

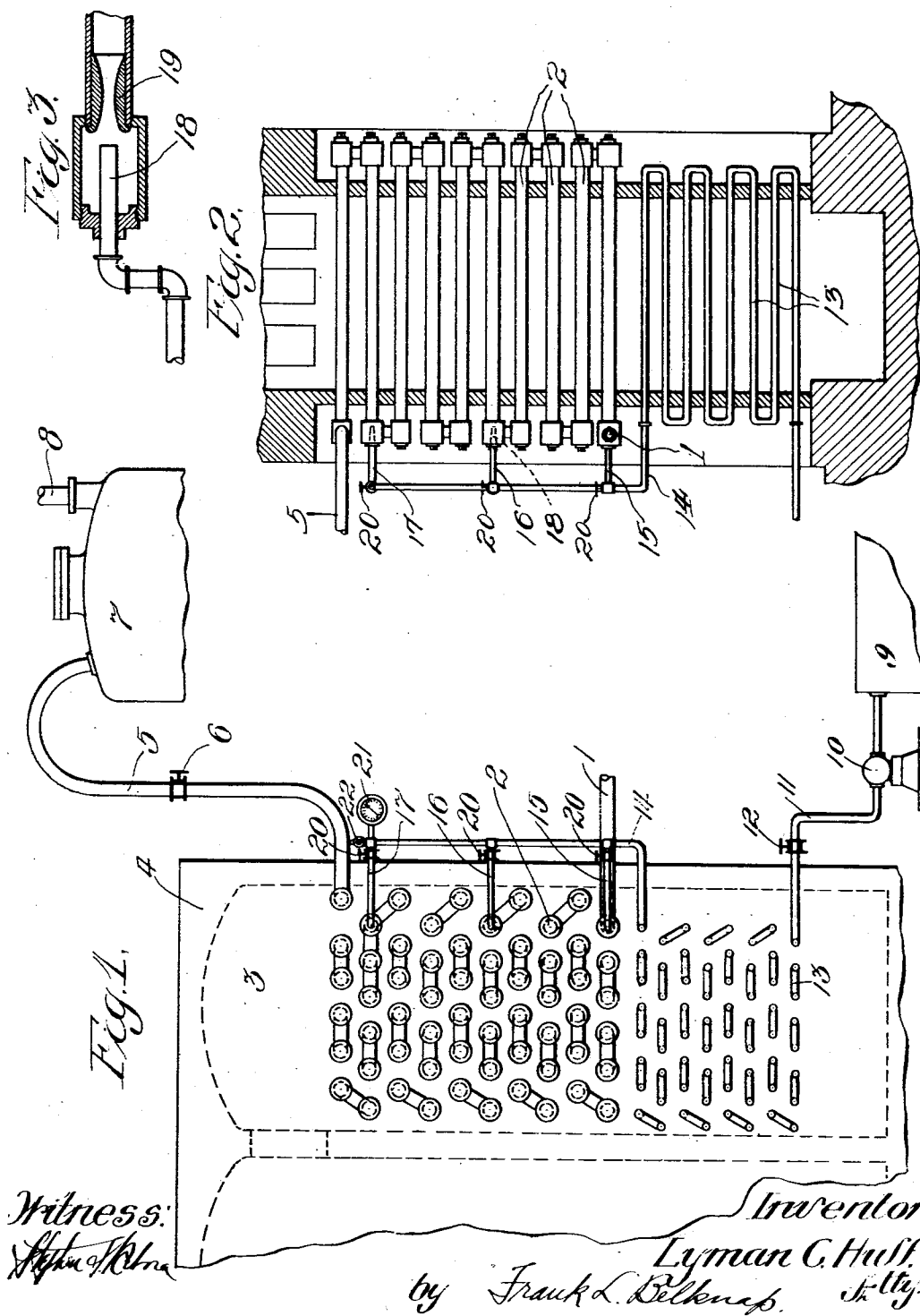
Sept. 25, 1928.

1,685,488

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PROCESS AND APPARATUS FOR CONVERTING HYDROCARBONS

Filed Feb. 19, 1923



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UNITED STATES PATENT OFFICE.

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PROCESS AND APPARATUS FOR CONVERTING HYDROCARBONS.

Application filed February 19, 1923. Serial No. 619,820.

This invention relates to improvements in a process and apparatus for converting hydrocarbons and refers more particularly to a process for the destructive distillation or hydrocarbon oil to produce a relatively light product having the characteristics of gasoline from relatively heavier oils.

Among the salient objects of the invention are to provide a process in which the oil is treated under a substantial pressure circulated at a high velocity in a relatively small stream, to provide a process in which the velocity of the oils through the heating stage is accelerated by the successive injections of a relatively inert fluid such as superheated steam, to provide a process in which steam is generated in the heating stage and is circulated with the oil through the heating stage, being injected at different points into the oil body to facilitate and increase the travel of the oil therethrough, and to provide an improved type of apparatus for carrying out this process, and, in general, to provide a process and apparatus of the character referred to.

In the drawings the complete system in which the oil is treated is only diagrammatically shown including only those portions of the apparatus incorporating the details of the invention. Such parts of the apparatus which are common in the art, such as the dephlegmating, condensing and collecting means, together with the circulating and charging means, have been purposely omitted.

