Aug. 27, 1957 J. F. SURIANO 2,804,427

METHOD AND APPARATUS FOR DEODORIZING OILS AND FATS

Filed Oct. 27, 1955 2 Sheets-Sheet 1

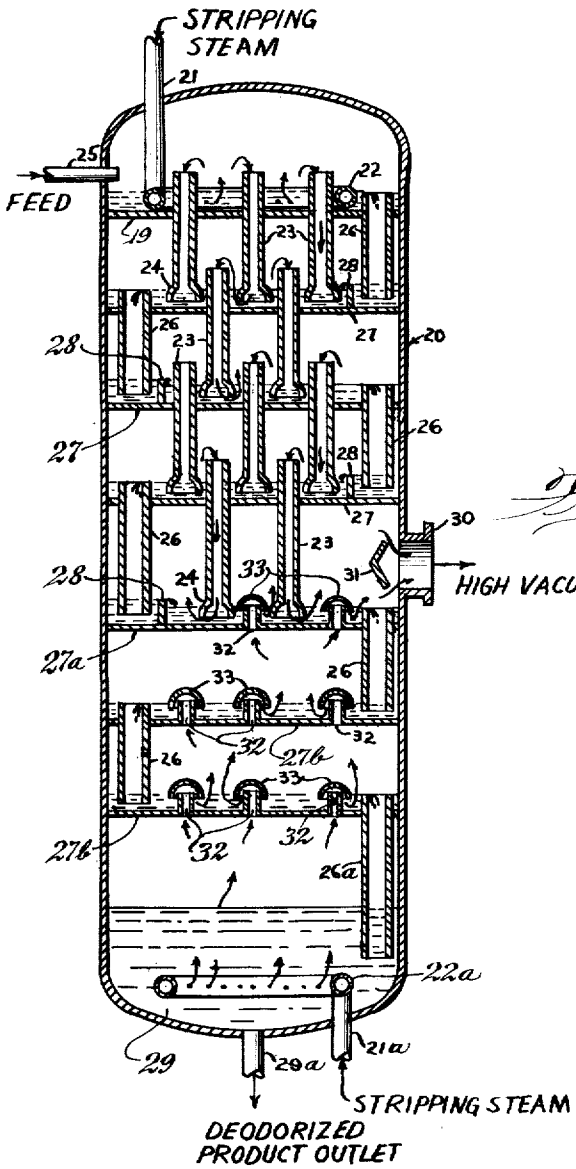


Fig. 1.

INVENTOR.
Jack F. Suriano
By Ahlberg, Kupper & Gradolph
Attorneys.

Aug. 27, 1957 J. F. SURIANO 2,804,427

METHOD AND APPARATUS FOR DEODORIZING OILS AND FATS

Filed Oct. 27, 1955 2 Sheets-Sheet 2

Fig. 2.

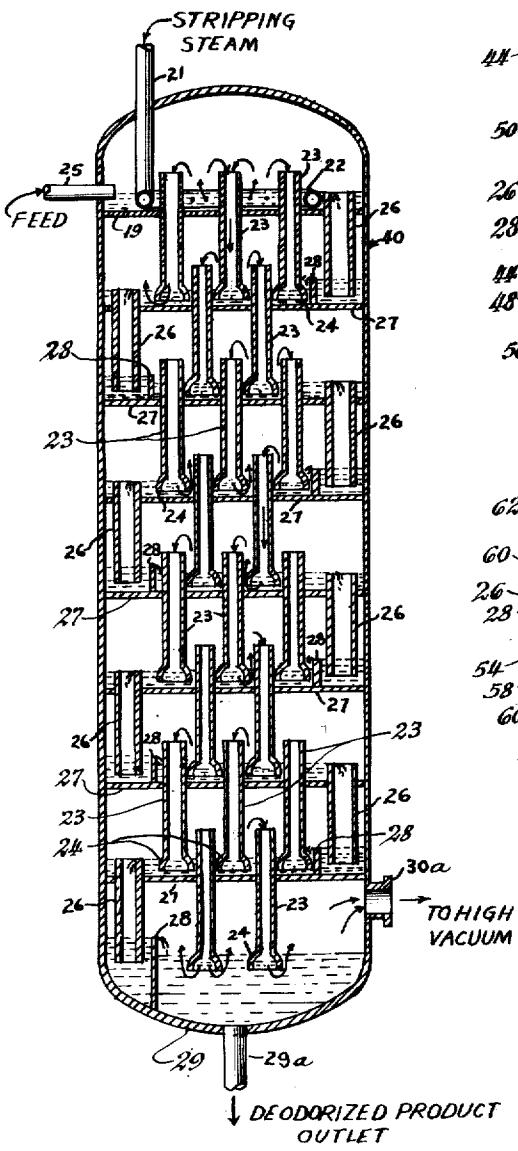


Fig. 3.

