July 25, 1939. F. J. McGOVERN 2,167,028

CONDENSER

Original Filed Sept. 5, 1935 2 Sheets-Sheet 1

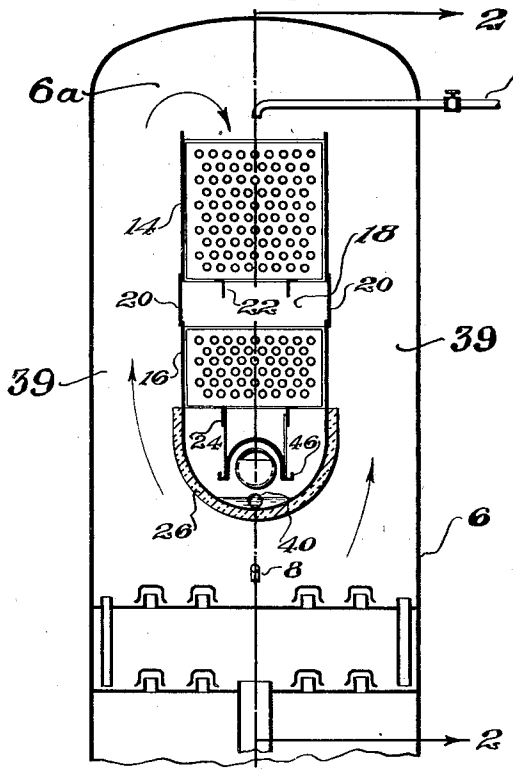


Fig. 1

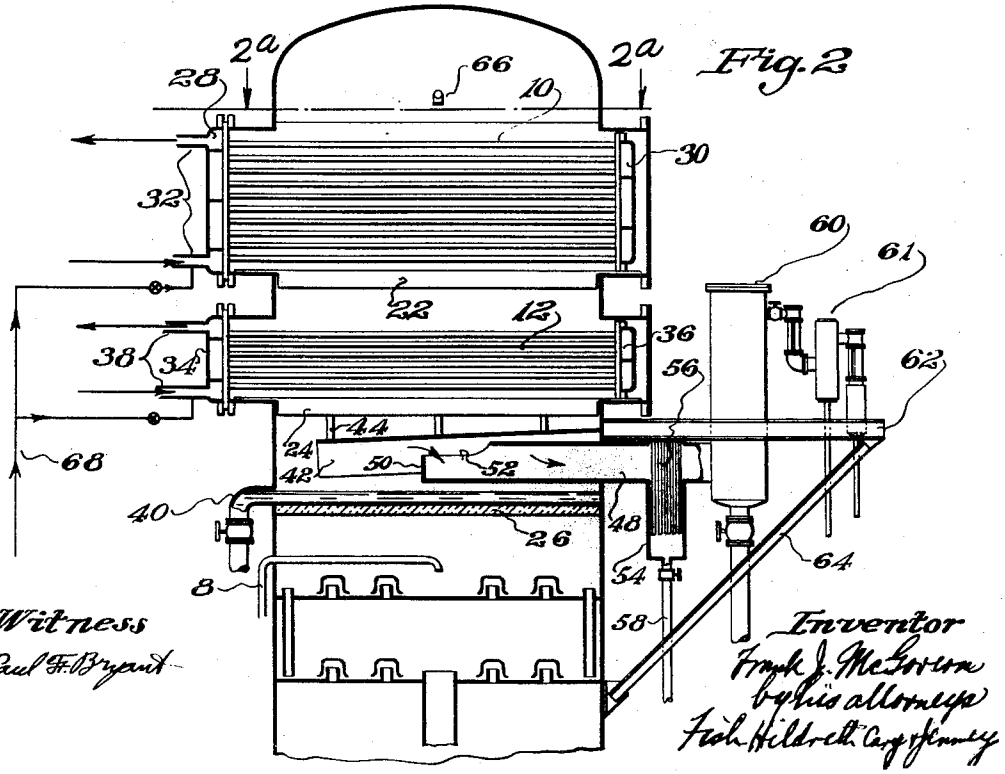


Fig. 2

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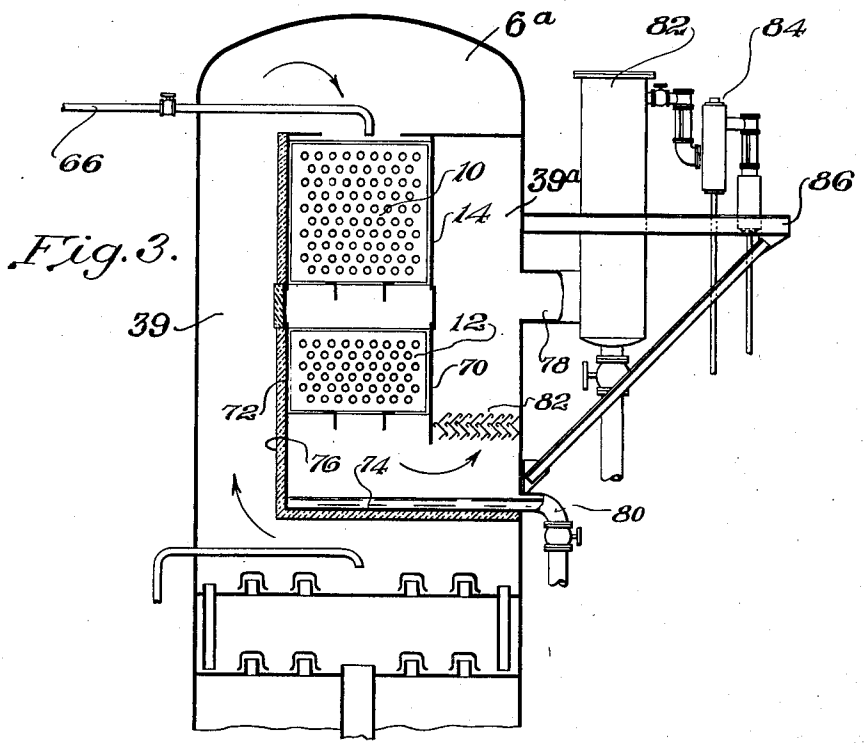


Fig. 3.

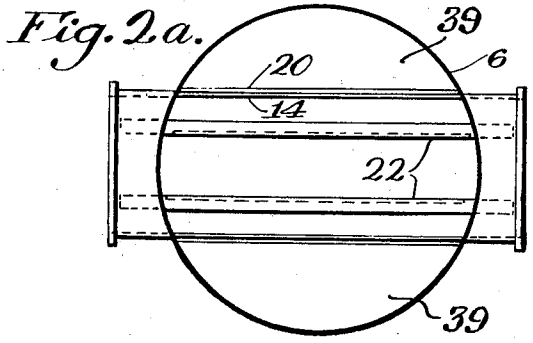


Fig. 2a.

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2,167,028

CONDENSER

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Application September 5, 1935, Serial No. 39,263
Renewed May 14, 1938

8 Claims. (Cl. 257—34)

The present invention relates to condensers and more particularly to condensers for condensing oil vapors distilled under vacuum.

The principal objects of the present invention are to provide a condenser associated with a vacuum distilling column and requiring a minimum of structural support, to provide a condenser opposing a minimum of resistance between the distilling column and the evacuating system, to provide for effective separation and collection of entrainment in steam distillation, and also to provide means for simple and effective cleaning of the condenser tubes.

With these and other objects in view, as will hereinafter appear, the present invention comprises the apparatus hereinafter described and particularly defined in the claims.

In the accompanying drawings, Fig. 1 is a sectional elevation of one form of the present invention; Fig. 2 is a sectional elevation on line 2—2 of Fig. 1; Fig. 2*a* is a section on line 2*a*—2*a* of Fig. 2, showing the arrangement of the shell and partitions, the condenser section being removed; and Fig. 3 is a sectional elevation of a modified form of the invention.

