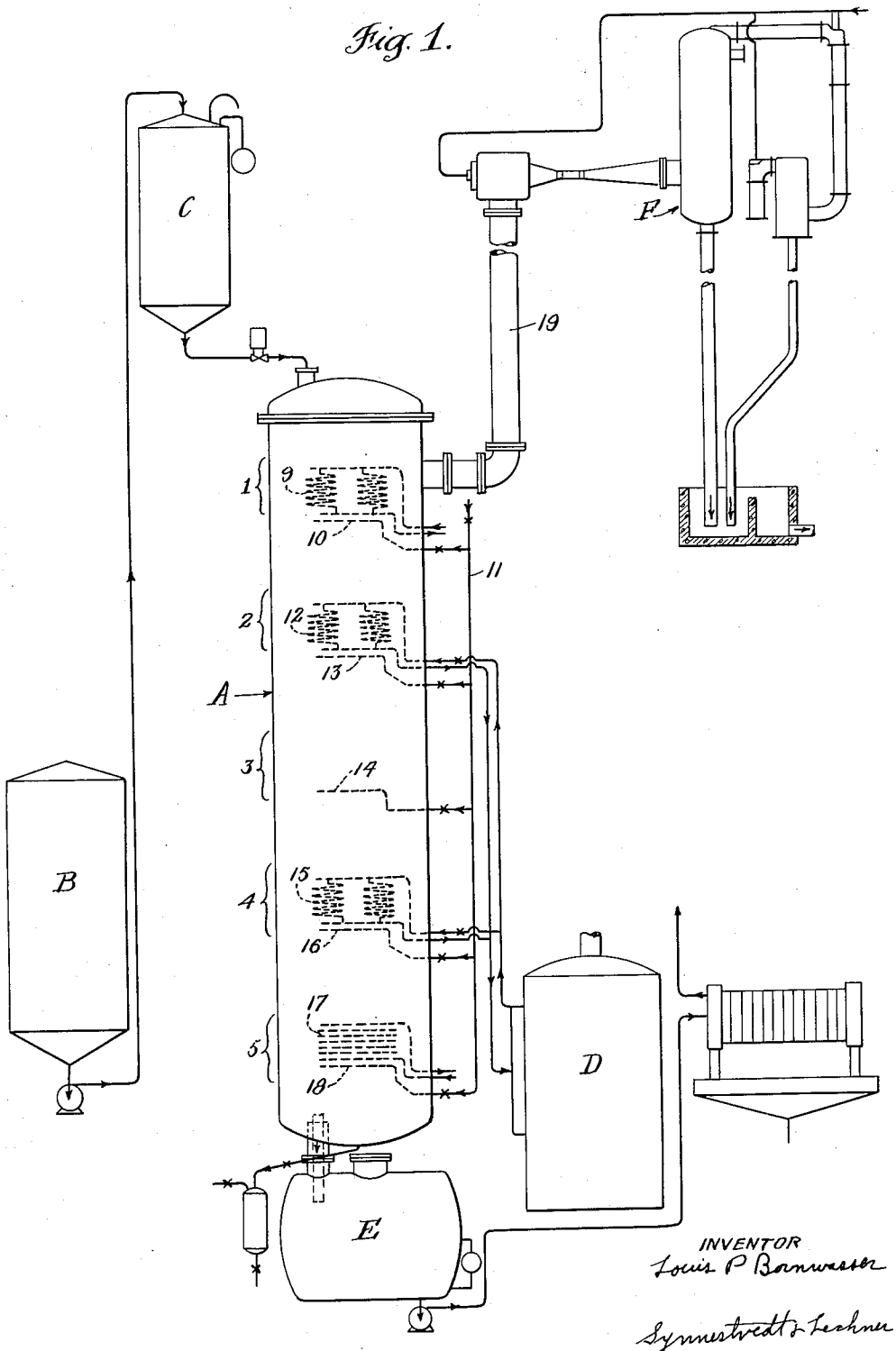
May 1, 1956 L. P. BORNWASSER 2,743,916

STEAM STRIPPING EQUIPMENT

Filed June 13, 1952 4 Sheets-Sheet 1

Fig. 1.