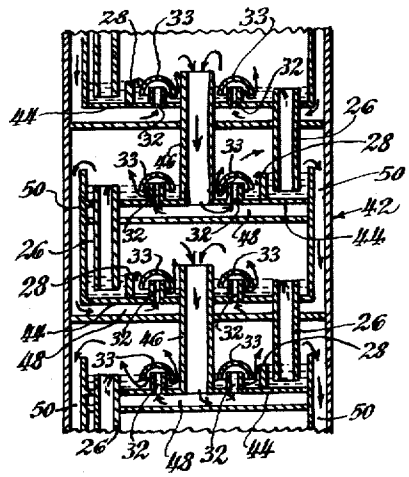
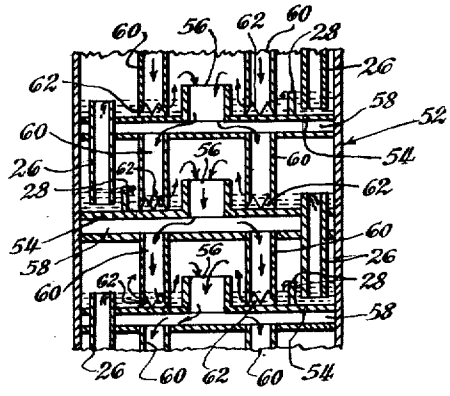


Fig. 4.



INVENTOR.

Jack F. Suriano

By Ahlberg, Wupper & Gradolph

Attorneys.

United States Patent Office 2,804,427 Patented Aug. 27, 1957

2,804,427

METHOD AND APPARATUS FOR DEODORIZING OILS AND FATS

Jack F. Suriano, Chicago, Ill.

Application October 27, 1955, Serial No. 543,237

10 Claims. (Cl. 202—46)

The present invention relates to an improved method and apparatus for the continuous deodorization of fats and oils.

The terms oils or fats as used herein are intended to denote oils or fats of vegetable, animal or marine origin, the products of esterification produced from natural or synthetic fatty acids and glycerine, any mixtures of two or more of the aforesaid materials, and the hydrogenated derivatives of the aforesaid materials.

The processing of fats and oils to make them odorless and tasteless is now carried out by a countercurrent steaming method in a column or tower equipped with a plurality of bubble cap trays or their equivalent to provide intimate contact between descending oil and ascending stripping vapor or gas, the entire operation being conducted under a vacuum. In such tower the lowest absolute pressure is maintained near the top at the vacuum takeoff and in the vicinity of the heated oil inlet, and each tray down the tower, downstream of the flowing oil, induces an increase in the absolute pressure or a loss in the vacuum, so that the highest absolute pressure (or poorest vacuum condition) exists adjacent the product exit.

The stripping action of the steam or vapor is greatest when the volume of the steam is greatest, and this volume exists at the point of lowest absolute pressure or highest vacuum. It is axiomatic, therefore, that towers of the type described in the preceding paragraph are not efficient in that they fail to utilize the full stripping potential of the steam.

Concurrent flow towers have been devised but they have the disadvantage of introducing the heated oil into the tower at the bottom thereof and consequently need a means of lifting the oil from tray to tray.

It is the principal object of the present invention to provide a new and improved oil stripping method and tower which overcome the disadvantages of the prior art and utilize the full stripping potential of the stripping vapor or gas.

Another object is to provide a new and improved oil stripping method and tower which locates the high vacuum takeoff so as to utilize to the fullest extent the stripping potential of the steam.

Another object is to provide a new and improved oil stripping method and tower which utilizes concurrent flow of oil to be deodorized and stripping steam so as to obtain the greatest efficiency from the concurrent flow technique.

Another object is to provide a new and improved oil stripping method and power which increases the capacity of the method and tower by advantageously locating the high vacuum takeoff so that the vacuum loss or increase in absolute pressures in the tower will be minimized.

