrated in Fig. 4 wherein similar reference numerals, but with a prime added thereto, are used for equivalent parts found in the modification previously described. In Fig. 4, a holder, designated generally by the numeral 50, forms a third component of the extractor. The holder comprises concentric inner and outer cylindrical walls 52 and 54 respectively, joined at their bottom ends by a porous partition or screen 56 which preferably is made of filter material which will permit the passage therethrough of the solution but prevent the passage of solid particles. The walls 52 and 54 may also be joined elsewhere to add additional strength to the three components in this form of the extractor, if so desired, such as by providing radial struts or a spider formation (not shown) between the inner and outer walls 52 and 54. The diameters of the walls 52 and 54 may be varied, but the diameter of the outer wall 54 will be limited by the diameter of the outer wall 32' of the main component of the extractor, while the diameter of the inner wall 52 need be larger so as to fit around the inner component 40', as will be obvious from inspection of Fig. 4. The operation of the form illustrated in Fig. 4 is similar to that of the form previously described except that a filtering action takes place before the solution can be siphoned off. Thus, the delivery of solid particles to the flask is prevented.

It may sometimes be desirable, as shown in Fig. 5, to cut the upper end of the vapor tube 42 and provide it with a cap 45 to prevent dropping of the condensed solvent from the condenser tube 12 back into the vapor tube. In Fig. 5, equivalent parts are designated by the same numerals as in Figs. 1-3.

The extractor may be made entirely of glass or metal, or part of glass and part of metal; or it may be made of any suitable material not attacked chemically by the solvent and substances processed.

It is not requisite that all parts be concentric. The siphon parts only may be concentric and placed eccentrically in the walls 32. In such case, danger of dripping of the solvent from the condenser into the vapor tube can be avoided.

Many modifications within the scope of the invention will occur to those skilled in the art. Therefore, it is not limited to the specific form and detail as illustrated in the drawing.

What is claimed is:

1. Extraction apparatus having separable component parts, one of said components comprising a container for material containing an extractive, a tube which extends up into said container and is open at its lower end to permit liquid discharge therethrough, the other component comprising means at least a portion of which is tubular and provides a vapor passage when inserted in said first tube, said means having a second tubular portion coaxial with said vapor-passage portion and loosely telescoping over said first tube, said vapor-passage and said second tubular portions having their walls sealed together at their upper ends to provide a closed connection between the two legs of a siphon of which one leg is formed

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by said second tubular portion and said discharge tube and the other leg is formed by said discharge tube and said vapor tube portion.

2. Extraction apparatus having separable component parts, one of said components comprising a container for material containing an extractive and a liquid discharge tube, the other component comprising a vapor tube and means surrounding the walls of said discharge tube to form one leg of a siphon for siphoning out liquid from said container when the liquid reaches a certain level therein, the other leg of the siphon being formed by the walls of said vapor tube and said discharge tube, said vapor tube and surrounding means being sealed at their upper ends to form a closed connection between the legs of the siphon, said vapor tube remaining free for vapor flow at all times.

3. Extraction apparatus having two separable component parts including a container for material containing an extractive, said container being closed at the bottom and open at the top, a discharge tube within the container and passing down through said closed bottom providing a passage through the container, the second component having a siphon-wall portion around said discharge tube and a vapor tube inserted into said discharge tube, the walls of said discharge tube together with said siphon-wall portion forming one leg of a siphon and together with said vapor tube forming the second leg of such siphon, said vapor tube and said siphon-wall portion being joined at their upper ends to completely close the connection of the siphon legs at their upper ends, whereby said siphon acts automatically to discharge the container contents when the liquid rises in said container and in said first siphon leg to overflow into said discharge tube.

4. Extraction apparatus having two separable cooperating parts; one part including a container for material containing an extractive and a tubular liquid discharge member extending upward into the container through the bottom thereof and making a tight joint with said bottom, the lower end of said discharge member being open; the other of said cooperating parts having a vapor tube insertable within said tubular liquid discharge member, a tubular siphon wall around said vapor tube and sealed thereto at its upper end, said siphon wall being located outside said discharge member, said tubular siphon wall with said tubular discharge member forming one leg of a siphon and said tubular discharge member with said vapor tube forming the other leg of the siphon, whereby when the liquid rises in said container and first siphon leg to overflow into the discharge tube the siphon starts to operate automatically.

5. Extraction apparatus as claimed in claim 3 having a holder for the material containing the extractive within the container.

6. Extraction apparatus as claimed in claim 5 in which the holder is provided with means for filtering the solution.

7. Extraction apparatus as claimed in claim 5 in which the holder has walls concentric with the container and is removable therefrom and is provided with means for filtering the solution.

8. Extraction apparatus as claimed in claim 3 adapted to be connected at the bottom to a solvent container and at its top to a reflux condenser, having means to prevent condensed solvent from the condenser dripping into said vapor-passage means.

9. Extraction apparatus as claimed in claim 8 in which the means to prevent entrance of the condensed solvent comprises a rounded perforated cap over the vapor-passage means.

10. Extraction apparatus as claimed in claim 3 wherein the vapor-passage means has a spherical top with lateral perforations for exit of the vapor, said spherical top

preventing dripping of solvent into said vapor-passage means from above.

11. Extraction apparatus as claimed in claim 3 in which the walls of the means which form the siphon are tubular and concentric.

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