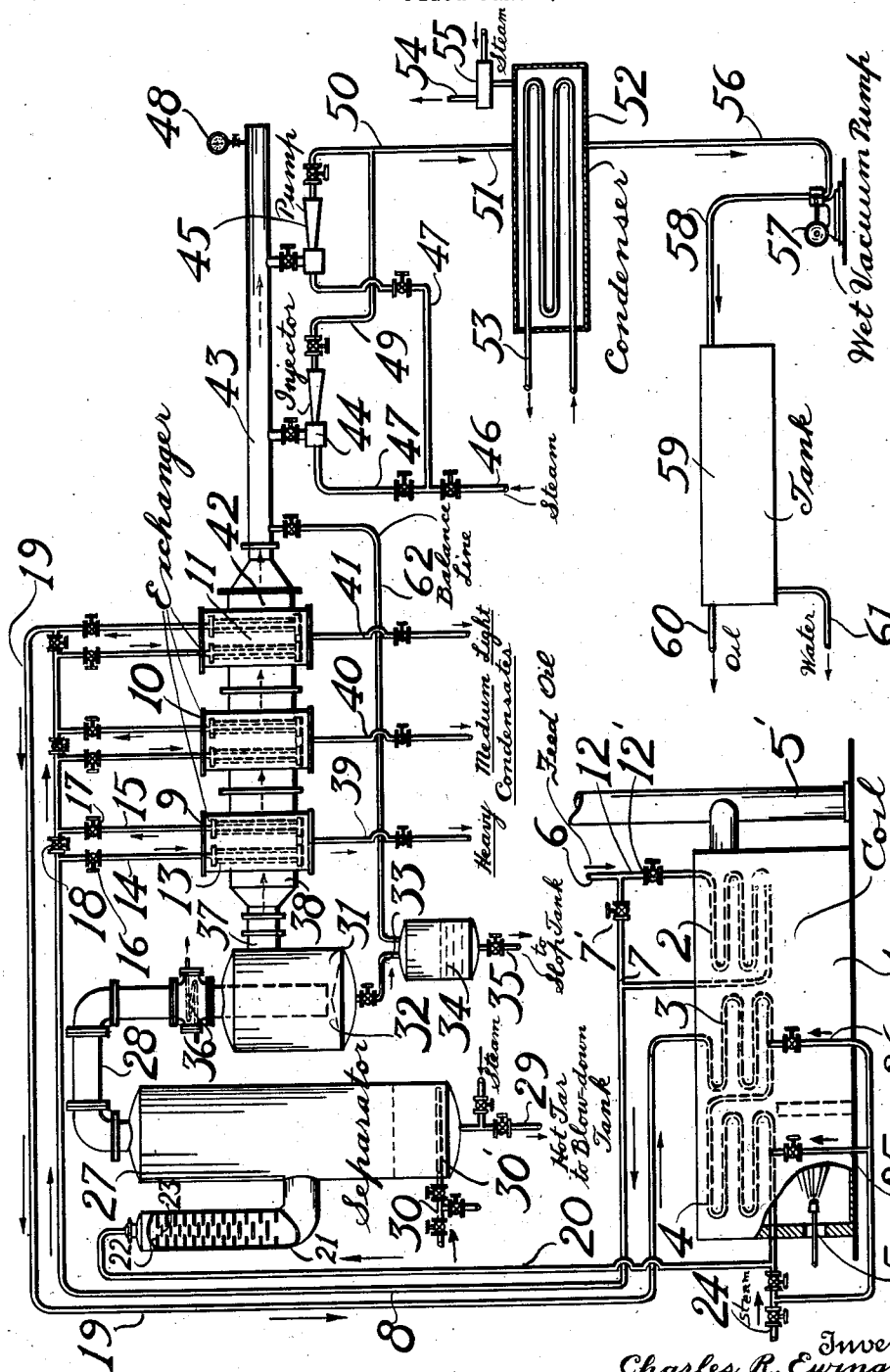
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METHOD AND APPARATUS FOR DISTILLING OIL

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METHOD AND APPARATUS FOR DISTILLING OIL

Application filed January 3, 1929. Serial No. 330,011.

This invention relates to improvements in methods and apparatus for the distillation of petroleum oils and the like, especially for the production of asphalt stocks and lubricating distillates. The invention will be fully understood from the following description read in connection with the accompanying drawing, in which the figure is a diagrammatic side elevation of the preferred equipment.