A further object is to provide a new and improved oil stripping method and tower which combines concurrent flow of oil and stripping steam with countercurrent flow of oil and stripping steam.

Other objects and advantages will become apparent

from the following description taken in conjunction with the accompanying drawings wherein,

Fig. 1 is a vertical medial sectional view of an oil deodorizing tower or column showing a preferred form of construction wherein continuous deodorization is effected by both concurrent flow of oil and stripping steam and countercurrent flow of oil and steam;

Fig. 2 is a view similar to Fig. 1, showing another form of tower wherein the continuous deodorization is carried out by concurrent flow of oil and steam;

Fig. 3 is a fragmentary vertical medial sectional view of a deodorizing tower showing a modified structure for accomplishing deodorization by concurrent flow of oil and steam; and

Fig. 4 is a fragmentary sectional view similar to Fig. 3, showing a further modified tower construction.

Referring to Fig. 1, the reference character **20** indicates a vacuum tower or column for the continuous deodorization of heated oil by contacting the oil with stripping steam. The heated oil is fed into the deodorizing tower **20** at its upper end through an inlet pipe **25** connected to a conventional oil heater (not shown). The heated oil flows laterally across the uppermost tray **19** in the tower where it is first contacted with the stripping steam. The steam is supplied to the top of the tower through a supply pipe **21** connected at its inlet end to a steam generator and at its opposite end to a distributing header **22** positioned above the tray **19** and in the flow path of the oil entering the tower from the feed pipe **25**.

The steam bubbles through the heated oil in the tray **19**, and, under the influence of the vacuum created in the tower at the high vacuum take-off **30** passes downwardly in the tower through a plurality of tubes **23** secured to the tray **19** with their upper ends located a substantial distance above the surface of the tray **19** so that no oil flows through the tubes **23**. The oil overflows into a down pipe **26** the upper open end of which is located a predetermined distance above the tray **19** and the lower outlet end of which is positioned adjacent the surface of a tray **27** positioned immediately below the tray **19**. The outlet of the down pipe is located behind a weir **28** to control the flow of oil onto the tray **27** and to provide a liquid seal preventing the passage of stripping steam through the pipe **26**.

The lower ends of the steam tubes **23** are fitted with slotted caps **24** or similar distributing troughs immediately above the surface of the tray **27** and immersed in the oil flowing downwardly by gravity through the pipe **26** and across the tray from the weir **28** to the next down pipe **26**. The stripping steam thus contacts the heated oil on the tray **27** removing impurities therefrom.

The oil being deodorized flows by gravity from tray **27** to the next lower tray **27** until it flows onto tray **27*a***. The stripping steam from the pipe **21** passes downwardly through the tubes **23** and distributing headers **24** until it contacts the tray **27*a***. It will be noted that the high vacuum takeoff **30** is located in the side wall of the tower **20** below the lowermost of the series of trays **27** and above the tray **27*a***, so that the contaminated stripping steam from the tray **27*a*** will be evacuated through the outlet **30** by suitable vacuum creating equipment, such as a pump (not shown).

The lower end of the tower is formed as a sump **29** to collect the purified and deodorized oil which is drawn off through an outlet **29*a***. Additional stripping steam is introduced into the lower end of the tower **20** through a steam inlet pipe **21*a*** connected to a steam generator and a distributing header **22*a*** located in the sump **29**.

The steam passes upwardly in the tower toward the vacuum takeoff **30** and past a series of deodorizing trays **27*b*** which are positioned below the tray **27*a***. Each tray **27*b*** is equipped with a plurality of short bubble cap

risers **32** covered with spaced bubble caps **33**, the steam passing through the risers **32** and out from under the bubble caps **33** and across the tray **27***b* to contact the heated oil thereon.

The heated oil being deodorized flows downwardly under the force of gravity from the tray **27***a* to the tray **27***b* therebelow through down-pipe **26** and also from one tray **27***b* to the next lower tray **27***b* through the down-pipes **26**, finally flowing to the sump **29** from the lowermost of the series of trays **27***b* through the down-pipe **26***a*.

The stripping steam in the lower part of the tower **20** passes upwardly, through the oil on the tray **27***b* and the tray **27***a* to the point of lowest absolute pressure in the tower to pass in contaminated condition through the high vacuum takeoff **30**. The steam outlet is protected by a screen or baffle **31** to prevent entrainment of oil with the evacuated vapors.

