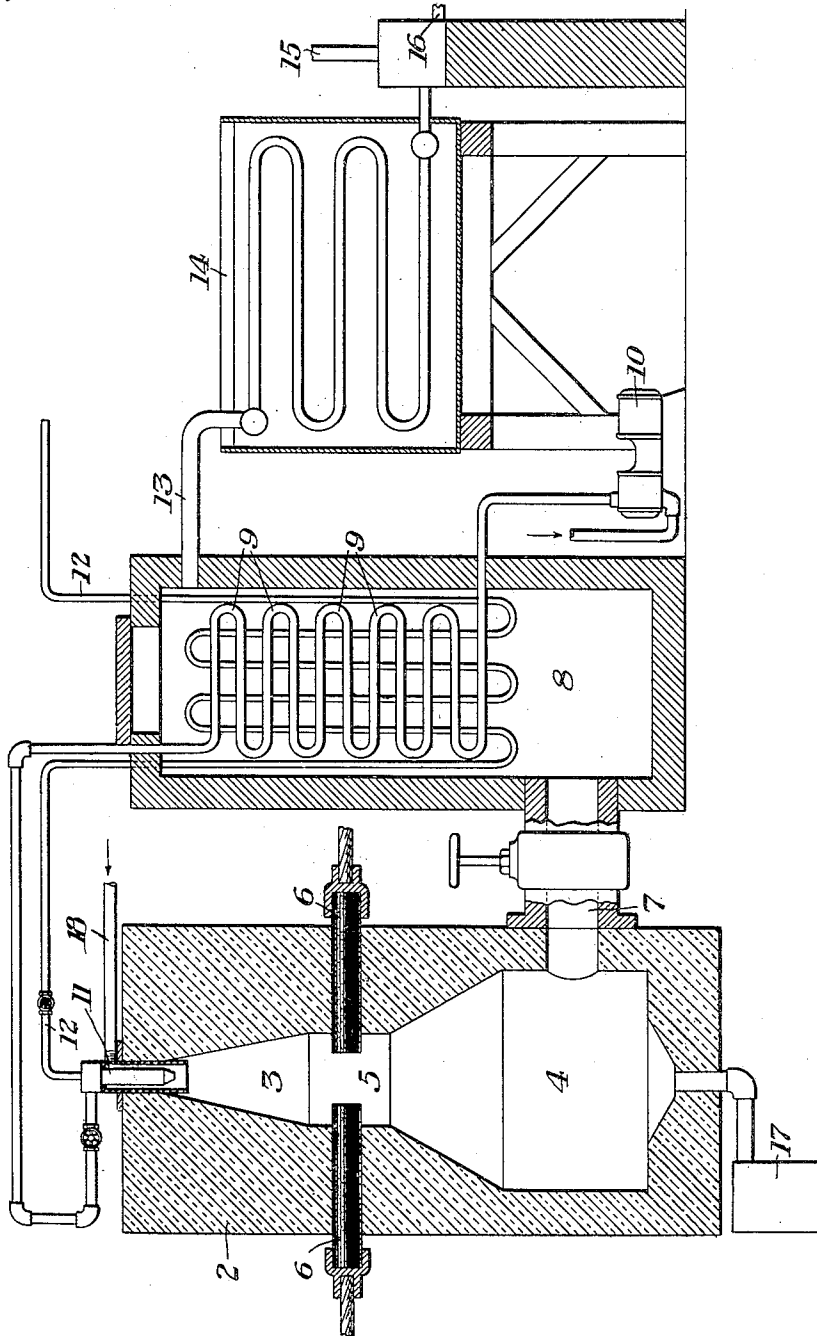


L. E. HIRT.
 METHOD OF AND APPARATUS FOR FRACTIONATING HYDROCARBONS.
 APPLICATION FILED OCT. 21, 1916.

1,250,879.

Patented Dec. 18, 1917.



WITNESSES
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UNITED STATES PATENT OFFICE.

LEON E. HIRT, OF LOS ANGELES, CALIFORNIA.

METHOD OF AND APPARATUS FOR FRACTIONATING HYDROCARBONS.

1,250,879.

Specification of Letters Patent.

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Application filed October 21, 1916. Serial No. 126,941.

To all whom it may concern:

Be it known that I, LEON E. HIRT, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Improvement in Methods and Apparatus for Fractionating Hydrocarbons, of which the following is a full, clear, and exact description, reference being had to the accompanying drawing, forming part of this specification, in which the figure is a vertical section of one form of apparatus for carrying out my invention, the view being largely conventional or diagrammatic in character.