The apparatus shown in Figs. 1 and 2 comprises a shell 6 having boiling cap decks of any suitable form. For fractionation of the vapors, reflux liquid is introduced on the top deck by a pipe 8. In the upper part of the column, the shell is provided with rectangular openings to receive the tubes of the condenser sections 10 and 12. The condenser sections are enclosed between vertical partitions 14 and 16, a space 18 being provided between the sections for access to the tubes. The space 18 is enclosed by removable cover plates 20. Angles 22 and 24 extending across the column serve as supports for the condenser sections during insertion or removal.

As shown in Fig. 1, the partition 16 is formed at the bottom with a semi-circular collecting pan which is covered with any suitable insulating material 26.

The condenser tubes of the section 10 are connected with headers 28 and 30, the former having connections 32 for circulating the cooling fluid. The tubes of the section 12 are similarly connected into headers 34 and 36, of which the former has the cooling liquid connections 38.

The partition walls 14 and 16 together with parts of the shell 6 form bifurcated vapor conduits 39 around the condenser section so that vapors of steam and oil rising from above the boiling cap decks pass around the condenser section as indicated by the arrows in Figure 1. Above the condenser section, the vapors then combine in the vapor collecting section 6*a* from which the vapors pass downward through the opening into the condenser section across the tube bundles. The condensing action is particularly efficient because of the uniform cross-section presented to the vapor flow, whereby maximum contact of vapors with previously condensed liquid is effected. The condensate collects in the semi-circular portion of the partition 16 and is withdrawn by a pipe 40. The uncondensed vapors comprising primarily steam with some oil pass under a semi-cylindrical baffle 42 which is supported by brackets 44 depending from the angles 24. The baffle 42 is formed along its sides with upwardly facing channels 46 serving to catch some of the entrained drops of oil which would otherwise pass under the baffle. Since the baffle is inclined, as shown in Fig. 2, the entrainment flows into the semi-circular pan.

The vapors continue, as indicated by the arrow in Fig. 2, into a cylindrical outlet 48 which is disposed within the baffle 42. The outlet 48 is partially closed at the end by a baffle plate 50 and is provided with an opening part-way along the top, as indicated at 52. The tortuous course of the vapors in passing from the condenser tubes around the end and bottom of the baffle 42 and over the baffle plate 50 into the outlet pipe 48 serves to prevent passage of a considerable part of the entrainment with the steam.

Outside the column, the outlet pipe 48 leads into a final entrainment separator 54 consisting of a vertical cage with vertical baffle plates 56 of any suitable form. The baffle plates serve to separate any remnant of entrained oil, which is withdrawn from the bottom of the cage by a pipe 58. The outlet pipe then leads into the usual barometric condenser 60 and vacuum jet system 61 which are mounted on a bracket 62 extending from the shell and braced by an inclined strut 64.

The present invention contemplates a simple method of cleaning the condenser tubes. The valves in the draw-off lines 40, 58, etc., are closed and a cleaning solution is introduced around the tubes by means of a pipe 66. If hot cleaning solution is required, steam is introduced internally of the tubes by the steam lines 68. By this means, the cleaning solution may be brought to the boiling point. After the cleaning operation, the solution may be removed from the system by opening the valve in the draw-off line 40.

The apparatus shown in Fig. 3 is similar to that previously described. The condenser tube bundles 10 and 12 are supported in the shell. The

upper tube bundle 10 is enclosed between partitions 14 but the lower tube bundle is enclosed between a short partition 70 on one side and an angle partition 72 on the other side, the latter extending to a point considerably below the tube bundle and having a horizontal pan 74 extending into the shell. The horizontal pan 74 and the vertical partitions at the left side of the condenser bundles are covered with insulating material 76.

As in the prior construction the column 6 is similarly bifurcated with the vapor conduit passages 39 and 39a formed by the wall 72 and the shell on one side, and the partitions 14 and 70 and the shell on the other side. In this construction however, the vapors pass from the boiling cap section upwardly through the conduit 39 at the left of the condensers, into the vapor collecting chamber 6a, thence downwardly through the condensers, and upwardly through the other bifurcated vapor space 39a at the right of the condensers, and finally out through an outlet pipe 78. The condensate drops on the partition 74 which serves as a collecting pan and is withdrawn by a pipe 80.