Fig. 1 is an end view of the heating chamber of a side-fired furnace showing the position of the oil and steam heating tubes.

Fig. 2 is a side view of the construction shown in Fig. 1.

Fig. 3 is a sectional view of the nozzles or injecting means through which the superheated steam is introduced.

Referring to the drawings and explaining the method of circulating and treating the oil, there is introduced from any convenient source a charging stock through the line 1. This charging stock is circulated through the continuous coil 2 mounted in the heating compartment 3 of the side-fired furnace 4. The oil after being raised to a conversion temperature in the heating stage is directed through the transfer line 5 controlled by a valve 6 and is introduced and collected in a substantial body in the expansion chamber 7 where the vapor and liquid oil constituents are separated during the conversion of the oil. This conver-

sion is preferably effected under a substantial pressure.

The vapors evolved in the expansion chamber pass off through a vapor line 8 through dephlegmating and condensing means not shown and are finally collected as liquid distillate. The unvaporized oil is collected in the bottom of the tank 7 and drawn off through lines not shown to storage or to be retreated as desired.

This treatment of the oil is a normal method of pressure distillation or cracking of hydrocarbon and is concerned in the present invention only in so far as the velocity of the oil through the heating tubes is effected by the injection of super-heated steam, as will hereinafter be more fully explained.

Water is drawn from a tank 9 and forced by means of the pump 10 through the line 11 controlled by a valve 12 into the heating coil 13, which consists of a continuous coil mounted below the oil tubes 2 in the heating compartment 3 of the furnace 4. This water, which is transformed into superheated steam, is circulated at a high velocity through the coils and from the discharge end of the coil 13 is directed to a header 14, into which are tapped connections 15, 16 and 17. These connections terminate in nozzles or jets 18 inserted into the ends of some of the tubes so that the generated steam under high pressure may be injected directly into the oil as it travels through the heating tubes. In the oil coil piles are positioned Venturi bushings 19 in front of the jets in order to decrease the diameter of the tube in front of the jets in order to produce a higher velocity in the oil in this portion of the heating coil. The amount of steam introduced through the connections is regulated by valves 20. The number of connections necessary to maintain the velocity at the desired rate may be varied with the number of tubes in the furnace or with the size of the tubes or the character of the oil to be treated.

In circulating a petroleum hydrocarbon through a heating coil of this character, it is essential that the oil be maintained at sufficient velocity to prevent the conversion of the oil in the heating stage. The conversion of the oil is attended by deposition of carbon particles which accumulate and produce hot spots in the apparatus which are objectionable, due to the fact that in those portions of the tubes in which the hot spots

form, the metal readily deteriorates and is burned out. To prevent these difficulties it is essential that any carbon particles which may be separated in the heating stage be kept in suspension in the liquid oil, and in this connection it is important to circulate the oil at sufficient velocity to keep any separated carbon in a suspended state.

By introducing steam at a high velocity at successive stages in the oil travel through the heating coil, the velocity of the oil will be increased sufficiently to prevent carbon deposition. The steam introduced through the lower connection 15 will increase the velocity of the oil traveling through the lower tubes. When this oil has reached the intermediate zone it will be taken up and its velocity again accelerated by steam introduced through the connection 16. In a like manner the oil will be discharged from the upper tubes at a high velocity due to the introduction of steam through the connection 17. A pressure gauge 21 and a relief cock 22 are positioned in the steam line to control the pressures therein.

In addition to steam, an uncondensable gas such as that produced in the apparatus may be recycled and introduced to the heating coils under high pressure and in the same manner as the steam is introduced. This introduction of an inert gas or inert vapor serves not only to overcome the friction, but in addition, supplies heat internally and has a further advantage of loosening any carbon deposition which may tend to take place in the heating coil.

I claim as my invention:

1. The step of heating oil in an oil cracking process, which consists in continuously passing the oil in a restricted stream through an elongated conduit disposed within a furnace, wherein the oil is raised to a cracking temperature, in stepping up the velocity of flow

of the oil stream through said conduit, and in assisting in the heating of the oil in the stream by introducing a super-heated inert gas into the oil stream in successive sections of said conduit under a pressure in excess of the pressure on the oil stream and at a velocity greater than the velocity of flow of the oil stream.

2. A step in an oil cracking process of the continuous type, which comprises continuously introducing oil to be treated to an elongated conduit disposed within a furnace, in raising the oil during its passage through said conduit to a cracking temperature without causing substantial decomposition of the oil in said conduit, in stepping up the velocity of flow of the oil as it advances through said conduit by introducing to the oil intermediate the inlet to and outlet from said conduit a super-heated inert gas under a pressure in excess of the pressure at which the oil is introduced to said conduit and at a velocity greater than the velocity of flow of the oil through said conduit.

3. An apparatus adapted to perform the step of raising oil to a cracking temperature in an oil cracking process of the continuous type, which comprises an elongated heating coil of restricted cross-section disposed within a furnace, means for introducing oil to be treated to the inlet of said coil, means for conveying the heated oil from said coil, means for accelerating the velocity of flow of the oil as it advances through said coil, comprising means for introducing to said coil intermediate its inlet and outlet a super-heated inert gas at a pressure greater than the pressure under which the oil is introduced to said coil and at a velocity greater than the velocity of flow of the oil through the coil.

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