

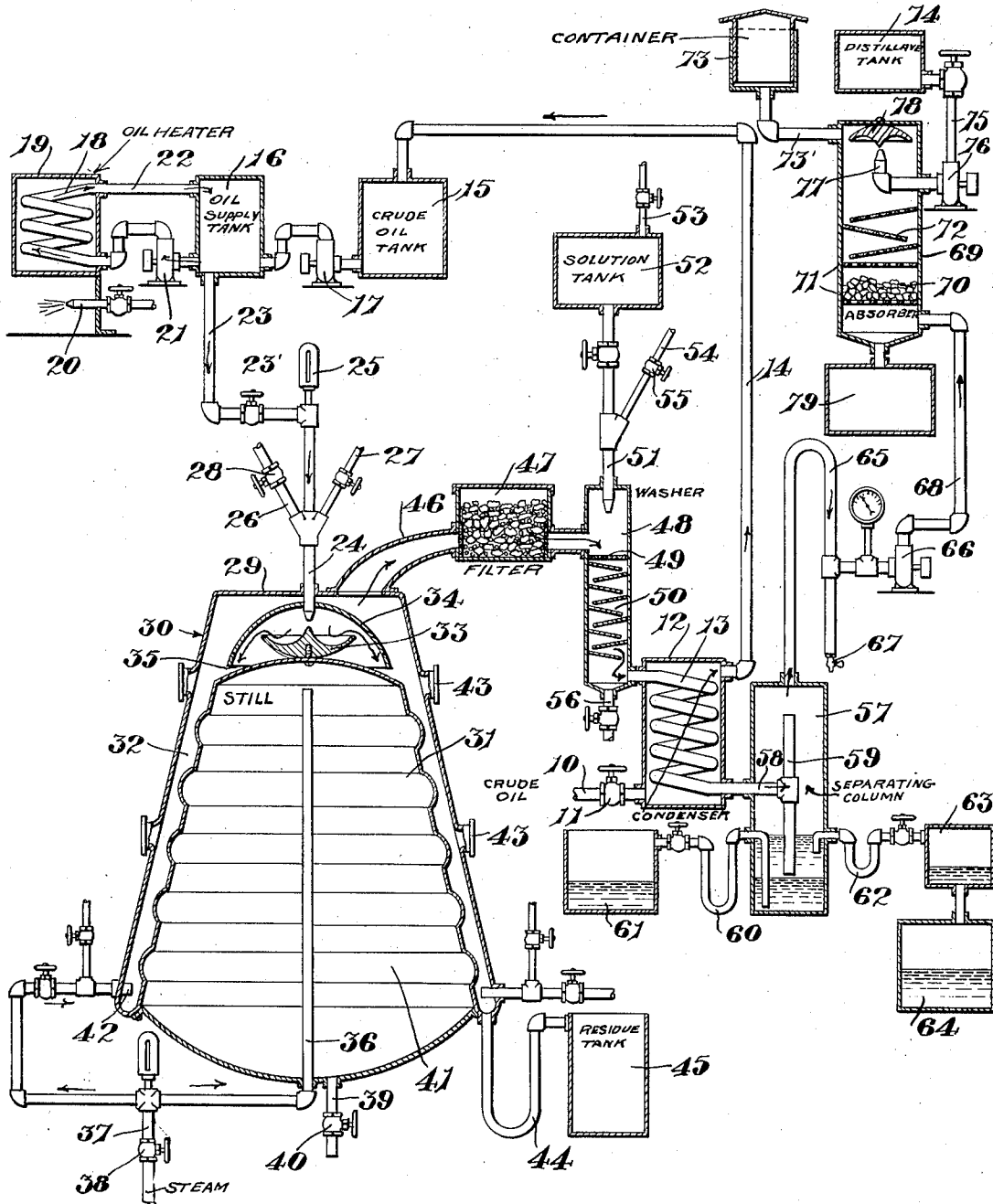
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APPARATUS FOR DISTILLING OILS

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APPARATUS FOR DISTILLING OILS.

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This invention relates to the distilling and refining of mineral oils and other liquids, in a continuous process.

