July 30, 1946. R. E. BURK ET AL 2,404,789

APPARATUS FOR FRACTIONAL DISTILLATION

Filed Nov. 10, 1941

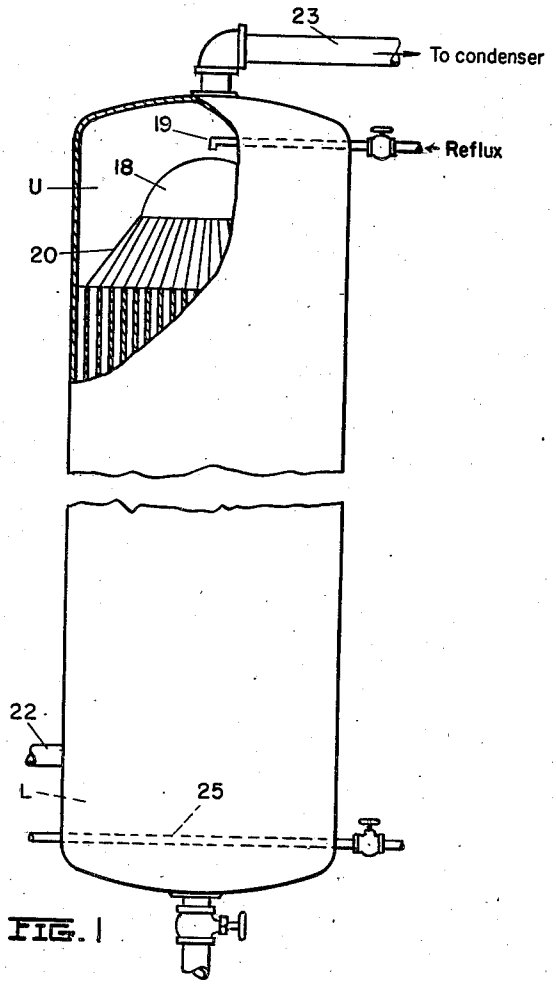


FIG. 1

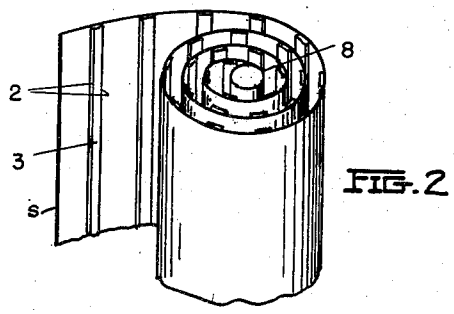


FIG. 2

FIG. 3

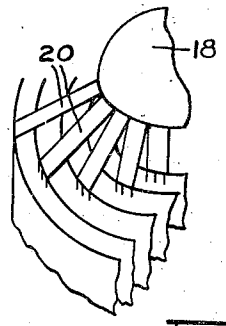
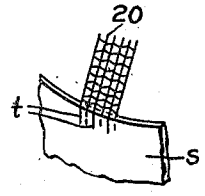


FIG. 4



INVENTORS
ROBERT E. BURK and
EINAR KROPP

BY Oberlin, Limbach & Day.
ATTORNEYS

Patented July 30, 1946

2,404,789

UNITED STATES PATENT OFFICE

2,404,789

APPARATUS FOR FRACTIONAL DISTILLATION

Robert E. Burk, Cleveland Heights, and Einar Kropp, Cleveland, Ohio, assignors to The Standard Oil Company, Cleveland, Ohio, a corporation of Ohio

Application November 10, 1941, Serial No. 418,518

4 Claims. (Cl. 261—112)

1

In apparatus involving liquid and gasiform contact, particularly as in fractional distillation, and based on multiple narrow vapor passways with walls providing smooth continuous free drainage of liquid in film, it is a matter of difficulty to maintain proper spacing between the liquid-filming surfaces. If material of sufficient self-sustaining thickness be employed and anchored at the top and bottom ends, the necessary thickness of the material takes up too much space. On the other hand if desirably thin sheet metal be employed, close-intervalled spacing means to hold the surfaces properly apart is required, and this tends to interfere with uniform filming of the down-flowing liquid. We have now found that a particularly advantageous construction may be had by thin sheet, material such as sheet metal, with exposed vertically extending continuous edges at spaced intervals, as set forth more in detail hereinafter.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described, and particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail certain illustrative embodiments of the invention, these being indicative however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawing:

Fig. 1 is a partly broken side elevation view showing an embodiment of the invention; Fig. 2 is a fragmentary detail perspective view of a portion of the interior construction; Fig. 3 is a fragmentary perspective detail of the means for feeding the liquid; and Fig. 4 is an enlarged detail of the attachment of the feed strip.