INVENTOR
Louis P Bornwasser

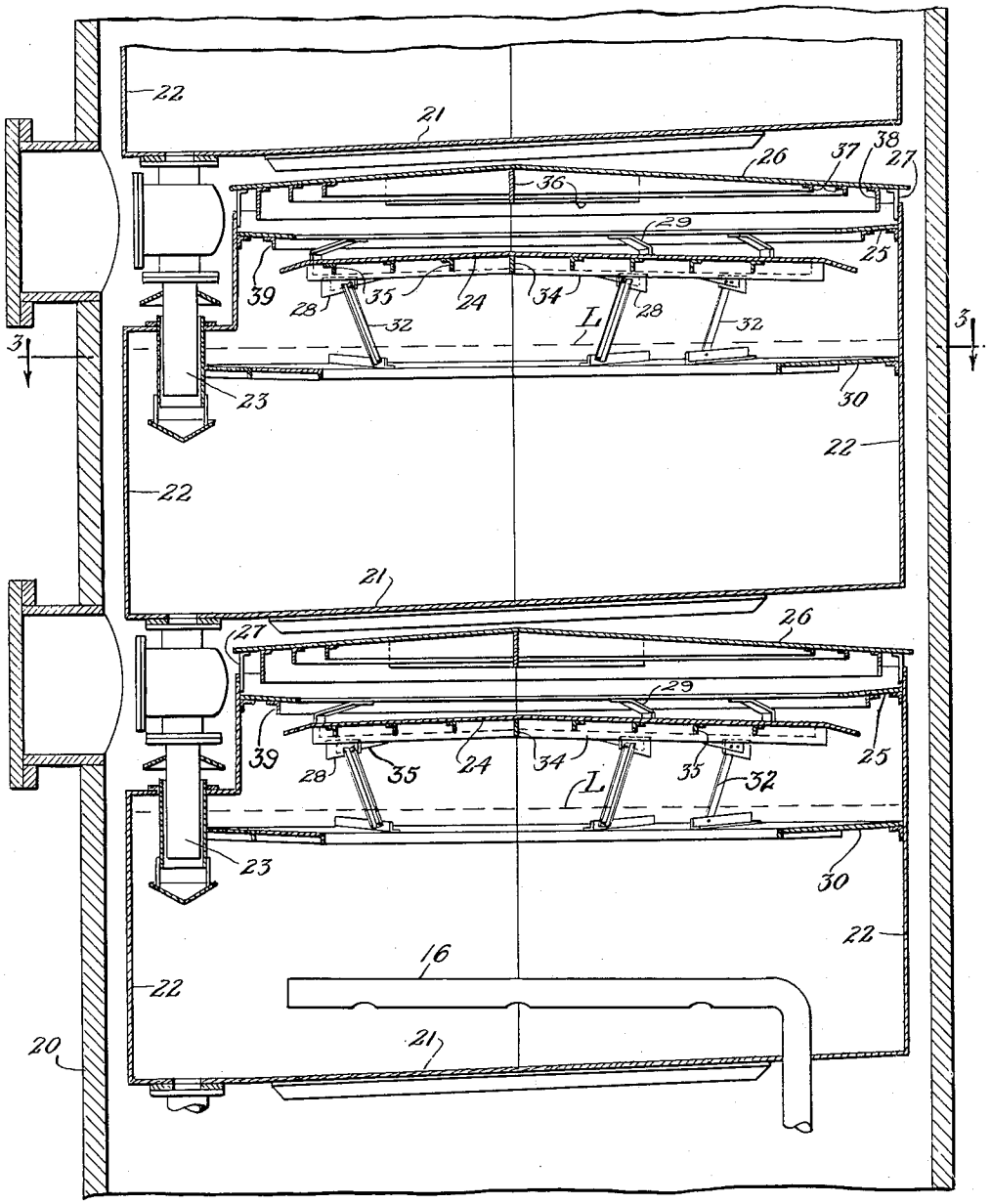
Symmestvedt & Lechner
ATTORNEYS

May 1, 1956 L. P. BORNWASSER 2,743,916

STEAM STRIPPING EQUIPMENT

Filed June 13, 1952 4 Sheets-Sheet 2

Fig. 2.



INVENTOR
Louis P Bornwasser

Synnestvedt & Lechner
ATTORNEYS

May 1, 1956 L. P. BORNWASSER 2,743,916

STEAM STRIPPING EQUIPMENT

Filed June 13, 1952 4 Sheets-Sheet 3

Fig. 3.