It is the principal object of the present invention to provide an apparatus for bringing about the fractional distillation of oil, and especially of crude petroleum, a further object being to provide a suitable apparatus for producing from crude oil an increased quantity of gasoline or benzine, to convert a portion of the kerosene fraction into gasoline or benzine, to convert portions of the heavier fractions into gasoline or benzine, to separate, purify, clarify, deodorize, refine and filter the main products and by-products and by the process avoid the necessity of further treatment with acids and alkalies and thereby effecting an economy of time and expense.

The present invention contemplates the use of a plurality of filters, stills and condensing coils and other apparatus used in conjunction therewith through which the crude product is successively passed, distilled and filtered and the various by-products continuously drawn off.

The invention is illustrated by way of example in the accompanying drawing, in which:

The figure is a diagrammatical view disclosing the schematic arrangement of a plant embodying the present invention.

Referring more particularly to the drawings, 10 indicates a crude oil feed pipe provided with a regulating valve 11. This pipe communicates with the shell of condenser 12. The shell incloses a radiation and condensation coil 13 provided for a purpose which will be hereinafter described. Feed pipe 10 communicates with the lower end of the shell while the draw-off pipe 14 is attached to the top of the shell and conveys the liquid to a crude oil tank 15. This tank is in communication with an oil supply tank 16 and the transfer of the oil from tanks 15 to 16 is brought about by pump 17 which establishes pressure in the tank 16. Tank 16 is in communication at its top and bottom with the coil 18 of an oil heater 19. This device may obtain its heat from any desired source as, for example, the burner 20 or by superheated steam. Due to the provision of a circulating pump 21 and a return pipe 22 the oil within the coil 18 and

the tank 16 will be in rapid continuous circulation and its temperature will be maintained at a substantially uniform degree. A draw-off pipe 23 communicates with the bottom of oil supply tank 16 and leads to a nozzle 24. This nozzle is vertically disposed with the tip at its lower end. A thermometer 25 indicates the temperature of the oil flowing to the nozzle while the flow of oil is regulated by valve 23'. The oil is partially vaporized as it passes from the nozzle due to the presence of steam and air introduced into the nozzle by pipes 26 and 27 respectively, valve members 28 being provided to regulate the relative proportions.

The nozzle 24 projects downwardly through the top wall of a shell 29. This shell forms the inclosing structure of a still 30. This still is substantially frusto-conical in formation, the outer casing 29 inclosing an inner shell 31. The inner shell substantially agrees in configuration with the outer case and its vertical walls are spaced a distance therefrom to form a vaporization chamber 32. The outer surface of the shell 31 is formed with annular corrugations which tend to increase the surface over which the oil flows and insures that the oil will be applied in a thin film to this surface thus being subjected to the maximum effect of all the heat radiated from the shell. Disposed directly beneath the nozzle is a spray plate 33 having a central conical point in vertical alignment with a longitudinal axis of the shell and being flared outwardly to provide an annular surrounding recess of arcuate section tending to divert the downward flowing oil, air, and steam, upwardly and outwardly against a bell shaped canopy 34. This canopy is secured over the top of the shell 31 and is formed with outlet openings 35 around its base to permit the liquid to flow out onto the outer corrugated surface of the shell.

This corrugated wall is heated by steam or some other suitable medium delivered to a vertical feed pipe 36 from a supply pipe 37, the supply being regulated by a valve 38. Draw-off pipe 39 is connected with the bottom of the shell 31 and is regulated by a valve 40 making it possible to readily drain the steam chamber 41 formed within the shell. Nozzles 42 communicate with the annular chamber 32 of the still and deliver

steam and hot air to the still thus facilitating in breaking up the film of liquid which is flowing down over the corrugated surface of the shell 31.

5 The progress of the distillation may be observed through observation parts 43 distributed along the outer casing of the still. The residue accumulating within the chamber 32 of the still may be drawn off through
10 U pipe 44 and into a residue tank 45.

