May 9, 1933. H. R. SNOW 1,908,001

ART OF CONVERTING HYDROCARBON OILS.

Filed April 25, 1930

Fig. 1.

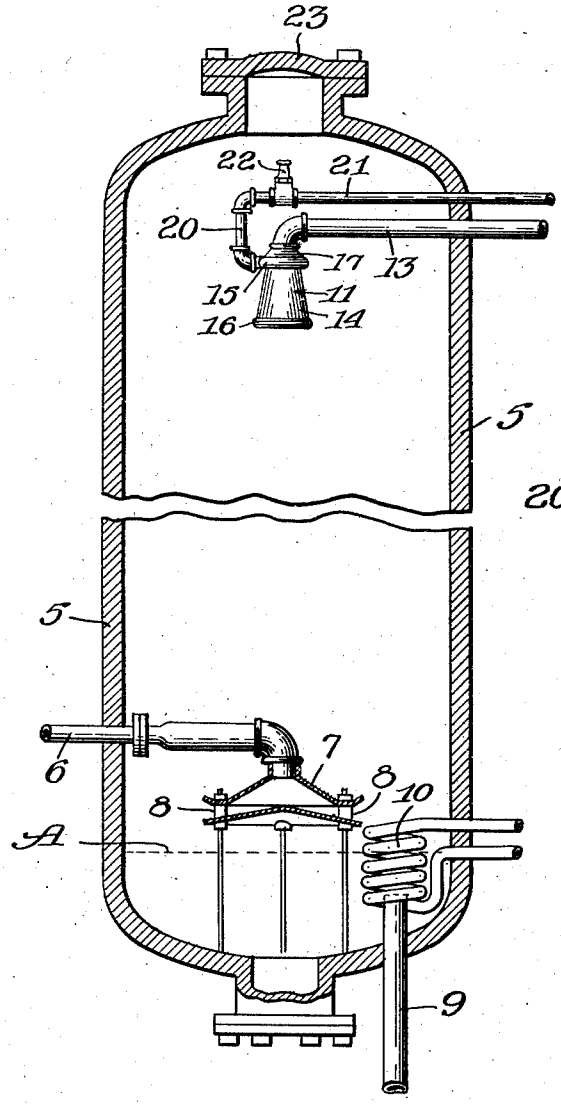
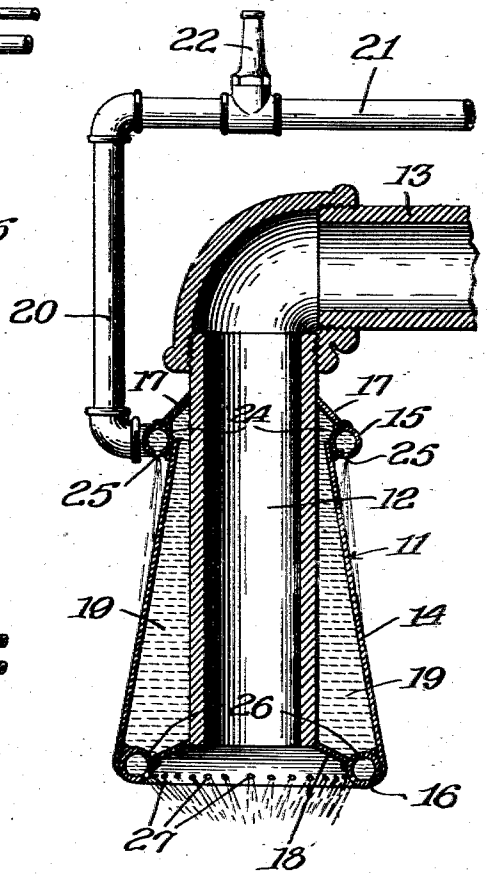


Fig. 2.



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UNITED STATES PATENT OFFICE

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ART OF CONVERTING HYDROCARBON OILS

Application filed April 25, 1930. Serial No. 447,265.

