

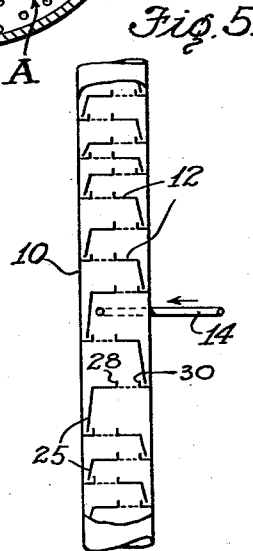
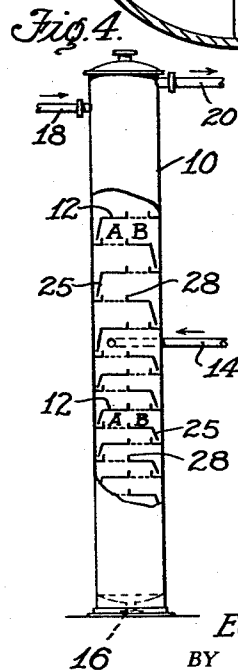
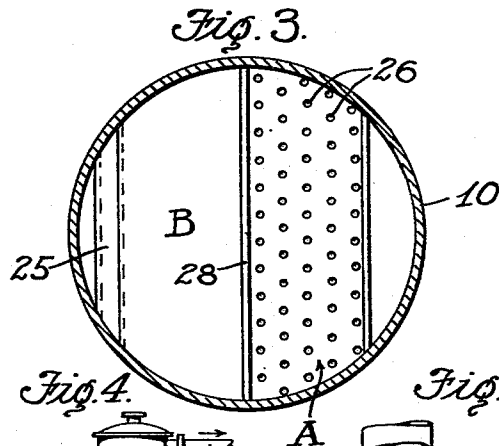
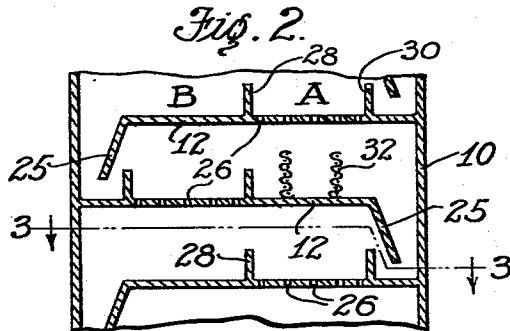
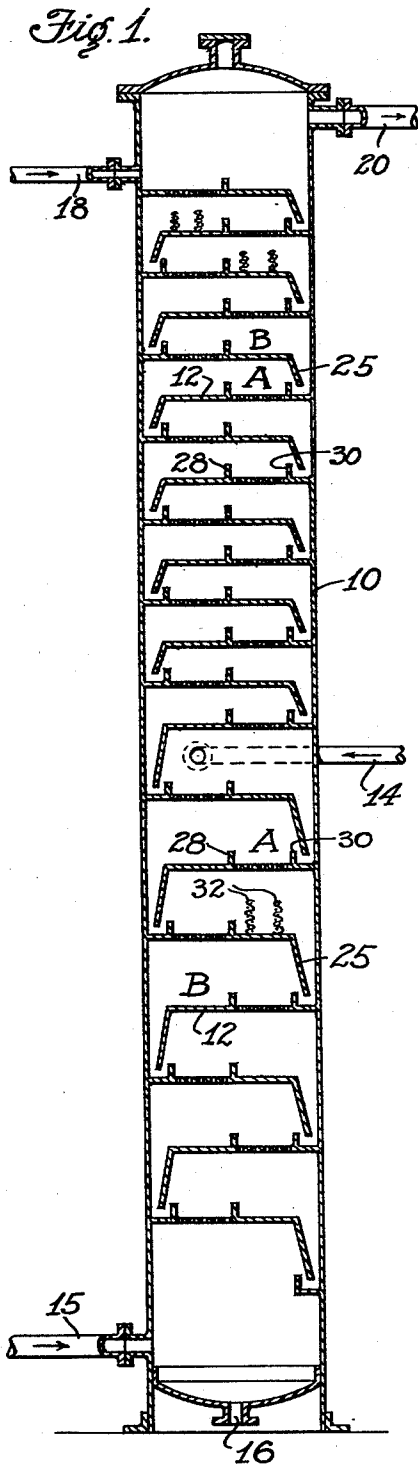
May 10, 1938.