The top of the still is fitted with a vapor draw-off pipe 46. This pipe establishes communication between the chamber 32 of the still and a filter box 47 which contains
15 broken coke, charcoal, or other granular carbonaceous material having the effect of deodorizing the vapors. The vaporizing hydrocarbons will then pass into a vapor washer 48. This washer stands vertically
20 having a screen 49 across its throat and beneath which a plurality of alternately inclined shelves 50 are arranged in superposed relation to each other.

The upper end of the washer is fitted with
25 a nozzle 51 which communicates with a solution tank 52. This tank is under air pressure due to an air delivery pipe 53. Any desired solution may be used in the tank which would have a tendency to free the hydrocarbon vapors from sulphur, carbons
30 and other solid impurities. A preferable solution is formed by the mixture of water and alkalis or alkaline earths. This solution may be delivered to the washer under pressure by admitting air through the nozzle
35 51 through a pipe 54, suitable valves 55 being provided to regulate the flow of air and solution.

The lower end of the washer is provided
40 with a valve controlled draw-off pipe 56 through which the impurities may be carried away from the washer. The free and condensed vapors are then drawn into the condenser coil 13 and as they have previously
45 attained a temperature considerably higher than that of the initially entering crude oil, a portion of this heat will be transmitted to the crude oil which is circulated through the shell 12 of the condenser.

50 The lower end of the coil leads to a separating column 57 where a T shaped connection is made on the coil pipe 58 as indicated at 59. Member 59 extends vertically thus permitting the uncondensed gases to
55 pass upwardly and allowing the heavy hydrocarbons and water to pass downwardly and accumulate at the bottom of the column. The lower end of the member 59 extends into the body of liquid normally accumulated. A goose-neck siphon tube 60 extends
60 to the bottom of the column and is in communication with a water tank 61. A similar siphon 62 extends into the column and communicates with a filter tank 63. It will be
65 readily understood that the variation in

specific gravity of the distillate and water accumulating in the column will cause them to become separated, the water settling to the bottom and the distillate forming an upper
70 layer. This action will be facilitated due to the existence of a partial vacuum in the tank. Due to the two siphons these two liquids may be separately withdrawn, the water into the tank 61 and the distillate into
75 the filter 63. This distillate after passing through the filter 63 may be accumulated in a distillate tank 64.

The upper end of the column 57 is provided with a U shaped tube 65 in communication with a vacuum pump 66. A drain valve
80 67 is formed as a continuation of the tube 65. The uncondensed vapors and gases drawn from the separating column by the vacuum pump are delivered through a pipe 68 to the bottom of a gas column 69. A volume of filter material 70 is disposed near the
85 bottom of the column and between perforated plates 71. The gases may percolate upwardly through this material and around and through the foraminous baffle members
90 72. The upper end of the gas column is in communication with a gasometer 73.

Distillate is delivered to the gas column from a tank 74 through a pipe 75. A circulating pump 76 is provided to force the distillate from an upwardly extending nozzle
95 77 and against a deflector 78 similar in construction to the deflector 33 previously described. This distillate may pass down over and through the baffle screen members 72
100 coming into intimate contact with the ascending gases tending to absorb them and thereafter flowing into a condensate tank 79.

In operation of the present invention, superheated steam is supplied by any standard
105 form of boiler, not shown, from pipe 37, through control valve 38 into steam chamber 41 of the still. Vacuum pump 66 is then put into action. Crude oil from any supply source is introduced into pipe 10,
110 through control valve 11 and passes into condenser 12, where it is heated by hot vapors passing through coil 13, thus utilizing and effecting an economy in heat. The crude oil then passes through pipe 14, to crude oil
115 tank 15, and is then drawn through pump 17, and forced into oil supply tank 16 where a pressure head is accumulated. The oil is then circulated through pipe 22 and coil 18 at high speed and under suitable pressure, by
120 the circulation pump 21. The oil is returned to the oil supply tank 16, having been subjected to further heat while in coil 18 of oil heater 19, which coil derives its heat from application of superheated steam or direct
125 heat as may be required. By this process the physical character of the oil is changed without excessive heating and a large percentage of high gravity distillate may be recovered when distilled.