In the drawing, 1 denotes a pipe still setting in which are a preheating coil section 2, a convection heat coil section 3 and a radiant heat coil section 4. The setting is fired at 5 and the gases escape through a stack 5'. While the coils may be heated in any suitable way, we prefer direct firing as described.

The oil to be distilled is pumped through lines 6, 7 and 8 into the first of a series of vapor heat exchangers 9, 10 and 11. A bypass 12 connects line 6 with coil 2 so that the oil may be preheated in that coil, if this is desirable because of the high viscosity of the oil, or for any other reason. Valves 7' and 12' control the flow of oil through lines 7 and 12.

The oil passes in series through the tube bundles 13 in the heat exchangers as shown. The exchangers are preferably of the type shown in application Serial No. 330,012 filed January 3rd 1929, by Charles R. Ewing and Thomas Montgomery, according to which application the vapors sweep horizontally across removable tube bundles, but any suitable equivalent form of heat exchanger may be used.

The line 8 is connected with the tube bundles 13 by branch lines 14 and 15, in which valves 16 and 17 are respectively installed. We provide valves 18 in line 8 intermediate the junction points of lines 14 and 15 with it. By the use of valves 16, 17 and 18 the flow of oil through the heat exchangers may be regulated as desired.

The preheated oil passes through line 19 to the coil sections 3 and 4 in the furnace setting 1. The oil from coil 4 is discharged through line 20 into a vaporizer 21, which is a tower, column, or chamber equipped with baffle means, such as annular plates 22 and disks 23. Steam, gas, chemical treating agents, or the like, or mixtures of the same, may be injected into the oil through a line 24 and/or branch lines 25 and 26. The oil passes from vaporizer 21 into a separator 27, which it preferably enters tangentially. The separator is a large drum having a vapor line 28 and a tar draw-off line 29. Steam or other stripping agent may be injected through pipe 30 into the body of oil in the bottom of the drum. The oil level may be maintained at the proper height by suitable float valve mechanism or the like, not shown.

The vapor line 28 extends downwardly to a point near the bottom of an entrainment separator 31 where the vapors are ejected against a conical baffle 32. Any liquid collected in the entrainment separator is run off through line 33 into a receiver 34 from which it may be discharged through a line 35 to a slop tank or other suitable storage. A partial cooler 36 may be installed in line 28.

Residual vapors leave the entrainment separator through a pipe 37 (this like the pipe 28 is of large diameter, for example 3 feet or more) and discharge through a large rectangular fitting 38 into the first heat exchanger 9. Heavy condensate is taken off from exchanger 9 through a line 39, medium condensate from exchanger 10 through a line 40 and light condensate from exchanger 11 through line 41. It will be understood that suitable receiving tanks, pumps, etc. are provided in each case, but they have not been shown in order not to complicate the drawing.

Any vapors escaping condensation in the exchangers pass out through a rectangular fitting 42 into a vapor header 43. Injector pumps 44 and 45 are connected to the vapor header. These pumps are preferably of the steam jet type. Steam is supplied to the pumps through line 46 and branches 47. A vacuum gage 48 is installed near the outer closed end of header 43. The discharge from the pumps is received in lines 49 and 50 respectively and flows through line 51 into the surface condenser 52 to which cooling water

is supplied through a pipe 53. Air is vented from the condenser through a pipe 54 by means of a steam injector 55. Condensate is drawn off through line 56 by wet vacuum pump 57 through line 58 to a tank 59. A pipe 60 serves to withdraw oil from this tank; water is removed from it by way of pipe 61. A barometric condenser can be used in place of the surface condenser 52 and the wet vacuum pump 57.

A balancing or pressure equalizing line 62 connects the receiving drum 34 to the vapor header 43. The line 62 may also be connected to drums provided to receive the several condensates from the heat exchangers.

The system above described is well adapted for general use in so-called flash distillation in which the oil is heated to a vaporization temperature in a coil and is then discharged into an enlarged zone held under sub-atmospheric pressure. However, since our method has proved to be particularly useful in running for asphalt stock and lubricating distillates, this use will be described by way of example.