My invention has relation to the fractionation or cracking of hydrocarbons, and consists in the provision of an improved method and apparatus whereby the fractionation may be carried out in a simple and highly effective manner.

In my copending application Serial No. 41,109, filed July 21, 1915, I have described and claimed a method and apparatus for this same general purpose, in which the oil to be fractionated is subjected to the action of an electric arc within a closed furnace or retort, in which a controllable pressure may be maintained. Hydrogen in some form or other suitable agent is present in the retort, the reaction between the hydrogen and the oil under the heat of the arc being present. The oil vapors thereby produced are conducted away and condensed.

The present invention adds some further features of advantage to this general method.

Referring to the accompanying drawings, the numeral 2 designates a refractory furnace or retort having an interior atomizing chamber 3, which is enlarged toward its lower end, as shown at 4. 6 designates electrodes which project into the throat portion 5 of the furnace chamber. The lower portion of this chamber is provided with an off-take 7, which may be controlled by any suitable valve and which is shown as opening into a preheating chamber 8. Within this preheating chamber is arranged a coil 9, through which oil may be pumped from any suitable source by a pump 10. The outlet end of the coil 9 is connected to a nozzle 11, opening into the upper portion of the atomizing chamber 3. This nozzle 11 is also preferably provided with a supply pipe 12 for supplying superheated or saturated steam. This steam may be furnished from

any desired source, and if desired, the supply pipe therefor can be led through the preheating chamber 8. 13 designates a pipe leading from the preheating chamber 8 for conducting the vapors to the coils of a condenser 14. The ends of these coils may be conducted to a gas off-take 15 and also to a lighter oil off-take 16. The form of condenser shown consists simply of a water tank in which the condensing coils are immersed, but I may use any suitable form or forms of condensers.

The numeral 17 indicates a trap connected with a lower portion of the furnace chamber and in which will collect any heavier oils resulting from the operation and which can be retreated, if desired, under different conditions of pressure and intensity of heat.

The fractionation or refractionation takes place in the furnace or retort chamber under a controllable pressure which may be either positive or negative. Positive pressure of any desired degree can be created within said chamber by regulating the discharge of the vapors to the off-take 7, so as to hold them back within said chamber. In the form of apparatus shown, the ingoing oil is preheated in the chamber 8 to a high degree, since the temperature of the outgoing vapors will be high, depending upon the rate at which oil either atomized or as a vapor is fed. The outgoing temperature can thus be held between 600 and 1500° F., as may be desired. The oil will therefore be discharged into the furnace chamber largely in the form of a vapor and any unvaporized oil will be atomized by the action of the superheated steam passing through the nozzle. The pump 10 will maintain the oil pressure to the desired intensity, and as the oil and steam pass the arc, the oil is partly broken up and fractionated. The steam introduced with the oil becomes more or less dissociated, the nascent H_2 so formed entering into the reaction with the oils, and by causing the requisite pressure in the furnace chamber, any desired thermochemical compound of the oils can be formed. The O_2 liberated combines with carbon to form CO gas. This is greatly preferable to carbon in the free state, since the latter clogs up the furnace and discolors the condensed fractions. I may also introduce free chlorine gas with the oil, or oil and steam, to unite with the carbon and form carbon tetrachlorid. The latter can be recovered and

used as a cleaning compound. Bromin gas may also be added either with or without steam. The halogen gas may be inserted through a pipe, such as indicated at 18.

- 5 Instead of using steam, I may, of course, supply hydrogen either in the free state or by some other gas containing the same. I may, for instance, use natural gas either combined with the steam or in lieu thereof.
- 10 Under the heat, this will break up to $2H_2$ and free carbon, and sufficient free O_2 can be added to convert substantially all the carbon formed from the gas into CO , thus keeping the furnace clean. I may also employ any suitable catalytic agent of known character to assist in any particular reaction that it may be desired to produce. This agent may, for instance, be iron clippings, or filings, or firebrick checkerwork, or it
- 20 may be any metallic or metallic compound catalyzer of well known character. The catalyzer, if used, will preferably be placed within the chamber 4. While I have shown the retort or furnace in vertical position, it is obvious that it can be supported in any other desired position.

I may, of course, employ as many arcs or groups of arcs as may be desirable for any particular case.