This invention relates to improvements in connection with the pyrogenetic treatment of hydrocarbon oils and refers more particularly to the method of and means for retarding the deposition of coke upon certain portions of apparatus employed in the decomposition of hydrocarbon oils. The invention will be fully understood from the following description, illustrated by the accompanying drawing, in which:

Figure 1 is a vertical sectional view of a reaction chamber suitable for use in connection with apparatus for the conversion of hydrocarbon oils, the chamber being provided with means for preventing the deposition of coke against and within the vapor outlet and adjacent the upper man-head; and

Fig. 2 is an enlarged vertical sectional view of the outlet conduit and the coke preventing means shown in Fig. 1.

Referring to the drawing, the numeral 5 designates a reaction chamber of suitable design for use in the cracking or conversion of hydrocarbon oils. The chamber 5 is particularly adapted to be employed in cracking processes of the vapor phase type, for example, processes such as those described in the co-pending applications of myself, Serial No. 428,430, filed February 14, 1930, and another and myself, Serial No. 427,216, filed February 10, 1930. In such processes, the oil undergoing treatment is heated in a heating zone wherein it is vaporized and the vapors brought to an effective cracking temperature at which the desired type of cracking will be secured. The products then flow from the heating zone and into a suitable reaction chamber.

The reaction chamber employed in such a vapor phase process is ordinarily a vertically disposed elongated chamber of cylindrical form. and is maintained largely filled with vapors, only a low level of tarry liquid being permitted therein, if any.

In cracking or conversion processes, particularly those of the type described in the applications already alluded to, coke formations of an objectionable character tend to form upon and within the vapor outlet leading from the reaction chamber and also adjacent certain portions of the interior of the chamber. By means of the present invention this objectionable formation of coke is substantially avoided.

In the present embodiment, the vapor products flow from the heating zone and into the reaction chamber 5, by means of a pipe 6. The pipe 6 protrudes into the interior of the chamber 5 and communicates with an inlet distributor indicated as a whole at 7. This distributor is described in detail in my co-pending application Serial No. 428,431, filed February 14, 1930. The outlet 8 of the distributor 7 is located above the level of the tarry liquid, the level of which is indicated by the dotted line A. The level of this liquid is controlled by continuously or intermittently withdrawing predetermined portions of it through the draw-off line 9. The opening of the draw-off line 9 is surrounded by a coil 10 through which may be circulated a suitable cooling medium. The purpose and operation of this coil 10 and the outlet 9, are described in the already alluded to co-pending applications Numbers 427,216 and 428,430.

The vapor outlet of the present invention is preferably located within the upper portion of the reaction chamber 5 and is designated as a whole at 11. The interior of the outlet member 11 is provided with a downwardly depending outlet conduit 12 the upper end of which is connected to a vapor drawoff line 13 through which the vapor may be passed to the next step of the process, for example, fractionating means (not shown). The depending conduit 12 is surrounded by a spaced sheet metal jacket 14, the upper and lower ends of which are attached to encircling pipe rings 15 and 16, respectively, which are spaced from the conduit 12. The upper ring 15 is secured to the outer surface of the conduit 12 by means of a sheet metal frustro-conical ring 17 and the lower ring 16 is secured to the lower portion of the conduit 12 by means of a similar frustro-conical sheet metal ring 18. The various parts may be secured together in a leak-proof manner, for example, by welding. The lower ring 16 is preferably located at, or slightly below the opening of the depending conduit

12. There is thus formed within the metal jacket or shell 14 a chamber or enclosure 19 surrounding a large portion of the depending outlet conduit 12. Obviously, it may be proportioned to surround the entire outlet assembly, if desired.

The upper pipe ring 15 is connected to a pipe 20, the upper end of which is connected to a horizontally disposed pipe 21 leading from a suitable source of hydrocarbon oils and having interposed therein a nozzle 22 directed upwardly toward the top of the reaction chamber 5 and particularly toward the manhead 23 of the chamber top. The upper pipe-ring 15 is provided with perforations 24 opening interiorly at a point between the top of the jacket 14 and the outer edge of the ring 17 so as to feed oil into the chamber or enclosure 19, and is also provided with downwardly opening perforations 25 adapted to spray jets of oil upon the exterior of the jacket or shell 14. The lower pipe-ring 16 is provided with perforations 26 communicating with the chamber or enclosure 19, through which the said pipe-ring 16 receives oil discharged into the chamber from the upper pipe-ring 15. The oil thus received is discharged from the pipe-ring 16 through a plurality of perforations 27 which are so positioned as to discharge jets of oil downwardly and across the mouth of the depending conduit 12 and into the vapors flowing thereinto.