A suitable stock, such as 50 per cent bottoms from topping Colombian crude, is pumped through lines 6, 7 and 8 into the heat exchangers 9, 10 and 11 and then through line 19 to the pipe still coils 3 and 4. The pump pressure should be sufficient to send the oil rapidly through the coils, for example at the rate of about 5 feet per second at the coil inlet and about 25 feet per second at the coil outlet. The oil emerges from the last coil at a temperature of about 720° F. and is discharged at substantially the same temperature through line 20, which is well insulated, into the top of vaporizer 21. The hot oil showers downward throughout the baffle means in the vaporizer tower and is then projected tangentially into the separator 27. Under the influence of the reduced pressure imposed on the system there is a practically complete separation of the lighter vapors from the oil entering the separator. It will be noted that in our invention the vaporizer or oil distributing section is a separate unit. In this way we obtain a very thorough agitation and exposure of oil surfaces without interfering with the action of the separator. The distributed oil entering the latter is in condition to yield its low boiling fractions freely.

In order to insure that no substantial cracking shall take place in the heating coils, we prefer to inject steam (superheated or saturated), gas, or an equivalent carrier into the coils at a number of points, as for example through branch lines 25 and 26 and also to inject steam or the like through pipe 24 into the oil as it leaves the last coil. The body of heavy oil or tar collected in the bottom of the separator is heated and agitated by steam from line 30. The steam may be distributed in the separator through a heater 30'. In this way any lighter fractions which may have remained in the oil, notwithstanding the effects above referred to, are displaced.

The tar is drawn off from separator 27 through line 29 and is blown or otherwise treated for the production of asphalt. Residual vapors pass through the entrainment separator 31 in which they are, to a large extent, freed from entrained particles without much condensation of oil. Other forms of entrainment separators may be used with or without preliminary cooling of the vapors, or the entrainment separator may be omitted in case it is not required to have the distillates entirely free of asphaltic or other bodies that may be carried forward with the vapor stream.

The heat exchangers are preferably cooled by the feed oil as described but other cooling media may of course be used in some or all of them.

The equipment is designed throughout to permit as free flow of vapors as possible. It will be noted that the vapor passages are very wide and relatively unobstructed. The pumping equipment should be sufficient to maintain a relatively high vacuum on the separator. In running Colombian crude for the production of asphalt, it is desirable to have the absolute pressure in the system not above 20 mm. of mercury at any point past the vaporizer.

The vaporizer may be made in the form of a cone, or in other shapes, but the cylindrical form is preferred. Likewise, we do not wish to limit ourselves to the particular type of baffle shown in the vaporizer as other efficient baffle means would give a similar result. A fair degree of fractionation may be obtained by means of the three heat exchangers shown, but if further separation is desired more exchangers may be provided or means may be installed for taking off two or more condensates from each exchanger. The characteristics of the condensates can be controlled also by regulation of the cooling medium flowing through the tube bundles.

The foregoing description is illustrative of the invention and various changes and alternative arrangements may be made within the scope of the appended claims in which it is my intention to claim all novelty inherent in the invention as broadly as the prior art permits.

We claim:

1. Apparatus for distilling oil, comprising a pipe still, means for heating the same, means for passing oil through the still, a separator adapted to receive oil from the still through an outside connection communicating with the pipe still provided with a series of baffle plates, said outside connection serving as a vaporizer and discharging both

vapors and liquids through a large unobstructed passageway into the body of the separator at a point well below its top, and means for taking off a vapor fraction and a liquid fraction from the separator.

2. Apparatus for distilling petroleum oil, comprising a pipe still, a separator, means for passing oil from the still into the separator, a vaporizer arranged in said last mentioned means and provided with a plurality of baffles, said vaporizer having a large unobstructed outlet into the separator at a point near its middle, an entrainment remover connected to the separator, means for taking off a vapor fraction and a liquid fraction from the separator, and means for condensing the vapor fraction.

3. Method of running asphalt containing petroleum oils for asphalt and lubricating distillates, comprising passing the oil in a narrow confined stream through a heating zone in which the oil is raised to a temperature at which vaporization tends to occur, discharging the hot oil into a separating zone through an intermediary stage in which the oil is caused to pass over a series of baffles and is then discharged through a large, substantially unobstructed opening into the separating zone, taking off tar from said zone, withdrawing vapors therefrom, removing entrained particles from the vapors and condensing the vapors.

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