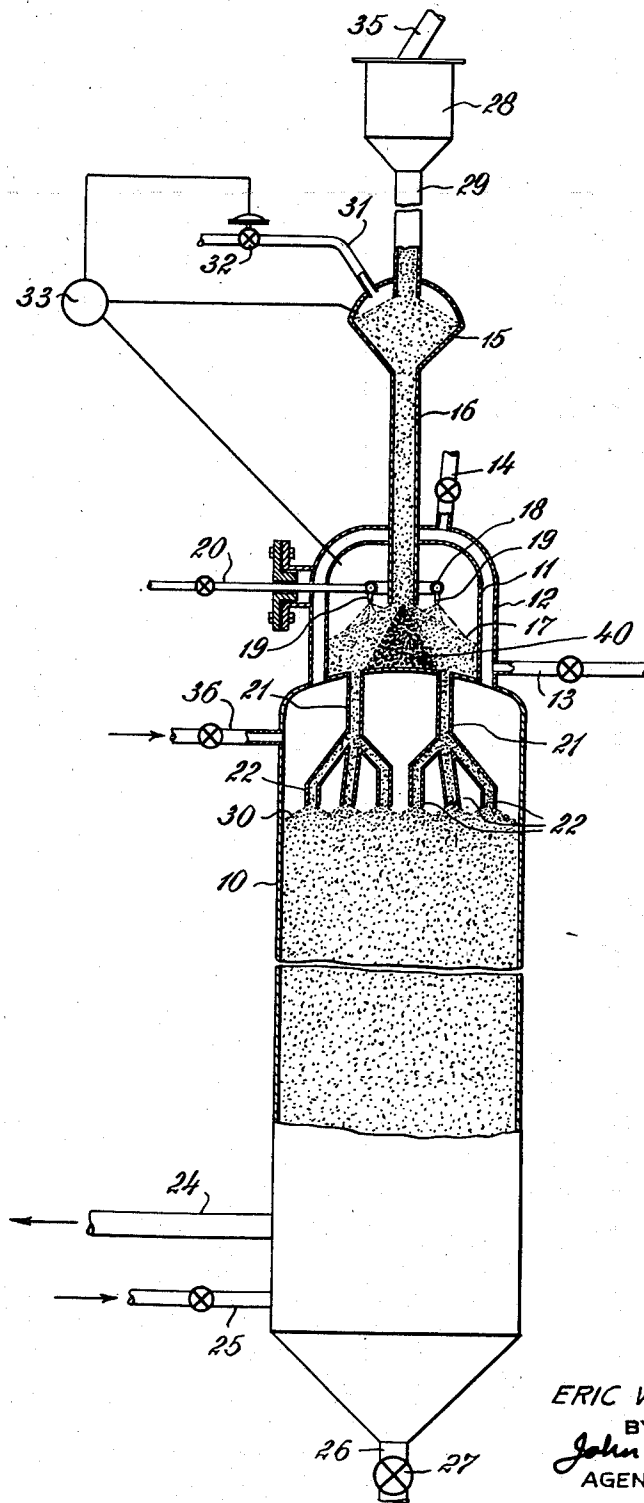


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METHOD AND APPARATUS FOR CONVERSION
OF FLUID HYDROCARBONS
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METHOD AND APPARATUS FOR CONVERSION OF FLUID HYDROCARBONS

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This invention has to do with a method and apparatus for conversion of high boiling liquid hydrocarbons or mixed phase hydrocarbons to lower boiling hydrocarbons in the presence of a moving particle-form contact mass material which may or may not exhibit catalytic properties with respect to the conversion reaction. Typical of such processes is the catalytic conversion of heated liquid hydrocarbons to lower boiling gasoline containing gaseous products by the contacting of a high boiling liquid charge at temperatures of the order of 850° F. and upwards with a particle-form adsorbent catalytic material. Other exemplary processes are the thermal visbreaking, coking or cracking of liquid or mixed phase hydrocarbon charge by contact with heated particle-form inert contact materials.

Another difficulty arising in systems for the conversion of high boiling liquid hydrocarbons is the tendency for the liquid charge to form coke on hot metal surfaces at the inlet end of the converter. In cyclic conversion systems used for conversion of vaporized hydrocarbons it has been customary to supply the contact material into the conversion chamber through one or more tubes extending downwardly through a short upper section of said chamber and terminating at the surface of the column of contact material within said chamber. When a liquid or mixed phase hydrocarbon charge is to be converted it is desirable to supply all or a large part of the heat required for conversion in the incoming contact material. This means that the incoming contact material and the tubes through which it enters and other metal surfaces in the upper section of the conversion vessel exist at temperatures sufficiently high to cause, upon contact by the liquid hydrocarbon charge, rapid conversion of said charge. As a result there is a marked tendency for coke to form on the hot tubes and metal surfaces in the upper section of the conversion vessel. This coke eventually breaks off from the metal surfaces in large chunks which pass downwardly through the converter and plug up restricted passages for solid flow near the lower end of the converter and in other portions of the cyclic system.