In the operation, the vaporous products enter the chamber 5 through the line 6 and issue from the laterally opening outlet 8 of the nozzle 7. The vapors rise slowly through the reaction chamber, in which the desired vapor phase cracking temperatures are maintained. The period of time that the vapors are retained in the chamber 5 depends upon the conditions of operation, such as the rate of feed, the size of the chamber, etc., as well as the type of product desired. The reaction chamber may be insulated, or may be mildly heated, if desired.

A suitable cooling fluid is introduced through the lines 20 and 21 into the vapor outlet 11. The fluid employed is preferably one which is not entirely vaporized by the hot vapors, the unvaporized portions being removed with the cracked vapor products by entrainment. This fluid may suitably be a distillate hydrocarbon, or the fresh feed stock for the system, which is thereby preheated and redistilled, and blended with the vaporous cracked products, to be later condensed with the heavier portions of the latter to form a composite feed stock which is fed to the heating zone for substantial vaporization and cracking. A portion of the cooling fluid flowing through pipe 21 is ejected in the form of a jet through the nozzle 22 and against the man-head 23 in the top of the chamber 5, while the remaining fluid flows to the outlet assembly 11. A portion of the remaining fluid flows through the chamber 19 formed by the jacket 14 and is discharged in the form of jets from the perforations 27 in the lower pipe ring 16. These jets are preferably directed across and adjacent the open end of conduit 12 and into the vapors adjacent to and flowing into the open end of the said conduit. The remainder of the fluid is discharged through the perforations 25 in the upper ring 15 and along and against the outer wall of the chamber 19. The fluid thus passed to the outlet member 11 functions to exert a cooling effect both interiorly and exteriorly of the conduit 12, effectively preventing coke formations which would cause stoppage of the operation. The fluid ejected through the nozzle 22 has a similar effect in preventing the formation of coke upon and around the man-head 23.

The withdrawn vapors flow through pipe 13 and are passed to any suitable fractionating devices (not shown) to condense therefrom vaporized products heavier than the desired distillate products, which condensed products will include those heavier products from the cooling hydrocarbon liquid introduced into the chamber 5 through the outlet member 11. Suitable fractionating means for handling the vapors from the reaction chamber are described in the co-pending application of another and myself, Serial No. 427,216 filed February 10, 1930.

Although I have described the present invention in connection with a description of specific embodiments thereof, it is not intended that the details set forth shall be regarded as limitations upon the scope of the invention, except in so far as included in the accompanying claims.

I claim:

1. In combination, a reaction chamber, and apparatus for withdrawing vaporous hydrocarbon oil products of conversion therefrom, which comprises an outlet conduit member extending into said reaction chamber and into the body of vapors therein, means for spraying a cooling liquid over a portion of the exterior of said conduit member within said reaction chamber, and means for supplying cooling liquid to said spray means.

2. In combination, a reaction chamber, and apparatus for withdrawing vaporous hydrocarbon oil products of conversion therefrom, which comprises a downwardly depending outlet conduit member extending into said reaction chamber and into the body of vapors therein heated to conversion temperature, said conduit being open at its lower end and extending to a point exterior of said reaction chamber, means for spraying a cooling liquid on the exterior of the portion of said conduit within said reaction chamber at a point above

the lower end of said conduit, and means for supplying liquid to said spray means.

3. In combination, a reaction chamber, and apparatus for withdrawing vaporous hydrocarbon oil products of conversion therefrom, which comprises a conduit member extending into said reaction chamber and into the body of vapors therein heated to conversion temperature, said conduit being provided with an exterior jacket for receiving a liquid cooling medium, means for spraying a liquid cooling medium over a portion of the exterior of said jacket, and means for supplying cooling liquid to said jacket and to said spray means.

4. In combination, a reaction chamber, and apparatus for withdrawing vaporous hydrocarbon oil products of conversion therefrom, which comprises a downwardly depending outlet conduit member extending into said reaction chamber and into the body of vapors therein heated to conversion temperature, said conduit being open at its lower end, a jacket surrounding said conduit member from a point adjacent the lower end thereof to a point substantially above the said lower end and adapted to receive a liquid cooling medium, means for spraying a liquid cooling medium over the exterior of said jacket at a point substantially above the lower end of said conduit, and means for supplying liquid cooling media to said jacket and to said spray means.

