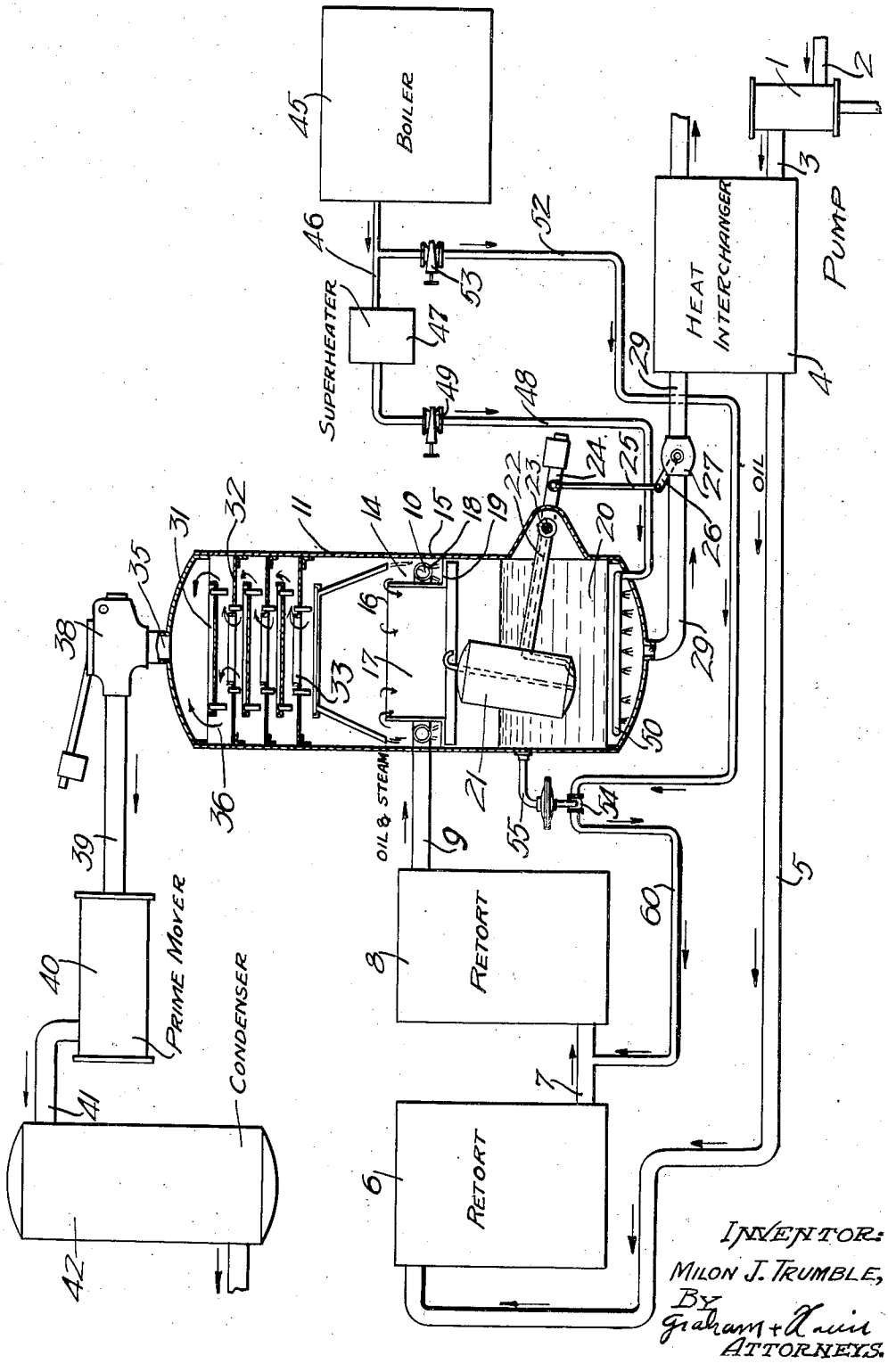
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APPARATUS FOR DISTILLING HYDROCARBONS

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APPARATUS FOR DISTILLING HYDROCARBONS.

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This invention relates to the art of refining petroleum oils and relates particularly to an improved equipment for use in distilling light hydro-carbon constituents from crude petroleum oils. The process with which the hereinafter described apparatus is employed is fully set forth in my application, covering a refinery power plant, filed December 1, 1922, Serial No. 604,301.