E. G. RAGATZ

2,116,933

FRACTIONATING COLUMN

Filed Sept. 16, 1933



INVENTOR
Edward G. Ragatz
BY *Philip Subkow*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,116,933

FRACTIONATING COLUMN

Edward G. Ragatz, Los Angeles, Calif., assignor
to Union Oil Company of California, Los Angeles, Calif., a corporation of California

Application September 16, 1933, Serial No. 689,777

3 Claims. (Cl. 196—139)

This invention relates to methods of operation and construction of fractionating columns, and particularly to such methods, construction and arrangement of trays where they are to be used in the treatment of petroleum distillates.

The principal object of the invention is to increase the capacity of the fractionating column as well as the capacities of individual trays.

The invention comprises a tray arrangement to vary individual tray capacity in accordance with the vapor-liquid load imposed upon it at its corresponding position in the column, and also comprises tray structure adapted for so handling frothing as to insure adequate de-gassing of froth and coincident coalescing of the liquid therein so as to prevent flooding which has been occasioned in the past by the filling up of reflux down-spouts with foam overflow. Thus full advantage may be taken of tray spacing possibilities. According to a preferred form each tray is provided with a "coalescing section" which insures the desired de-gassing of the foam and the coalescing of the liquid particles. This section preferably should comprise about 30 to 50% of the tray area, and may include additional elements for positively acting upon the froth to break it down and thereby assist coalescence. From this section there extends the down-spout or equivalent overflow, which may or may not be calculated as a part of the coalescing section as desired. The other portion of each tray is conveniently perforated or may be of other conventional design as desired. The spacing of the trays in order to increase column capacity is such as to provide increased spacing in the lower portion of the column for capacity vapor-liquid load together with decreased spacing in the upper portions of the column to carry the lighter load. These spacings may vary according to zones, or may gradually decrease from tray to tray extending from bottom to top.

The invention may be stated broadly as residing in a tray structure having a coalescing section over which the liquid and foam passes to the overflow, this section being imperforate and comprising an appreciable portion of the tray, together with another portion permitting passage of the rising vapors. Such coalescing section may include means for positively assisting in the breaking up of the foam. The invention further includes the spacing of the trays by increasing their distance from each other from top to bottom in accordance with the vapor-liquid loads thereon. The invention resides further in the operating methods for controlling foam and handling the liquid-vapor loads.

In the accompanying drawing wherein certain embodiments of the invention are disclosed by way of illustration:

Fig. 1 is a vertical section of the fractionating

column showing the spacing of trays according to this invention and indicating the construction of these trays;

Fig. 2 is a vertical sectional detail showing on a large scale the specific tray structure together with a modification thereof;

Fig. 3 is a cross-section taken on the line 3—3 of Fig. 2; and

Figs. 4 and 5 are sectional elevations showing modified tray spacing arrangements.

In this drawing the fractionating column shell is employed according to ordinary practice and is equipped with a plurality of transverse trays 12, extending from near the bottom to approximately the top. A feed inlet 14 for the liquid to be fractionated is provided at an intermediate point, a hot vapor inlet 15 is provided below the lowermost plate, and a bottoms discharge 16 is located in the bottom of the column, a reflux inlet 18 is positioned above the uppermost tray, and a rectified vapor outlet 20 is located at the top.

I have discovered that by arranging the trays in the column in accordance with the vapor-liquid loads upon the respective trays the capacity of the column may be materially increased. Not only may this increase be accomplished with respect to any given height of column, but it may be further increased with respect to individual trays by providing adequate capacity above each of the lower trays over which the feed liquid (which is to be stripped of its lighter constituents) is to be flowed. Also this capacity is further increased by decreasing the spacing in the upper or fractionating section of the column in proportion to the load. Thus the spacing between the trays at the intermediate point of the stripping section may be greatest, and the spacing of the trays therebelow may be somewhat less in view of the relatively smaller amounts of vapors to be handled by each succeeding tray, while the fractionating trays, which are those above the stripping section, will have their spacing reduced in accordance with the decreased vapor-liquid load which these trays must handle with respect to the load of the lower trays. Such arrangement is illustrated in Fig. 5 where the spacing in the upper or fractionating section is further varied in accordance with vapor load so that the top portion of the fractionating section has a tray spacing less than that in the lower portion thereof.

The above description of tray arrangement refers to operations such as indicated in the drawing wherein a warm feed liquid is supplied to the column and the primary heat of distillation is supplied through the medium of hot vapors or other fluid medium introduced to the bottom through the inlet 15. It is possible however to adapt the present improvement relating to tray arrangement to operations where all of the heat is supplied through the medium of the

feed material, for example where cracked products are supplied directly from a cracking unit. In this case it will be the upper trays that will carry the heavier load, the lower trays carrying a lighter load. Under such conditions as these the tray spacing in the upper or fractionating section of the column will be greater than the tray spacing in the lower or stripping section, as in Fig. 4.