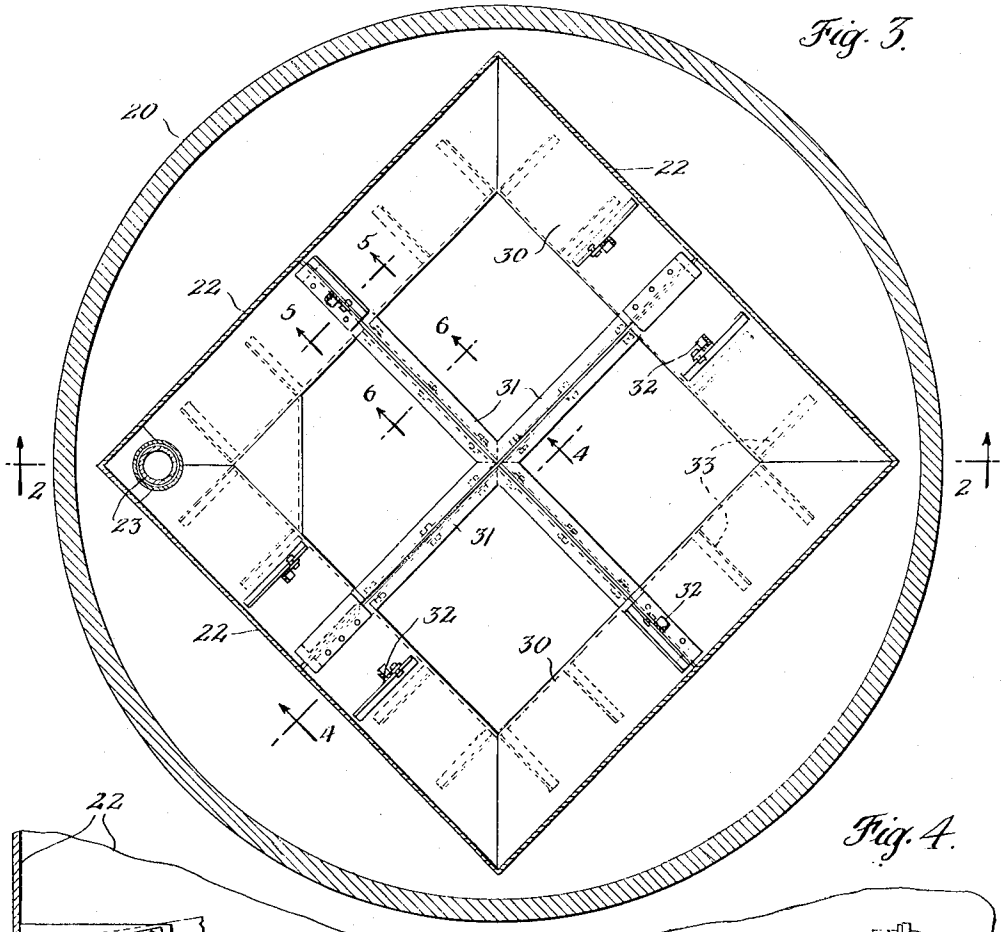
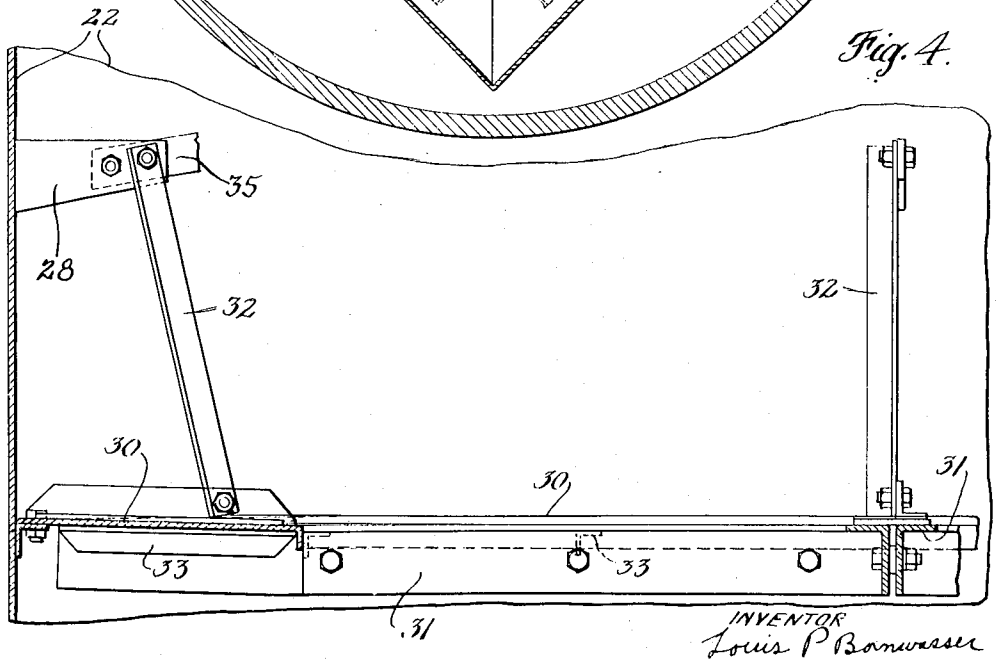