The tower **20** combines concurrent and countercurrent flow of oil and stripping steam which increases the capacity of the tower of any given height and diameter. It has already been noted that the stripping action of the steam is greatest where the steam volume is greatest and this occurs at the point of lowest absolute pressure in the tower which exists adjacent the contaminated steam outlet **30**. If it be assumed that the stripping trays **19**, **27**, **27***a* and **27***b* may be designed so that the increase in absolute pressure introduced by a concurrent flow tray equals the increase in absolute pressure introduced by a countercurrent flow tray at either side of the vacuum takeoff **30**, the absolute pressure in the tower at any tray above the outlet **30** will equal the absolute pressure in the tower at the same number of trays below the outlet **30**. It is clear, therefore, that in this tower the effective tray area at any absolute pressure is double that of a conventional tower of the same diameter, and the stripping action at such pressure is correspondingly increased. Furthermore, it should be noted that the loss of vacuum or increase of absolute pressure in the tower of Fig. 1 will be substantially less than that in the conventional towers having an equal number of trays. It follows, therefore, that the tower of Fig. 1 utilizes the stripping potential of the stripping steam with greatest efficiency by combining concurrent and countercurrent flow of oil and steam with the contaminated steam outlet under vacuum located between the two portions of the tower.

Fig. 2 illustrates a further embodiment of the present invention wherein the tower provides a novel concurrent flow arrangement. In this embodiment the tower **40** is equipped with a heated oil inlet **25** and a steam inlet pipe **21** and distributing header **22**. The oil flows across a top tray **19** to a down pipe **26** through which it flows by gravity to a lower tray **27**. The steam after contacting the oil to be deodorized passes through a plurality of down tubes **23** and slotted caps **24** under the influence of the vacuum in the tower created at the high vacuum takeoff **30***a* which is located at the bottom of the tower and below the lowermost stripping tray.

The tower **40** is equipped with a plurality of trays **27** which are fitted with the oil down-pipes **26** and weirs **28** and the steam tubes **23** and slotted headers **24**. These trays **19** and **27** function in the same manner as the trays **19** and **27** of the tower **20** shown in Fig. 1, and serve in the deodorization of oil by the concurrent downward flow of oil and steam. This tower **40** and its method of operation are improvements over the concurrent towers heretofore devised, because the oil flows downwardly by gravity and needs no arrangement to lift it from one tray to the next. The vacuum, therefore, is used to move the stripping steam through the tower and no vacuum is used in moving the oil.

In Fig. 3 there is illustrated in section a fragment of a tower **42** for concurrent downward flow of oil and stripping vapor and which may be used in the upper portion of a tower **20** or as an entire tower **40**. The deodorizing action takes place on the trays **44** which are provided with

flow regulating weirs **28** and gravity flow oil downpipes **26**. Stripping steam passes from above the upper tray **44** downwardly through a central down tube **46** to a manifold **48** located below the next lower tray **44**. The steam passes upwardly from the horizontal manifold **48** through risers **32** and out through bubble caps **33** to pass through and contact the oil. From above the second tray **44** the stripping steam passes downwardly through a plurality of tubes or passages **50** located adjacent the wall of the tower **42** to the horizontal manifold **48**. The two arrangements of down tubes for the stripping steam are alternated throughout the trays **44**.

Fig. 4 shows a further modification of a concurrent flow of deodorizing tower or tower portion **52** wherein deodorization takes place on trays **54** fitted with gravity flow oil downpipes **26** and oil flow control weirs **28**. The stripping steam passes from above each tray **54** through a relatively large centrally located pipe **56** to a horizontally disposed manifold **58** under the tray and then through a plurality of down tubes **60** having slotted lower ends **62** to the next lower tray **54**. The lower ends of the tubes are below the surface of the oil in the tray **54**. This conduction of steam and oil is carried out the length of the concurrent flow portion of the tower.

The method of operation of the structure shown in Figs. 3 and 4 is essentially the same as that discussed with reference to Figs. 1 and 2.

From the foregoing description it is clear that the objectives claimed for the improved tower and method are fully attained.

While several embodiments of the method and apparatus for deodorizing oils and fats constituting this invention have been shown and described, it will be apparent that modifications and variations thereof may be made without departing from the underlying principles of the invention. It is, therefore, desired by the following claims to include within the scope of the invention all such variations and modifications by which substantially the results of this invention may be obtained through the use of substantially the same or equivalent means.