In general it may be said that the spacing in the one section should be from about $1\frac{1}{2}$ to 3 times as great as the spacing in the other section, this spacing to be varied according to the conditions.

In some instances the present improvement may be applied by employing graduated spacing between trays, as where the vapor-liquid load varies from tray to tray in the respective section. For example the spacing in the fractionating section could be gradually decreased as the top is approached in those instances where successive fractional condensates are removed from various trays. This spacing would be reduced in accordance with the variation in the load caused by removal of the various fractions. The addition of reflux condensates to different trays would also afford an opportunity for adjustment of spacing to care for the corresponding changes in load variations.

In order to insure proper functioning upon the various trays so that full advantage of tray-spacing may be taken, the tray structure itself should be such as to insure adequate de-gassing of foam so as to break down the foam and properly coalesce the liquid therein, thereby to prevent interference with refluxing by clogging of down-spouts or other down-flow means with foam.

An important feature of this invention is the individual tray structure which is employed for aiding coalescence in the foam. Each of these trays as shown is provided at one side with a down-spout portion in the form of an inclined lip 25 for discharge to the tray below. The opposite side A of the tray from about the middle over to a point short of the portion which receives from the upper tray is perforated as indicated at 26 for the passage of the rising vapors. This portion may be and preferably is definitely defined by a middle up-standing flange or lip 28 and an up-standing side flange 30, these up-standing parts extending from wall to wall of the fractionating column. At the opposite side of the flange 28 each tray 12 is imperforate as shown thereby providing an undisturbed area B over which foam passes on its way to the down-flow-spout 25. This portion affords opportunity for the froth to break down thereby assisting de-gassing thereof and coalescence of the liquid particles, so that the down-spout 25 will not become filled with foam, thereby preventing an effective clogging of the down-spout and flooding of the tray. In practice the area of this coalescing section B should constitute between about 30 to 50% of the total tray area.

If in certain instances it is found that coalescing still is not adequately accomplished, suitable mechanical means may be placed upon the coalescing section B for further assisting breaking down of the froth and coalescence of the liquid. This means may be in the form of a plurality of up-standing screens or grids or the like as indicated at 32.

These tray structures have been found to avoid effectually the clogging of down-spouts and flooding of trays, thereby effecting an increase in capacity thereof. The value of this improvement can be best measured when it is considered that with normal tray structures an 18 inch reflux down-spout has been filled with foam and caused the tray to flood by reason of the fact that the head represented by the 18 inch foam column was equal to less than a four inch coalesced reflux liquid head on the tray. The present structure prevented the filling of the down-spout with the foam so that the liquid head was adequate to insure continuous down-flow and proper operation.

The foregoing is not to be taken as limiting but merely illustrative of one form of carrying out my invention as many variations can be made by a man skilled in the art within the scope of the invention.

I claim:

1. A fractionating column comprising a shell, a plurality of vertically spaced trays mounted within the shell and extending horizontally thereacross, each tray comprising a plate having its major portion at one side of a median line provided with a plurality of vapor-upflow perforations thereby constituting a perforate section, and having the major portion on the other side of said median line imperforate to constitute an imperforate section providing a relatively quiescent zone, an upstanding overflow partition between the perforate section and the imperforate section and extending from edge to edge of the plate, liquid downflow means adjacent the edge of the imperforate section remote from the perforate section, and a liquid receiving portion adjacent the edge of the perforate section remote from the imperforate section whereby liquid discharge from the imperforate section of each tray will descend to the liquid receiving portion of the plate next below and vapors will rise through the perforate section of the plate next above, and the received liquid will flow across the perforate section, thence through the quiescent zone across the imperforate section and thence to the liquid downflow.

2. A tray for fractionating columns comprising a plate having its major portion at one side of a median line provided with a plurality of vapor-upflow perforations thereby constituting a perforate section, and having the major portion on the other side of said median line imperforate to constitute an imperforate section providing a relatively quiescent zone, an upstanding overflow partition between the perforate section and the imperforate section and extending from edge to edge of the plate, liquid downflow means adjacent the edge of the imperforate section remote from the perforate section, and an imperforate liquid receiving portion adjacent the edge of the perforate section remote from the imperforate section, whereby received liquid will flow across the perforate section, thence through the quiescent zone across the imperforate section and thence to the liquid downflow.

3. A structure according to claim 1 wherein the imperforate section of a tray carries upstanding foraminous means to assist in breaking froth passing thereover.

EDWARD G. RAGATZ.