Fig. 4.



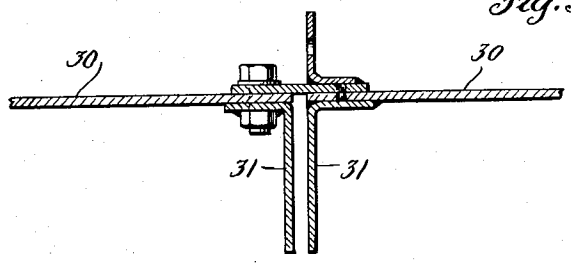
INVENTOR
Louis P Bornwasser
Synnestvedt & Lechner
ATTORNEYS

May 1, 1956 L. P. BORNWASSER 2,743,916

STEAM STRIPPING EQUIPMENT

Filed June 13, 1952 4 Sheets-Sheet 4

Fig. 5.



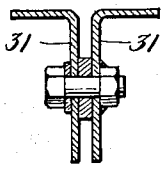


Fig. 6.

Fig. 7.

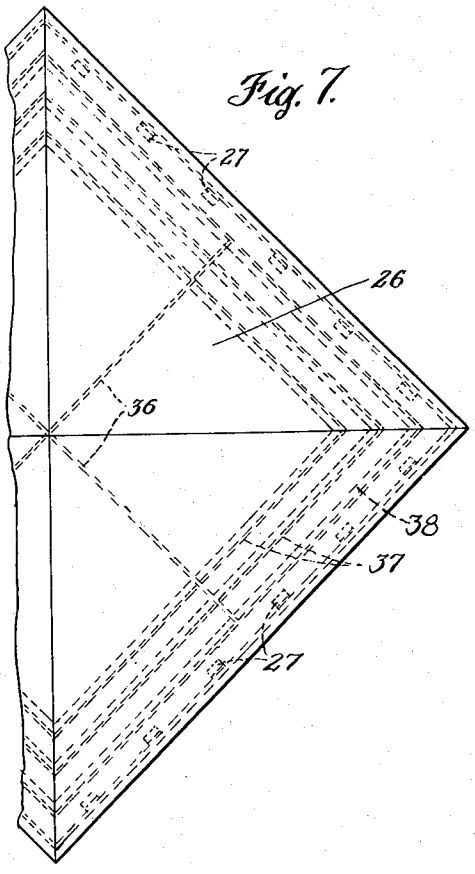
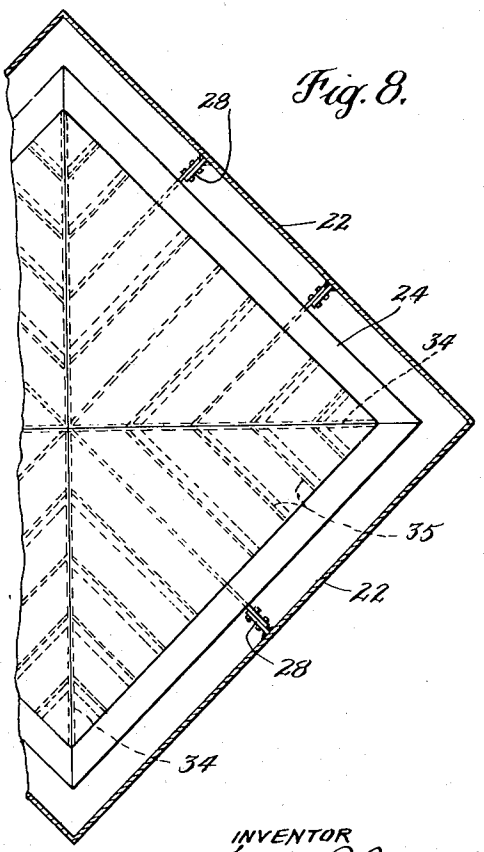


Fig. 8.