A major object of this invention is the provision in a process for conversion of high-boiling fluid hydrocarbons in the presence of a column of moving contact material particles of method and apparatus for supplying of contact material and fluid hydrocarbons onto the contact material column within the conversion zone which method and apparatus overcome the above described difficulties.

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Another object is the provision of a practical process for the simultaneous catalytic conversion of gaseous and liquid hydrocarbons in the presence of a moving mass of particle-form catalyst.

Another object is the provision in a continuous cyclic process for conversion of high boiling liquid or mixed phase hydrocarbons of an improved method and apparatus for hydrocarbon and contact material introduction into the conversion zone.

These and other objects of this invention will become apparent from the following discussion of the invention. Before proceeding with this discussion certain terms used in describing and in claiming this invention will be defined. The term "gaseous," as used herein, is intended to refer to a material existing in the gaseous phase under the particular operating conditions of pressure and temperature involved regardless of what may be the normal phase of that material under ordinary atmospheric conditions. The expression "contact material" is employed herein in a broad sense as covering solid particles which are suitable as a contacting or heat carrying agent for the particular conversion involved regardless of whether such solid particles exhibit a catalytic effect towards the conversion or not.

The invention may be best understood by reference to the single drawing attached hereto which is an elevational view, partially in section of an apparatus combination constructed according to this invention. In the drawing, there is shown a substantially vertical conversion vessel 10 which may be of circular or of any other suitable cross-sectional shape. Above the reactor is provided a mixing chamber 11 having a jacket 12 around its walls. An inlet conduit 13 is connected into the jacket for cooling fluid introduction to the jacketed space. An outlet conduit 14 is provided for fluid withdrawal from the jacketed space. A seal chamber 15 is positioned at a level above the mixing chamber 11. A conduit 16 extends downwardly from the seal chamber to a location within the mixing chamber below the upper end but above its lower end for flow of contact material from the seal chamber onto the bed of contact material 17 maintained in the mixing chamber. A ring type manifold 18 provided with downwardly depending spray nozzles 19 is positioned within chamber 11 above the surface level of bed 17. Liquid hydrocarbons may be introduced to this spray device through conduit 20 connecting into manifold 18. A plurality of conduits 21 having branches 22 at their lower ends extend downwardly from the bottom of cham-

ber 11 for flow of contact material into the upper section of conversion vessel 10. The branch pipes 22 all terminate at a common level below the upper end of vessel 10 and are spaced to deliver contact material uniformly over the entire cross-sectional area of vessel 10. An outlet 24 for withdrawal of gaseous material connects into the lower section of vessel 10. This outlet may communicate with suitable gas collecting devices (not shown) such as inverted troughs positioned within the lower section of vessel 10. An inlet 25 for purge gas introduction connected into vessel 10 below the level of conduit 24. A solid drain conduit bearing flow control valve 27 is provided at the lower end of vessel 10. Suitable baffles (not shown) may be provided within the lower section of vessel 10 to insure withdrawal of contact material uniformly from all portions of the vessel horizontal cross-sectional area.

In operation heated contact material existing at a temperature suitable for supporting the desired hydrocarbon conversion is supplied from hopper 28 through elongated gravity feed leg 29 into seal chamber 15. The contact material passes as a substantially compact column downwardly from seal chamber 15 through conduit 16 onto the surface of the contact material bed 17 within mixing chamber 11. The zone 40 in chamber 11 represents a zone wherein the contact material flow is very low or nil. A conical baffle may be provided in this zone if desired. Heated high boiling liquid hydrocarbons are introduced through conduit 20 to manifold 18 and spray nozzles 19 from which it is sprayed onto the surface of the bed 17 so as to become mixed with the contact material in chamber 11. In order to insure uniform mixing of the liquid and the contact material in chamber 11, the dimensions of chamber 11 and the level of the lower end of conduit 16 in chamber 11 should be such that the depth of the flowing stream of contact material at its shallowest point in chamber 11, which in the arrangement shown is just adjacent the end of conduit 16, is of the order of $\frac{1}{4}$ to $\frac{3}{4}$ inches while the depth of the flowing contact material stream at its deepest point is of the order of 3 to 5 inches. The oil charge should be sprayed onto the contact material where its depth of stream is least. The mixed liquid and contact material pass as a plurality of compact streams downwardly from chamber 11 onto the column of contact material 30 within the vessel 10. The contact material and liquid hydrocarbons pass downwardly within the column 30, so that the liquid hydrocarbons are converted to lower boiling gaseous hydrocarbon products. These gaseous products are withdrawn from the lower section of the conversion zone through conduit 24 and are passed to a conventional fractionation system (not shown). The used contact material is withdrawn from the lower end of vessel 10 through conduit 26 at a rate controlled by means of valve 27. By throttling the flow with valve 27 continuity of compact contact material body is maintained unbroken upwardly from the point of throttling through the conversion zone, pipes 22 and 21, bed 17 in chamber 11, conduit 16, the bed in chamber 15, and feed leg 29 to the accumulation in hopper 28. The used contact material may be passed through a reconditioning chamber (not shown) to condition it for re-use in the conversion chamber. For example, if the process involved is a catalytic conversion operation, the particle-form catalyst bearing a carbonaceous contaminant may be subjected un-