5. In combination, a reaction chamber, and apparatus for withdrawing vaporous hydrocarbon oil products of conversion therefrom, which comprises an outlet conduit member extending into said reaction chamber and into the body of vapors heated to conversion temperature therein, said conduit having an open end opening into the said body of vapors for withdrawing vapors from said chamber while at conversion temperature, a jacket on the extending portion of said conduit member within said reaction chamber and adapted to receive fluid cooling media, means for spraying fluid cooling media into vapors adjacent the open end of said conduit, means for supplying cooling fluid to said jacket, and means for passing cooling fluid from said jacket to said spray means.

6. In combination, a reaction chamber, and apparatus for withdrawing vaporous hydrocarbon oil products of conversion therefrom, which comprises an outlet conduit member extending into said reaction chamber and into the body of vapors heated to conversion temperature therein, said conduit having an open end for receiving vapors to be withdrawn from said chamber, means for spraying fluid cooling media over a portion of the exterior of said conduit within said reaction chamber, means for spraying fluid cooling media into the vapors adjacent the open end of said conduit, and means for supplying fluid to each of said spray means.

7. In combination, a reaction chamber, and apparatus for withdrawing vaporous hydrocarbon oil products of conversion therefrom, which comprises an outlet conduit member extending into said reaction chamber and into the body of vapors heated to conversion temperature therein, said conduit having an open end for receiving vapors to be withdrawn from said chamber, means for spraying fluid cooling media over a portion of the exterior of said conduit within said reaction chamber, means for spraying fluid cooling media across and adjacent the open end of said conduit, and means for supplying cooling fluid to each of said spray means.

8. In combination, a reaction chamber, and apparatus for withdrawing vaporous hydrocarbon oil products of conversion therefrom, which comprises an outlet conduit member extending into said reaction chamber and into the body of vapors heated to conversion temperature therein, the extending portion of said conduit being provided with a surrounding jacket for receiving fluid cooling media, and having an open end for receiving vapors, means for spraying fluid cooling media over a portion of the exterior of said jacket, means for spraying fluid cooling media into the vapors adjacent the open end of said conduit, and means for supplying cooling fluid to said jacket and to each of said spray means.

9. In combination, a reaction chamber, and apparatus for withdrawing vaporous hydrocarbon oil products of conversion therefrom, which comprises an outlet conduit member extending into said reaction chamber and into the body of vapors heated to conversion temperature therein, the extending portion of said conduit being provided with a surrounding jacket for receiving fluid cooling media and having an open end for receiving vapors, means for spraying fluid cooling media over a portion of the exterior of the jacket on said conduit, means for spraying fluid cooling media across and adjacent the open end of said conduit and into the vapors adjacent the open end of said conduit, and means for supplying cooling fluid to said jacket and to each of said spray means.

10. In the method of converting hydrocarbon oils into lower boiling hydrocarbon oils wherein a body of hydrocarbon oil vapors is maintained at conversion temperature within an enlarged chamber having a vapor discharge conduit protruding therein and provided with a surrounding jacket for receiving a fluid cooling medium, the steps of withdrawing vaporous products of conversion from said chamber through said conduit, introducing a fluid cooling medium into said jacket, discharging a fluid cooling medium against the exterior wall of said jacket thereby cooling the fluid within said jacket, and discharging a fluid cooling medium into the

vaporous products entering said conduit member.

11. In the method of converting hydrocarbon oils into lower boiling hydrocarbon oils wherein a body of hydrocarbon oil vapors is maintained at conversion temperature within an enlarged chamber having a vapor discharge conduit protruding therein and provided with a surrounding jacket for receiving a fluid cooling medium, the steps of withdrawing vaporous products of conversion from said chamber through said conduit, introducing a fluid cooling medium into said jacket to cool said conduit, and discharging a fluid cooling medium against the exterior wall of said jacket, thereby cooling the fluid within said jacket.

In testimony whereof, I hereunto affix my signature, this 18th day of April, 1930.

HAROLD R. SNOW.