INVENTOR
Louis P Bornwasser

Synnestvedt & Lechner
ATTORNEYS

United States Patent Office 2,743,916 Patented May 1, 1956

2,743,916

STEAM STRIPPING EQUIPMENT

Louis P. Bornwasser, Louisville, Ky., assignor, by mesne assignments, to National Cylinder Gas Company, Chicago, Ill., a corporation of Delaware

Application June 13, 1952, Serial No. 293,463

3 Claims. (Cl. 261—121)

This invention relates to equipment for use in treating oil with sparging or stripping stream. The invention is especially concerned with special arrangements for rereducing carry over and loss of oil particles entrained by the stripping steam. Although not limited thereto the invention is particularly adaptable for use in the splash plate type of equipment for steam stripping, i. e., the type of equipment in which the oil to be treated is projected in space against a splash or splatter plate by means of the stripping steam, so as to splatter the oil or break it up to increase surface area exposure to the stripping steam and thereby enhance the stripping action of the steam.

Briefly described, such an oil treatment equipment includes a receptacle or tray having bottom and side walls and adapted to receive oil up to a level only partially filling the tray. The splash plate is arranged toward the top of the tray well above the level of the oil therein. The splash plate covers the central region of the oil in the tray but has its edges terminated short of the side walls, to provide for exit of the stripping steam and the vapors or other constituents stripped from the oil by the steam and carried therewith. A steam inlet, usually comprising a perforated steam inlet pipe is disposed in the body of the oil well below the surface thereof. The operation is ordinarily carried out under high vacuum.

Introduction of the stripping steam into the body of the oil well below the surface causes the oil to be projected or splashed upwardly against the splash plate. In this operation small particles of oil are entrained by the stripping steam and these particles tend to be carried off through the vacuum offtake. Various forms of "knockout" or separator plates have been employed in an effort to remove the entrained oil particles from the current of stripping steam rising from the oil in the tray and leaving the tray for ultimate discharge through the vacuum offtake. In equipment of this kind the separated oil particles accumulate on the surfaces of the separator plates and then drip back into the body of oil in the treating tray.

In the kind of equipment with which the invention is particularly concerned a plurality of plate elements are arranged in the tray above the oil level therein and these elements have overlapping edge portions providing a tortuous steam exit passage of varying cross section so that the current of stripping steam varies in velocity at different points along its path to the final outlet.

One of the principal objects of the invention is to concentrate the dripping of accumulated oil from the plate elements in regions of the steam exit passage where the steam is travelling at relatively low velocity.

Other objects and features of the invention will appear more fully hereinafter following a description of a preferred embodiment of the invention. In considering the embodiment illustrated in the drawings, it is here first mentioned that the equipment of the present invention is of general applicability to oil or even other liquid treatments requiring a high degree of efficiency of steam

stripping and of separation of entrained liquid from the stripping steam. In connection with the use of the expression "stripping steam" herein, it is to be understood that any sparging operation is contemplated, such as stripping of some constituent from the oil or the removal of air therefrom, or the introduction of steam as an aid to distillation or merely for the purpose of agitating a body of oil.

As illustrative of a typical use of the equipment, reference is made to a plant for effecting deodorization of vegetable oils and the invention is illustrated in the accompanying drawings as applied to that particular use.

In the drawings—

Figure 1 is a somewhat diagrammatic or outline view of the major components of an oil treatment plant such as employed for the deodorization of vegetable oils.

Figure 2 is an enlarged vertical sectional view through a portion of the oil treatment column of Figure 1, showing the application of the equipment of the present invention in such a column. Certain of the heater elements and piping shown in Figure 1 are omitted from Figure 2 for the sake of clarity. Figure 2 is taken as indicated by the section line **2—2** on Figure 3.

Figure 3 is a horizontal sectional view taken as indicated by the section line **3—3** on Figure 2.

Figure 4 is a fragmentary view taken substantially as indicated by the section line **4—4** on Figure 3, illustrating certain details on an enlarged scale as compared with Figure 3.