What is claimed as new and desired to be secured by United States Letters Patent is:

1. An apparatus for continuously purifying and deodorizing preheated oils and fats, comprising an upright tower, an inlet at the top of said tower through which preheated product to be processed is introduced into said tower, means forming an outlet at the bottom of said tower for purified and deodorized product, a plurality of stripping trays positioned between said product inlet and said product outlet and on which stripping vapor is contacted with the product being processed, inlet means at the top of said tower for stripping vapor, a high vacuum outlet for contaminated vapor located below at least a portion of said trays, a down pipe for flowing the product from each of said trays to a successive lower tray by gravity, and a plurality of stripping vapor tubes for conducting the stripping vapor from above each tray into the product on the successive lower tray, each of said tubes having a flared and slotted lower end positioned closely adjacent and above the tray containing the product into which the stripping vapor flowing down through said tube is to pass.

2. An apparatus for continuously purifying and deodorizing preheated oils and fats, comprising an upright tower, an inlet at the top of said tower through which preheated product to be processed is introduced into said tower, means forming an outlet at the bottom of said tower for purified and deodorized product, a plurality of stripping trays positioned between said product inlet and said product outlet and on which stripping vapor is contacted with the product being processed, inlet means at the top of said tower for stripping vapor, a high vacuum outlet for contaminated vapor located below the lowermost of said trays, a down pipe for flowing the product from each of said trays to a successive lower tray and from the lowermost tray to said outlet by gravity, and a

plurality of stripping vapor tubes having lower outlet ends positioned to discharge stripping vapor into the product on said trays for conducting the stripping vapor from above each tray into the product on the successive lower tray, whereby purification and deodorization of the product are effected in a process having concurrent flow of product and stripping vapor.

3. An apparatus for continuously purifying and deodorizing preheated oils and fats, comprising an upright tower, an inlet at the top of said tower through which preheated product to be processed is introduced into said tower, means forming an outlet at the bottom of said tower for purified and deodorized product, a plurality of stripping trays positioned between said product inlet and said product outlet and on which stripping vapor is contacted with the product being processed, an inlet at the top of said tower for stripping vapor, an inlet at the bottom of said tower for stripping vapor, a high vacuum outlet for contaminated vapor located between said vapor inlets and between a pair of said trays, a down pipe for flowing the product from each of said trays to a successive lower tray by gravity, first a plurality of stripping vapor tubes for conducting the stripping vapor from above each tray into the product on the successive lower tray above the lower of said pair of trays and into the product on said lower of said pair of trays, and bubble cap means for conducting the stripping vapor from above each tray into the product on the successive higher tray which is below the upper of said pair of trays, wherey purification and deodorization of the product are effected in a process having concurrent and countercurrent flow of product and stripping vapor.

4. An apparatus for continuously purifying and deodorizing preheated oils and fats, comprising an upright tower, an inlet at the top of said tower through which preheated product to be processed is introduced into said tower, means forming an outlet at the bottom of said tower for purified and deodorized product, a plurality of stripping trays positioned between said product inlet and said product outlet and on which stripping vapor is contacted with the product being processed, inlet means at the top of said tower for stripping vapor, a high vacuum outlet for contaminated vapor located below at least a portion of said trays, down conduit means for flowing product from each tray into the product on a successive lower tray by gravity, said conduit means having the outlets therefrom below the surface of the product, and a plurality of stripping vapor tubes each having an open flared lower end closely adjacent the tray to which stripping vapor is to be delivered and below the surface of product on said tray and an open upper end above the product on the tray above said last mentioned tray thereby to conduct the stripping vapor from above the product level on each of said trays into the product on the successive lower tray.

5. An apparatus for continuously purifying and deodorizing preheated oils and fats, comprising an upright tower, an inlet at the top of said tower through which preheated product to be processed is introduced into said tower, means forming an outlet at the bottom of said tower for purified and deodorized product, a plurality of stripping trays positioned between said product inlet and said product outlet and on which stripping vapor is contacted with the product being processed, and inlet at the top of said tower for stripping vapor, and inlet at the bottom of said tower for stripping vapor, a high vacuum outlet for contaminated vapor located between said vapor inlets and between a pair of said trays, a down pipe for flowing the product from each of said stripping trays to a successive lower tray by gravity, a plurality of stripping vapor tubes for conducting the stripping vapor from above each tray into the product on the successive lower tray above the lower of said pair of trays and into the product on said lower of said pair of trays, bubble cap means for conducting the strippng vapor from above each tray

into the product on the successive higher tray which is below the upper of said pair of trays, and said vapor outlet being positioned so that the absolute vapor pressure at any tray above said outlet is substantially the same as the absolute vapor pressure at the corresponding tray below said outlet.