- 30 I claim:

1. The herein-described method of fractionating hydrocarbon oils, which consists in subjecting preheated vaporized oil to the action of an electric arc within a closed chamber or retort, maintaining a controllable pressure in said chamber or retort, and conducting off and condensing the oil vapors thus produced, substantially as described.

2. The herein-described method of fractionating hydrocarbon oils, which consists in subjecting preheated vaporized oil to the action of an electric arc in a closed chamber or retort in the presence of hydrocarbon, maintaining a controllable pressure in said chamber or retort, and conducting off and condensing the oil vapors thus produced, substantially as described.

3. The herein-described method of fractionating hydrocarbon oils, which consists in subjecting the oil mixed with steam to the action of an electric arc within a closed chamber or retort, maintaining a controllable pressure in said chamber or retort, conducting off and condensing the oil vapors produced in said chamber or retort, and utilizing the outgoing vapors to preheat the oil supply for said chamber or retort, substantially as described.

4. The herein-described method of fractionating hydrocarbon oils, which consists in subjecting the oil to the action of an electric arc within a closed chamber in the presence of a gas which will combine with the liberated carbon, substantially as described.

5. The herein-described method of frac-

tionating hydrocarbon oils, which consists in subjecting the oil to the action of an electric arc within a closed chamber in the presence of steam and a gas which will combine with the liberated carbon, substantially as de- 70 scribed.

6. The herein described method of fractionating hydrocarbon oils, which consists in passing the oil within a closed chamber through a zone containing an electric arc 75 and also supplying chlorin gas to said chamber, substantially as described.

7. The herein-described method of fractionating hydrocarbon oils, which consists in subjecting the oil to the action of an electric 80 arc within a closed chamber or retort, supplying natural gas to said chamber or retort, maintaining a controllable pressure in said chamber or retort, and conducting off and condensing the oil vapors produced therein, 85 substantially as described.

8. The herein-described method of fractionating hydrocarbon oils, which consists in subjecting oil to the action of an electric arc 90 within a closed chamber or retort, supplying natural gas and steam to said chamber or retort, and conducting off and condensing the oil vapors produced in said chamber or retort, substantially as described.

9. The herein described method of frac- 95 tionating hydrocarbon oils, which consists in passing the oil within a closed chamber through a zone containing an electric arc and also supplying a halogen gas to said chamber, substantially as described. 100

10. The herein described method of fractionating hydrocarbon oils, which consists in passing the oil in the form of a vapor within a closed chamber through a zone containing an electric arc, supplying hydrocarbon gas 105 to said chamber, and maintaining a controllable pressure in said chamber, substantially as described.

11. The herein described method of fractionating hydrocarbon oils, which consists in 110 passing the oil within a closed chamber through a zone containing an electric arc, supplying hydrocarbon gas to said chamber, and maintaining a controllable pressure in said chamber, substantially as described. 115

12. The herein described method of fractionating hydrocarbon oils, which consists in passing the oil within a closed chamber through a zone containing an electric arc and also supplying steam and halogen gas 120 to said chamber, substantially as described.

13. The herein described method of fractionating hydrocarbon oils, which consists in passing the oil within a closed chamber through a zone containing an electric arc, 125 supplying steam and halogen gas to said chamber, and maintaining a controllable pressure in said chamber, substantially as described.

14. Apparatus for fractionating oils, com- 130

prising a closed furnace or retort, means for producing an electric arc therein, means for producing a controllable pressure therein, a preheating chamber connected with the vapor offtake of the retort, and an oil supply system leading through the preheating chamber into the furnace or retort, substantially as described.

15. Apparatus for fractionating oils, comprising a closed furnace or retort, means for producing an electric arc therein, means for producing a controllable pressure therein, a preheating chamber connected with the vapor offtake of the retort, and an oil supply system leading through the preheating chamber into the furnace or retort, together with means for supplying hydrogen to said furnace or retort, substantially as described.

16. Apparatus for fractionating oils, comprising a closed furnace or retort, means for producing an electric arc therein, means for producing a controllable pressure therein, a preheating chamber connected with the vapor offtake of the retort, and an oil supply system leading through the preheating chamber into the furnace or retort, together with condensing means connected to the said preheating chamber, substantially as described.

In testimony whereof, I have hereunto set my hand.

LEON E. HIRT.

Witnesses:

GEO. E. REED,
F. L. THOMPSON.