The crude oil then travels from oil supply tank 16, through pipe 23 and valve 23' to nozzle 24. Compressed air is introduced through pipe 27, and superheated steam is introduced through pipe 26 and are mixed with the oil, steam, and air by regulating the valves 28 so as to supply the nozzle 24 with a suitable flow of oil which is sprayed under pressure against baffle deflector 33. This breaks up the oil into small particles and forces it in spray form against the bell shaped canopy 34 where it is further broken up by the impact. It then flows down over the outer walls 31 of steam chamber 41. As the oil continues down over the outer face of the shell 31 and over its corrugations it comes into contact with the heat radiated from steam chamber 41 through wall 31. This causes the further vaporization of the oil which vapor passes from vacuum vapor chamber 32 and through conductor 46 to vapor filter 47. Here the vapors come in contact with broken coke, charcoal or similar material which has the effect of bringing about this deodorization.

During the process of distillation in the still, steam and hot air are supplied to the lower part of vacuum vapor chamber 32 through a series of spray nozzles 42. This has the effect of assisting in expelling the vapors from the oil flowing over the walls 31 and its corrugations while this steam and hot air also aids in purifying and deodorizing the oil tending to prevent discoloration, bleaching distillates, eliminating sulphur and assisting in carrying the oil vapors and gases up through vapor draw-off pipe 46 for further treatment.

When the oil first reaches the top portion of wall 31 it flows downwardly in a thin film, and due to the special construction of the still which is frusto-conical in shape, the oil is spread over a greater area on its downward course as its circumference increases towards the bottom of the shell. The oil is thus spread in a much thinner film and will receive a correspondingly increased amount of heat in its downward flow thus more readily releasing its vapors. The corrugations present a tortuous route of travel for the oil and abruptly change its direction of travel at the same time thinning the film of oil while its molecular construction is suddenly changed and broken up affording an effective means of releasing its vapors. The conical shaped wall is preferably at least twice the circumference at the bottom as at the top which expansion thins the film of oil to about one half the thickness at the top portion. The residue or the oil not vaporized in the vacuum vapor chamber 32 is withdrawn through sealed pipe 44 and delivered to residue tank 45 for future treatment being subjected to a higher temper-

ature for extracting the lower gravity distillates. This may be done by passing the residue through other stills.

The oil vapors then pass out of the vacuum vapor chamber 32 through draw-off pipe 46 and filter 47 into vapor purifier 48, where they are washed, sprayed and agitated. Water with suitable chemicals such as alkalis or alkaline earths contained in solution tank 52 are forced by air pressure, through nozzle 51 into the top of vapor purifier 48, are sprayed against said oil vapors. This solution forces down through screen 49 and against top deflector 50 and so on down the series of opposing shelves 50 which action thoroughly agitates, aerates, washes and partly condenses said vapors and tends to free them from any sulphur, carbons, solids and impurities. Any sulphur, carbons, solids and impurities will settle to the bottom and can be withdrawn through pipe 56.

The remaining vapors and condensed vapors then enter condenser 12 where they pass through coil 13 and are further condensed as they flow through pipes 58 and 59 to separating column 57; the heavy distillate and water will readily settle by gravity and thereafter separate; the water will settle to the bottom and will flow through sealed pipe 60 to water tank 61 and the distillate recovered will remain on top and will flow through sealed pipe 62 and through a fuller's earth filter to distillate tank 64. The uncondensed gases will pass through pipe 65 and may be withdrawn by the suction action of vacuum pump 66. These gases will be discharged through pipe 68 into gas column 69. High gravity distillate is conducted from distillate tank 74 through pipe 75 to pump 76 and is forced by said pump through nozzle 77 and against baffle deflector 78 where it is minutely broken up into fine particles and thereafter settles down upon the uppermost of the series of fine mesh inclined screens 72. Here the distillate is brought into contact with the ascending gases and gradually absorbs them. The lower section of gas column 69 is provided with the perforated plates 71 between which is the filter bed 70 containing small pebbles, broken quartz, coke or any similar material forming a permeable body where the ascending gases come in contact with the down flowing sprayed absorbing fluid. This distillate menstruum has the effect of absorbing the first series of gases appearing. The condensed gases flow to condensate distillate tank 79 for further treatment. Any gas not absorbed will flow through the outlet pipe 73' to the gasometer 73 for future use.