6. An apparatus for continuously purifying and deodorizing preheated oils and fats, comprising an upright tower, an inlet at the top of said tower through which preheated product to be processed is introduced into said tower, means forming an outlet at the bottom of said tower for purified and deodorized product, a plurality of stripping trays positioned between said product inlet and said product outlet and on which stripping vapor is contacted with the product being processed, inlet means at the top of said tower for stripping vapor, inlet means at the bottom of said tower for stripping vapor, a high vacuum outlet for contaminated vapor located between said vapor inlets and between a pair of trays so that one of said pair of trays is above said high vacuum outlet and the second of said pair of trays is below said high vacuum outlet, a down pipe for flowing the product from each of said trays to a successive lower tray by gravity, a plurality of stripping vapor tubes for conducting the stripping vapor from above each tray into the product on the successive lower tray which is above said second of said pair of trays, bubble cap means for conducting the stripping vapor from above each tray into the product on the successive higher tray which is below said second of said pair of trays, and a plurality of stripping vapor tubes and bubble cap means for conducting the stripping vapor into the product on said second of said pair of trays from which it is withdrawn through said high vacuum outlet.

7. In the method of continuously purifying and deodorizing preheated oils and fats, the steps including introducing liquefied and preheated product into an enclosed stripping zone at the upper end thereof, introducing stripping vapor into the stripping zone at the upper end thereof, applying a high vacuum to the stripping zone at a point substantially below the product and stripping vapor inlets, contacting the stripping vapor with the product as the product and vapor move with concurrent flow down through the stripping zone, withdrawing contaminated vapor from the stripping zone by the high vacuum, and withdrawing purified and deodorized product from the bottom of the stripping zone.

8. In the method of continuously purifying and deodorizing preheated oils and fats, the steps including introducing liquefied and preheated product into an enclosed stripping zone at the upper end thereof, simultaneously introducing stripping vapor into the stripping zone at the upper and lower ends thereof, applying a high vacuum to the stripping zone at a point intermediate the stripping vapor inlets, flowing the product downwardly through the stripping zone while contacting it with stripping vapor from the vapor inlets, withdrawing contaminated vapor from the stripping zone by the high vacuum, and withdrawing purified and deodorized product at the bottom of the stripping zone.

9. In the method of continuously purifying and deodorizing preheated oils and fats, the steps including introducing liquefied and preheated product into an enclosed stripping zone at the upper end thereof, simultaneously introducing stripping vapor into the stripping zone at the upper and lower ends thereof, applying a high vacuum to the stripping zone at a single point intermediate the stripping vapor inlets, flowing the product downwardly through the stripping zone while contacting it with stripping vapor from the vapor inlets, maintaining the absolute pressure in the stripping zone at any point above the high vacuum takeoff substantially equal to the absolute pressure at a corresponding point below the high vacuum takeoff, withdrawing contaminated vapor from the stripping zone by the high vacuum, and withdrawing

purified and deodorized product at the bottom of the stripping zone.

10. In the method of continuously purifying and deodorizing preheated oils and fats, the steps including introducing liquefied and preheated product into an enclosed stripping zone at the upper end thereof, simultaneously introducing stripping vapor into the stripping zone at the upper and lower ends thereof, applying a high vacuum to the stripping zone at a single point intermediate the stripping vapor inlets, flowing the product downwardly through the stripping zone, contacting the product with stripping vapor from the upper vapor inlet with concurrent flow of product and vapor through the stripping zone above the high vacuum takeoff, contacting the product

with stripping vapor from the lower vapor inlet with countercurrent flow of product and vapor through the stripping zone below the high vacuum takeoff, withdrawing contaminated vapor from the stripping zone by the high vacuum, and withdrawing purified and deodorized product at the bottom of the stripping zone.

References Cited in the file of this patent

UNITED STATES PATENTS

2,221,691	Hickman	Nov. 12, 1940
2,368,669	Lee et al.	Feb. 6, 1945
2,559,129	Miller	July 3, 1951
2,578,670	Carleton	Dec. 18, 1951