In this refining process, the oil is raised to the temperature at which the hydrocarbon desired to be removed volatilizes, and is directed into a separator consisting of a chamber in which the volatile characters rise from the oil and are carried to a mechanical device, such as a turbine in which the heat of expansion of the gases is transformed into mechanical energy. In order that the pressure apparent at the turbine be kept constant, the process provides for the introduction of super-heated steam, which sustains the pressure in the system as well as maintains the required temperature to prevent premature condensation of the distilled constituents.

By the use of this process, a great saving is accomplished through the employment of the power, represented in the heat used to volatilize the hydro-carbon, for the purpose of driving a mechanical device. The prime mover employed is preferably a turbine and it is convenient to directly connect an electro-generator therewith, whereby the mechanical energy derived from the heat is transformed into electrical energy, which may be conducted to various points for use.

It is an object of my invention to provide a simplified form of apparatus for practising the hereinabove described process.

It is a further object of the invention to provide in this equipment, a means for spreading the heated oil in the form of a thin film from which the volatiles may readily separate.

It is a further object of the invention to incorporate in the separator employed therein, means for extracting from the volatilized constituents any heavy hydro-carbons which may be carried therewith.

The especial advantages of the invention and further objects thereof will be made evident hereinafter.

In the drawing which is a diagrammatic representation of an apparatus embodying the features of my invention, 1 represents the pump cylinder of a steam pump, or other pumping device, which receives oil through an oil delivery pipe 2 and drives it through piping 3 into a heat interchanger 4 wherein its temperature is raised by being brought into proximity with heated oil being discharged from the apparatus, as will hereinafter be described. The oil is delivered from the heat interchanger 4 through a piping 5, which leads into a furnace or retort 6, wherein the temperature of the oil is raised to a still higher degree. Through an interconnecting pipe 7, the oil passes through a second retort 8 from which it is directed through piping 9 into a distributor ring 10, situated within a separator or vaporizer 11. The distributor ring 10 rests in a circular channel 14 which is enclosed between the side wall 15 of the separator 11 and an annular member 16, having a fairly deep cylindrical wall 17.

The distributor ring 10 has downwardly directed outlet openings 18 in the under side thereof and is placed somewhat above the bottom 19 of the annular member 16. The oil which is spread into the channel 14 from the ring 10 often contains considerable quantities of sand, which is very sharp and abrasive. By placing the ring away from the bottom 19, space is left under the ring for the collection of sand, which provides a cushion against which sand carried in the oil strikes and is thus prevented from contact with the bottom 19. In this manner, the bottom 19, is relieved of wear which would occur if the sharp particles of sand were allowed to come continuously in contact therewith.

The oil upon entering the channel 14 rises at an even level continuously therearound, and reaching the upper edge of the cylindrical plate 17, flows downwardly in a thin film on the inner face of this plate 17. The reducing of the oil to a thin film in this manner, permits the volatile constituents to readily separate from the film of oil which flows down and collects in the bottom of the separator 11, as indicated at 20.

A float 21 is mounted upon an arm 22, which is associated through a pivot 23 with an external arm 24. This external arm 24 is connected by a link 25 to the operating lever 26 of a valve 27, situated in the residuum discharge piping 29. As the level of the body of oil 20 contained in the separator 11 lifts the float, the valve 27 is opened by

the interconnecting link mechanism and allows the hot residuum oil to flow through the piping 29 into the heat interchanger, where a greater portion of the heat thereof is transferred to the incoming unrefined oil delivered into the interchanger by the pump 1. It will be recognized that with the float and valve arrangement, a self operating control is accomplished, which will maintain at all times a body of oil within the separator 11 and that the outflow of oil through the pipe 29 will at all times be proportionate to the quantity of oil delivered into the separator through the pipe 9. In the upper portion of the separator 11 interceptor plates 31 and 32 are situated. The plates 32 are annular in shape and have lipped openings 33 in the center thereof. The plates 31 are of decreased diameter and are interposed between the plates 32. The gases in seeking the outlet 35 must pass around the plates 31 and 32 in a tortuous path as indicated by the arrows 36.