While I have shown the preferred form of my invention, it will be understood that various changes in the combination, construction and arrangement of parts may be

made by those skilled in the art, without departing from the spirit of the invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In an oil distilling apparatus, a still comprising a vertically disposed inner shell, a spray nozzle at the top of the still adapted to project a jet of oil against the upper end of said shell, a dome member disposed above the upper end of the shell and against which the oil is projected by the upper end of said shell, the impact of the oil spraying against said dome assisting in atomizing the oil, said dome being adapted to direct the oil to the outer surface of said inner shell over which the oil will flow, means for heating said shell for heating and vaporizing the oil passing thereover, and an outer shell surrounding the first named shell and forming a vaporization space therebetween for receiving the vapors thrown off from the heating film of oil passing over the inner shell.

2. In an oil distilling apparatus, a still comprising an inner shell arranged vertically and having downwardly diverging sides and a closed upper end, a spray nozzle at the top of the still adapted to project a jet of oil against the upper end of the inner shell to finely divide the jet, a dome member arranged above the upper end of the inner shell against which the finely divided oil will be sprayed said dome being adapted to direct the oil and distribute it evenly to the sides of the inner shell, the downwardly extending and outwardly diverging sides of the inner shell presenting increased area over which the oil will flow, thereby gradually thinning the film of oil as it passes downwardly over the inner shell, means for heating the inner shell whereby to heat the oil passing thereover to vaporize it, and a circumscribing shell surrounding the inner shell and forming a vaporizing space between the shells for receiving vapors thrown off from the film of oil passing over the inner shell.

3. An oil still comprising a shell having a top and side walls, said side walls being formed with a series of circumferentially extending corrugations in spaced relation to each other, a spray nozzle above the inner shell and adapted to direct a jet of oil toward the upper end of said shell, a spray plate interposed between said nozzle and said upper end of the shell whereby the oil from the jet will be projected against said spray plate and be mechanically atomized, a dome member arranged over said spray plate against which the spray plate is adapted to project the oil from the nozzle, said dome

being adapted to direct the oil to the outer surface of the sides of the shell, the sides of said shell gradually diverging outwardly whereby the film of oil passing over the outer surface thereof will gradually thin as it flows over the shell and over the corrugations therein, means for heating the shell to vaporize the oil passing over the sides thereof, and an outer shell inclosing said inner shell whereby to provide a vaporization chamber exteriorly of the inner shell.

4. An oil still comprising a frusto-conical shell formed with a series of circumferentially extending corrugations in its wall and in spaced relation to each other, a spray nozzle adapted to direct a jet of oil toward the upper end of said shell, a spray plate interposed between the nozzle and said end of the shell to mechanically atomize the jet of oil projected thereagainst, a dome member arranged above the spray plate and adapted to receive oil therefrom and to direct said atomized oil onto the outer surface of the shell whereby the oil will circulate down thereover in a thin film, the tapered sides of said inner shell causing said film to gradually thin as it flows down over the shell toward the enlarged base thereof and also successively thinning as it flows over the corrugations, means disposed within the shell for heating the wall thereof, an outer frusto-conical shell enclosing said inner shell of said structure and providing a vaporization chamber around the shell, means for delivering steam to the vaporization chamber, and means for drawing off the vapors and gases from said chamber.

5. An apparatus for the continuous distillation of mineral oils and the like comprising a frusto-conical shaped still having an inner circumferentially corrugated shell, means for heating the same, an outer enclosing shell forming a vaporization space around said corrugated shell, a spray plate secured within the outer shell and mounted upon the upper end of the corrugated shell, a nozzle extending through the end of the outer shell for projecting a jet of oil, air, and steam against the baffle plate, and a dome member mounted upon the upper end of the corrugated shell and disposed above the spray plate and having a concave surface against which the oil from the spray plate is directed, said concave surface of said dome being adapted to direct said vapors and liquids downwardly over the outer surface of said corrugated shell, and means at the top of the shell for drawing off the hydrocarbon vapors from the vaporization space.

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