In fractional distillation, and in liquid and gasiform contact generally, the thinnest possible continuous film of liquid flowing downwardly in counter current exposure with rising gasiform molecules is desired, and for efficiency the space for the latter molecules should be as narrow and uniform as possible. With construction of thin sheet metal S and spacing of the adjacent portions thereof by continuous vertical exposed edges, such edges provide spacing with a minimum loss, and being continuous from top to bottom of the unit the down-flowing film of liquid is subjected to a minimum of change of surface conditions in its travel. These exposed edges forming spacing means may be provided as the edges 2 of narrow strips 3, Fig. 2, secured to the sheet stock which is to be assembled to make up the unit. For non-corroding liquids and gases,

2

the sheet, material, such as sheet metal, may be sheet steel, iron, copper, brass, zinc, etc. With liquids and gases which might cause corrosion, stainless steel, high chromium steel, nickel, Monel, etc., may be employed. The joints may be made by soldering, brazing, welding, etc.

The sheet material, with the attached strips as in Fig. 2, may be rolled up, preferably about a central closed end tube 8, Fig. 2, and providing continuous vertical passways between portions of the sheet material, the spacing being uniformly that of the exposed edges 2.

As a further refinement, for particular precision it is desirable to position the exposed vertical edges 2 at progressively increasing intervals from what would be the center of the article, to the periphery, and as wound up in spiral form the spacing edges will thereby be at proper intervals apart in proportion to the arc of curvature at any given point. Where great precision is not required, such spacer distance compensation is not necessary.

With such closely spaced liquid-filming surfaces, accuracy of liquid feed at the top becomes of special importance, and while various means may be employed, a particular advantageous arrangement is a curved or preferably hemispherical liquid distributor surface 18, Figs. 1 and 3, the surface being if desired roughened for capillary film flow of liquid thereover, the liquid being supplied at the highest point by the feed pipe 19. From the lower edge of the rounded distributor 18, extension strips 20 lead to the various portions of the filler unit. These feed strips 20 again are roughened for capillary liquid flow, and they may advantageously be formed of mesh work material, as wire screen. By connecting the respective extensions 20 to the upper edges of the portions of the filler unit, the liquid spreading uniformly over the distributor 18 is divided to the extensions 20 and thence to the respective portions of the filler. Where the extensions 20 are of woven wire, it is convenient to remove one or more of the weft or horizontal strands of the mesh work and crimp the ends of the warp wires *t* on the two sides of the vertical sheet portion to which the liquid is to be distributed, as in Fig. 4, thereby attaining even distribution throughout. Any convenient number of wires may be placed to each side, but the number on each should be the same. It is advantageous to alternate every other wire. The joint between the mesh work and the vertical surfaces may be secured in suitable manner, as by soldering, brazing, welding, etc.

The manner of operation of the device will be readily understood from the foregoing. Liquid being fed from the distributor **18** flows down in films over the surfaces of the filler, while gas or vapor rises from below. An inlet supply pipe **22** is provided at the lower portion of the column, and an outlet **23** at the top. For fractionating, if additional heat be desired at the bottom, it may be had by heating means **25**, such as a steam coil.

The apparatus may be operated at atmospheric pressure, or under higher pressure, or under vacuum, according to particular requirements.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

We therefore particularly point out and distinctly claim as our invention:

1. Contact apparatus arranged for upward gas flow and for drainage of liquid in film form, which comprises a unit having multiple unobstructed narrow ascending vapor passways with walls providing smooth continuous free drainage of liquid in film and formed of spirally wound radially spaced sheet material with attached continuous vertical spacing strips, such passways being open below to a space for input, and open above to a space for off-take.

2. Contact apparatus arranged for upward gas flow and for drainage of liquid in film form, which comprises a unit having multiple unobstructed narrow ascending vapor passways with walls providing smooth continuous free drainage of liquid in film and formed of spirally wound radially spaced sheet material with attached continuous vertical spacing strips at progressive distance from each other along said material in accordance with the distance from the center of the assembly.

3. Contact apparatus arranged for upward gas flow and for drainage of liquid in film form, comprising a cylindrical chamber with upper and lower spaces therein and means located between said spaces forming vapor passageways with smooth, continuous film conducting surfaces extending vertically from the lower space to the upper space, said means embodying a plurality of radially spaced layers of material disposed around each other with means located therebetween and presenting circumferentially spaced and vertically extending edges cooperating with the adjacent faces of said layers of material to define said surfaces of the vapor passageways, and a liquid distributor in the upper space having a plurality of extensions depending into contact with the upper edges of said spaced layers of material.

4. Contact apparatus arranged for upward gas flow and for drainage of liquid in film form, comprising a cylindrical chamber with upper and lower spaces therein and means located between said spaces forming vapor passageways with smooth, continuous film conducting surfaces extending vertically from the lower space to the upper space, said means embodying a plurality of radially spaced layers of material disposed around each other with means located therebetween and presenting circumferentially spaced and vertically extending edges cooperating with the adjacent faces of said layers of material to define said surfaces of the vapor passageways, and a liquid distributor in the upper space having a plurality of extensions of woven wire depending into contact with the upper edges of said spaced layers of material and having alternate strands of the wire in contact with the two faces of the sheet material.

ROBERT E. BURK.
EINAR KROPP.