The cross sectional area of the spaces between the plates 31 and 32 is many times larger than the cross sectional area of the outlet 35, therefore the gases will pass between the plates at a comparatively slow rate of speed, and coming in contact with the faces thereof, will be relieved of all heavy oil constituents which may be carried with the volatiles desired to be separated. The outlet 35 leads into a pressure regulator 38, which connects through piping 39 with a prime mover 40 having connection through pipe 41 with a condensor 42. The prime mover 40 may preferably consist of a vapor turbine, and it is desirable to employ this turbine to drive a dynamo so that the power represented by the expansive heat contained in the vapors directed to the turbine may be transformed into electrical energy.

In the distillation of light hydro-carbons from crude oil, the pressure within the apparatus varies greatly at different periods, due to the change in the light hydro-carbon carried in the various portions of oil being treated, and also to the change of temperature in the equipment. My invention, however, employs a means for delivering steam under pressure into the apparatus, this steam serving to stabilize the pressure within the separator, and to sustain the heat therein.

The power value of the steam is reclaimed at the prime mover 40 in other words it is transformed into electrical energy. This steam is generated at a boiler 45, having a delivery pipe 46 leading therefrom into a superheater 47. From the superheater 47, the steam is carried through piping 48, having valve means 49 therein to a distributor ring 50 situated in the bottom of the separator 11. From the pipe 46, delivery piping 52 provided with a valve 53 is carried to a pressure regulating valve 54, which associates through a pipe 55 with the interior of the separator 11. When the pressure within the separator 11 fluctuates downwardly, the pressure regulator 54 allows the passage of a larger quantity of steam from the delivery pipe 52 into the piping 60 which directs the steam into the interconnecting pipe 7 between the retorts 6 and 8.

In the manner previously described, a substantially even pressure may be maintained at all times within the apparatus, notwithstanding some variation in temperature therein and a constant generation of power at the prime mover is effected. The power represented in the heat used for generating the steam is reclaimed at the prime mover 40, and by the use of this steam is made possible the reclamation of the heat contained in the volatiles, which heat has heretofore been dissipated by the use of large quantities of cold water.

I claim as my invention:

1. In oil distilling apparatus, the combination of: means for raising oil to the desired temperature of volatilization; a separator into which the heated oil is delivered; means for regulating the discharge of oil from said separator in proportion to its entrance thereinto; means associated with the vapor outlet of said separator for definitely regulating the pressure within said separator; and means for converting the expansive heat energy of the vapor products from said separator into mechanical energy.

2. In oil distilling apparatus, the combination of: means for raising oil to the desired temperature of volatilization; a separator into which the heated oil is delivered; means for regulating the discharge of oil from said separator in proportion to its entrance thereinto; means associated with the vapor outlet of said separator for definitely regulating the pressure within said separator; steam generating means; means controlled by the internal pressure of said separator for introducing steam into said separator; and means for converting the expansive heat energy of the vapor products from said separator into mechanical energy.

3. In oil distilling apparatus, the combination of: means for raising oil to the desired temperature of volatilization; a separator into which the heated oil is delivered; means for maintaining a body of heated oil in said separator; means for introducing steam at the bottom of said separator, which steam percolates upwardly through said body of oil; means associated with the vapor outlet of said separator for definitely regulating the pressure within said separator; and means for converting the expansive heat energy of the vapor products from said separator into mechanical energy.

4. In oil distilling apparatus, the combination of: means for raising oil to the

desired temperature of volatilization; a separator into which the heated oil is delivered; means for maintaining a body of heated oil in said separator; means for introducing steam at the bottom of said separator, which steam percolates upwardly through said body of oil; means associated with the vapor outlet of said separator for definitely regulating the pressure within said separator; steam generating means; means controlled by the internal pressure of said separator for introducing steam into said separator; and means for converting the expansive heat energy of the vapor products from said separator into mechanical energy.

5. In oil distilling apparatus, the combination of: means for raising oil to the desired temperature of volatilization; a separator in which the heated oil is delivered; means for regulating the discharge of oil from said separator and for maintaining a body of oil in the bottom of said separator; a steam generator; means controlled by the internal pressure of said separator for introducing steam from said generator with the heated oil delivered into said separator; a superheater connected with said steam generator; means for introducing superheated steam from said superheater into the bottom of said separator so as to percolate upwardly through said body of oil in said separator; means associated with the vapor outlet of said separator for definitely regulating the pressure within said separator; and means for converting the expansive heat energy of the vapor products from said separator into mechanical energy.

In testimony whereof, I have hereunto set my hand at Los Angeles, this 9th day of April 1923.

MILON J. TRUMBLE.