Figures 5 and 6 are enlarged views of certain details taken as indicated by the lines **5—5** and **6—6** on Figure 3.

Figure 7 is a partial top plan view of the hood or umbrella which is arranged above each of the oil treatment trays as shown in Figure 2.

Figure 8 is a partial plan view of the splash plate employed in each of the trays as shown in Figure 2.

In the layout of Figure 1, the oil treatment column A is supplied with oil from an oil supply B through a measuring tank C. The column is provided with a plurality of treatment zones, there being a series of five such zones in the particular illustration of Figure 1, as is indicated by the numerals **1** to **5** inclusive applied to the column with brackets. Treatment of different kinds are carried out in different zones. Each zone is desirably defined by an oil treatment tray arranged within the column, the five zones and trays being serially superimposed. The nature of the trays and of certain parts thereof is described in detail hereinafter with reference to Figures 2 to 8 inclusive, but it is here noted that as shown in Figure 1 the several trays are provided with certain heater elements and steam inlets, as follows:

In zone **1** heating coils **9** are provided, and these may be supplied with steam or other heating medium. Zone **1** also is provided with a perforated steam inlet pipe **10** which is supplied from the steam line **11**.

In zone **2** heater elements **12** are provided and these may be supplied with a heating medium, for instance Dowtherm vapor generated by the unit D. Steam is introduced into zone **2** through a perforated pipe **13**.

Zone **3** as shown in the particular layout of Figure 1 is not provided with a heater coil but is provided with a stripping steam inlet **14**.

Zone **4**, in the particular illustration of Figure 1, is shown as provided with a heater **15** also supplied from the generator D, as well as a perforated stripping steam inlet pipe **16**.

Zone **5** has a cooling coil **17** therewith, and in addition is provided with a steam inlet pipe **18**.

The general arrangement of column illustrated in Figure 1 forms no part of the present invention per se but is merely representative of the type of layout in which the steam stripping trays and associated equipment of

the present invention may advantageously be utilized. For a full description of operation of a system such as shown in Figure 1 reference may be made to the copending application of Alton E. Bailey, Serial No. 54,967, filed October 16, 1948, now Patent No. 2,691,665, issued October 12, 1954, and assigned to the assignee of the present application.

It may be mentioned briefly that as disclosed in said copending application the type of column illustrated in Figure 1 provides for successive batch-wise treatment of oil, a measured quantity being introduced from the tank C into the tray defining zone 1 and treated therein for a given interval of time, after which this batch is dropped into the tray defining the next zone, and a new batch is introduced into the first zone. Each period of treatment is carried on for the same length of time and each batch of oil is successively dropped into the next lower zone until each batch is subjected to treatment for the given time interval in each of the five zones, following which it is dumped into the receiving tank E below the column. In such a column the first two trays serve to raise the oil to effective deodorization temperature and in these trays a relatively small amount of steam is introduced, primarily for the purposes of agitating the oil and removing air therefrom. Deodorization takes place in the trays of zones 3 and 4 so that here the steam is being used for stripping. The steam in the tray of zone 5 serves again for agitation.

Advantageously the entire operation carried out within the column is effected under high vacuum and for this purpose a vacuum connection 19 is provided near the upper end of the column, the vacuum being drawn by equipment indicated in outline at F.

With the foregoing in mind as representative of an oil treatment system of the kind in which the steam stripping equipment of the invention may be utilized, attention is now directed to the disclosure of Figures 2 to 8 inclusive.

In Figures 2 and 3 the shell of the treatment column is indicated at 20. Within the shell are the superimposed oil receiving trays which serve to define the several zones of treatment referred to above in connection with Figure 1. Thus, in Figure 2 several of the treatment trays are shown. Each tray has a bottom wall 21 and side walls 22. The uppermost tray shown in Figure 2 only fragmentarily may, for the purpose of this discussion, be assumed to be the tray defining zone 2 in Figure 1; and the tray in the central portion of Figure 2 may be assumed to be that defining zone 3 in Figure 1. Similarly, the lowermost tray of Figure 2 may be assumed to be that defining zone 4.

It will be observed that the heater coils and stripping steam inlet pipes have been omitted from the illustration of Figure 2 for the sake of clarity, but it will be understood that these elements are disposed in the lower portions of the trays well below the oil level therein. Such oil level is illustrated in Figure 2 at L. It is also mentioned that the equipment of the invention may be used whether or not heating or cooling coils are present in the treatment trays.