In the vertical space leading to the outlet 78, entrainment catching baffles 82 are provided, these being formed with hooked edges to free the steam vapors of withdrawn oil. The baffles 82 are preferably inclined to direct the entrainment into the pan.

The outlet 78 leads into the barometric condenser 82 and vacuum jet equipment 84, as in the previously described construction. The external apparatus is mounted on a bracket 86 identical with that shown in Fig. 2.

Cleaning of the tubes may be effected by introducing cleaning fluid through the pipe 66, as in the construction of Figs. 1 and 2.

The present invention provides a condensing and evacuating system, of which the major portion of the weight is supported centrally of the column itself. The rectangular cross-section of the condenser is not only of maximum effectiveness for condensation of the vapors, but also provides a simple construction having the advantages of low cost and accessibility. The apparatus is particularly useful for equipment to be operated under vacuum, since the large vapor passages on opposite sides of the condenser allow flow of vapors with small resistance.

The invention having been thus described, what is claimed is:

1. The combination with a column having a distilling section, of a condenser having tubes in the upper part of the column, a partition forming a vapor space leading from the distilling section to the top of the condenser, an outlet for uncondensed vapors, evacuating equipment connected with said outlet, and means for supporting the evacuating equipment from the side of the column.

2. The combination with a column having a distilling section, of a condenser having tubes in the upper part of the column, a partition forming a vapor space leading from the distilling section to the top of the condenser, a condensate pan below the condenser, an inlet for cleaning fluid above the condenser to permit filling of the space above the pan, and means for passing heating fluid through the tubes to heat the cleaning fluid.

3. The combination with a column having a distilling section, of a condenser having tubes in the upper part of the column, a partition forming a vapor space leading from the distilling section to the top of the condenser, a condensate pan below the condenser, a baffle between the condenser and the pan, and an outlet below the baffle.

4. The combination with a column having a distilling section, of a condenser having tubes in the upper part of the column, a partition forming a vapor space leading from the distilling section to the top of the condenser, a condensate pan below the condenser, a semi-cylindrical inclined baffle above the pan, and an outlet below the semi-cylindrical baffle and having an upstanding baffle over which the uncondensed vapors pass.

5. The combination with a column having a distilling section, of flat partitions extending across the upper part of the column to define a rectangular condenser space between them and to provide vapor spaces between the partitions and the column wall, a condenser section having tubes in a bundle of rectangular cross-section enclosed within the partitions, and a condensate pan extending from the bottom of one partition below the other partition to the column wall.

6. The combination with a column having a distilling section, of a condenser comprising a bundle of horizontal tubes extending across the upper part of the column, fixed partitions extending completely across the column alongside the tube bundle and forming vapor spaces between the tube bundle and the column wall whereby vapors from the distilling section are directed to the top of the condenser, a condensate pan below the condenser and connected with at least one of the partitions, headers for the tube bundle, and means for removably supporting the tube bundle and headers independently of the partitions and condensate pan.

7. The combination with a column having a distilling section, of a condenser comprising a bundle of horizontal tubes of generally rectangular cross-section extending across the upper part of the column, fixed vertical partitions extending completely across the column alongside the tube bundle and forming vapor spaces between the tube bundle and the column wall whereby vapors from the distilling section are directed to the top of the condenser, a condensate pan below the condenser and connected with at least one of the partitions, headers for the tube bundle, and means for removably supporting the tube bundle and headers independently of the partitions and condensate pan.

8. A column having a distilling section, a bifurcated vapor section, and a vapor collecting section in communication with the distilling section through a part of said bifurcated vapor section, means to close off another part of the bifurcated vapor section from direct communication with the distilling section, a condenser chamber between the walls of the bifurcated vapor section with walls in common, said condenser chamber receiving vapors from said vapor collecting section, means to condense vapors in the condenser chamber and means to remove uncondensed vapors through another part of said bifurcated vapor section.

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