Although the trays or treating vessels may be of any desired shape, from inspection of Figure 3 it will be noted that the trays in this particular illustration are of square horizontal section, leaving open shell space substantially completely surrounding the trays through which the stripping steam and vapors are withdrawn from the several trays independently of each other for ultimate discharge out of the vacuum offtake 19.

Figures 2 and 3 also show the dump pipes 23 through which the oil, after treatment in one tray, is delivered to the next subjacent tray.

As hereinabove mentioned, the equipment of this invention utilizes a splash plate, this being shown at 24 in Figures 2 and 8. As best seen in Figure 8, the splash plate is of generally square shape, although it is cut out appropriately in the region of the dump pipe 23; and the edges of the splash plate are terminated short of the upright side walls of the tray so as to leave a steam exit passage. It will be understood that the plan shape of the splash plate will substantially conform with the plan shape of the particular tray or vessel in which it is used. As clearly appears in Figure 2 each splash plate is located at a level well above the level of the oil in the tray, so that when the stripping steam is admitted toward the bottom of the body of oil in the tray, the oil is projected upwardly against the under side of the splash plate in a surging or geyser-like manner, thereby causing the oil to splatter and break up into small masses, so as to increase the exposed surface area for contact with the stripping steam.

Above the level of the splash plate a deflector ring 25 is provided, this ring projecting inwardly from the side walls of the tray and overlying the space between the edges of the splash plate and the side walls of the tray, thereby causing the rising steam to converge inwardly from all sides toward the central portion of the superimposed umbrella or hood 26. The marginal edges of this hood are located above and project somewhat beyond the upright side walls 22 of the tray and are supported by spaced brackets 27 so that the steam may escape under the edge of the hood into the shell space. The hood prevents dripping of oil into the tray from surfaces lying above.

Brackets 28 projecting inwardly from the tray walls serve to support the splash plate 24 in the manner explained hereinafter.

A deflector 30 is arranged in a position well below the splash plate and projecting inwardly from the side walls of the tray, this deflector serving to prevent surging of the oil upwardly along the side walls of the tray and into the steam exit passage surrounding the periphery of the splash plate.

The employment of a deflector in association with the splash plate, as described just above, forms no part of the present invention per se, but is described and claimed in copending application of Bruce De Haven Miller and Charles E. McMichael, Serial No. 293,461, filed concurrently herewith.

The deflector 30 may be supported within the tray in any suitable manner, as by horizontal angle members 31 extended across the tray from wall to wall just underneath the deflector. These may be arranged in the form of a cross as clearly appears in Figure 3, or in some other appropriate manner. Additional inclined braces for the deflector 30 may be provided above the deflector, as illustrated for example at 32 in Figures 3 and 4. These latter supporting elements are hung from the brackets 28 on which the splash plate is supported. Reinforcing angles such as shown at 33 may also be provided on the under side of the deflector 30. The deflector 30 is desirably downwardly inclined from the side walls of the tray so as to avoid trapping of oil when the batch is dumped from one tray to another.

As best seen in Figures 2 and 8, the under side of the splash plate 24 is provided with a plurality of fins or ribs 34 and 35 which serve not only to reinforce the plate but also to improve the operation of the equipment in several respects. The elements 34 extend across the under surface of the splash plate between diagonally opposite corners; and the elements 35 are arranged in spaced parallel relation in a manner to provide channels extending from the mid or interior region of the splash plate outwardly toward the marginal edges thereof. The several rib or fin elements 34 and 35 cooperate in providing a tendency for a surge or mass of oil striking the splash plate to be directed toward localized regions of the marginal edges of the splash plate, i. e., they tend to prevent uniform spread of a surge of oil in all directions on the under surface of the splash plate. This is of advantage since in the case of a particularly large surge of oil a

uniform spread thereof toward all edges of the splash plate might tend to unduly restrict the steam exit passage around the edges of the splash plate.

The various fins on the lower side of the splash plate are, of course, wetted with oil, and the fins increase the total wetted surface and thereby also increase the surface area of the oil exposed to the action of the stripping steam.

The provision of fins or ribs on a splash plate, as designated by numerals **34** and **35**, forms no part of the present invention per se, being described and claimed in copending application of Charles N. Maravell, Serial No. 293,462, filed concurrently herewith, now abandoned.

Certain of the elements **35** project outwardly beyond the edges of the splash plate and are fastened to the supporting brackets **28** to give support to the splash plate, as is clearly shown in Figures 4 and 8.

In considering certain of the important features of the present invention, it is first noted that the splash plate **24**, deflector **25** and hood **26** constitute plate-like elements having overlapping portions which cooperate to define a tortuous passage for the steam leaving the tray. This passage is of varying cross section so that the velocity of the steam changes in different portions of the passageway. For example, the steam velocity at the periphery of the splash plate is relatively low as compared with the zone defined by the inner edge of the deflector **25** and the subjacent surface of the splash plate. Similarly, in the region above the deflector **25**, the depending skirt **38** which projects downwardly from the under side of the hood **26** provides a passageway of relatively small cross section, as compared with the space below the hood and inwardly of the skirt **38**.

It is also here mentioned that oil particles entrained in the steam tend to accumulate on the surfaces of the deflector **25** and also of the hood **26**. In the absence of provision to the contrary, most of this oil accumulating on these surfaces would tend to run down to a low point, for instance the inner edge of the deflector **25** or the lower edge of the skirt **38**, and drip therefrom. However, the inner edge of the deflector **25** and the lower edge of the skirt **38** both define regions of high steam velocity, as a result of which oil particles dropping therefrom would tend to be carried with the steam.

With the foregoing in mind, the invention provides certain drip lips on certain of these plate-like elements, located in regions where the steam velocity is relatively low and serving to concentrate the dripping of oil in those regions, thereby minimizing the dripping in the regions of high steam velocity.

The arrangement of such fins on the hood **26** appears to best advantage in Figure 2 and 7. Here it will be noted that the hood **26** has fins **36** located in the central region of the hood in the general form of a cross; and additional fins **37** arranged in rings paralleling the edges of the hood and spaced inwardly from the skirt **38**. Oil accumulating on the undersurface of the hood therefore drips in large part from the fins **36** and **37** and therefore falls into regions of relatively low steam velocity.

In addition to the above function, the fins **36** and **37** further serve to increase the surface area exposure of the oil in the entire system, thereby enhancing the action of the stripping steam.

A drip fin **39** depends from the under side of the deflector ring **25**, this fin **39** being spaced outwardly an appreciable distance from the inner edge of the deflector, and thus in a region where the velocity of the steam is relatively low. This also aids in reducing the carrying of oil particles with the steam in its passage out of the tray.

I claim:

1. In an oil treating vessel having side walls and adapted to receive oil up to a level providing a body of oil only partially filling the vessel, a splash plate in the central region of the vessel well above said level and having its edges spaced from the side walls, an inlet for introducing stripping steam into the vessel below said level, a hood at the top of the vessel above the splash plate, a skirt depending from the hood in a position spaced slightly inwardly from the side walls of the vessel, and fins projecting downwardly from the lower surface of the hood in the region thereof overlying the space within the side walls of the vessel, said fins being spaced inwardly from said skirt.

2. A construction according to claim 1 in which said fins extend in a direction parallel to an edge of the hood.

3. In an oil treating vessel having side walls and adapted to contain a body of oil only partially filling the vessel, a splash plate in the central region of the vessel well above said level having its edges spaced from the side walls, an inlet for introducing steam into the vessel below said level to accelerate masses of oil against the splash plate and promote contact between oil and steam, a hood at the top of the vessel extending generally horizontally above and spaced from the splash plate and having an edge extending above the top edge of one of said side walls to define in cooperation therewith an exit passage for discharge of steam from the vessel, a skirt depending from said hood along an edge thereof parallel to said top edge to block the escape of oil masses through said passage, said edge and said skirt being lower than central portions of the hood and thus positioned in the path of flow of liquids accumulating on the undersurface of said hood, and a drip fin depending from said hood generally parallel to said edge and inwardly thereof to divert the flow of accumulated liquids from said portions to said skirt and discharge the same into said vessel away from said constricted opening.

References Cited in the file of this patent

UNITED STATES PATENTS

920,721	Bradley	May 4, 1909
1,170,069	Ihrig	Feb. 1, 1916
1,366,956	Schneible	Feb. 1, 1921
1,664,483	Piron	Apr. 3, 1928
1,773,073	Beach	Aug. 12, 1930
1,858,158	Laird	May 10, 1932
2,491,645	Clark et al.	Dec. 20, 1949