der controlled elevated temperature to contact with air to burn off the contaminant. The hot regenerated catalyst is then supplied to hopper 28 through conduit 35. Gaseous hydrocarbons may be purged from the used contact material in the lower section of vessel 10 by the introduction of an inert purging gas such as steam or flue gas through conduit 25. The escape of hydrocarbons from chamber 11 through the contact material feed system may be prevented by the introduction of a suitable inert seal gas such as steam or flue gas into seal chamber 15 through conduit 31 at a rate controlled by diaphragm actuated valve 32 and differential pressure control instrument 33 such as will maintain the seal gas pressure in chamber 15 slightly above the gaseous pressure in chamber 11. For example, the pressure in chamber 15 may be maintained about $\frac{1}{4}$ to $\frac{1}{2}$ pound per square inch above that in chamber 11.

In the above described operation, the entering contact material should exist at a temperature sufficiently high to provide the heat for the desired hydrocarbon conversion without the contact material temperature in vessel 10 falling below a level suitable for rapid hydrocarbon conversion. For example, in catalytic cracking operations, the catalyst may enter chamber 11 at temperatures of the order of 950–1150° F. These temperature levels are sufficiently high to cause rapid cracking conversion of the high boiling liquid hydrocarbon charge. During such cracking conversion a substantial amount of coke may be formed. This coke, if deposited on the catalyst may be easily withdrawn from the conversion system and removed by burning. If, however, it deposits on metal walls such as the walls above the catalyst level in chamber 11, it may accumulate in large chunks. These chunks may eventually break off from the chamber walls and join the catalyst stream. Soon the chunks plug up the system at some restricted point and prevent further catalyst flow. To avoid this a suitable cooling medium is introduced into the jacketed space around chamber 11 through inlet 13. The cooling medium is withdrawn through pipe 14. The cooling medium may take the form of a gas such as steam or it may preferably take the form of a liquid such as hot water under pressure or certain low melting point mixtures of fused inorganic salts or certain low melting metal alloys. The rate of flow and temperature of the cooling medium should be controlled such as to control the temperature of the walls of chamber 11, particularly at points above the level of bed 17 below a level which would promote the substantial deposition of coke on the walls if they are contacted by the high boiling liquid hydrocarbon charge. In general, the wall temperature should be controlled below about 750° F. and preferably within the range about 500–600° F.

Inasmuch as the liquid hydrocarbon charge is uniformly deposited on the contact material delivering onto the surface of column 30 in the conversion vessel, vaporized hydrocarbon charge may be introduced through conduit 36 above the level of column 30 and then passed downwardly through column 30 without any gas channeling difficulties arising. Thus both liquid and gaseous hydrocarbon charges may be simultaneously converted to lower boiling gaseous hydrocarbons in the system described hereinabove.

The method and apparatus described hereinabove may be applied to a number of different

processes for conversion of liquid or mixed phase petroleum stocks. For example, the conversion may be a strictly high temperature thermal conversion in the presence of a heat carrying particle-form inert material or it may be a catalytic cracking conversion. The operating conditions will, of course, vary widely depending upon the particular process and materials involved. As an example of the application of this invention its use in the catalytic cracking conversion of high boiling fluid hydrocarbons may be considered. In such an operation, a particle-form catalyst which may be of clay-type is introduced into the conversion chamber at a temperature within the range of about 900-1200° F. depending upon the desired conversion temperature, the clay to oil ratio and the particular hydrocarbon charge involved and the desired products. A liquid hydrocarbon charge which may consist principally of hydrocarbons boiling above the desired coverage conversion temperature is introduced through pipe 20. Such a charge may consist of a reduced crude which has been preferably preheated to a temperature of the order of 600-800° F. A gas oil fraction which may have been obtained from the same stock as the reduced crude, may be vaporized and heated to a temperature of the order of 800-950° F. in a conventional heater and introduced into the upper section of the convertor 10 through conduit 36. Gaseous products containing high yields of gasoline may be withdrawn from the conversion chamber through conduit 24. The pressure in the conversion chamber may be quite low, usually of the order of 5 to 30 pounds per square inch gauge. The total oil space velocity may be within the range of about 0.5 to 10 volumes of oil (measured as a liquid at 60° F.) per hour per volume of flowing catalyst in the conversion zone. The relative ratio of liquid to gaseous hydrocarbon charge may vary widely depending upon the specific refinery stock conditions. The catalyst to oil ratio on the weight basis may be within the range about 2.0 to 20 parts of catalyst charged per part of oil. In the regeneration zone, air may be employed to burn from the catalyst the carbon across contaminant formed thereon in the conversion zone. Sufficient heat should be withdrawn from the catalyst during regeneration to prevent it from reaching a heat damaging temperature. For clay type catalysts the heat damaging level is of the order of about 1200° F.

It will be understood that the particular details of apparatus design and operating conditions and the examples of application of this invention given hereinabove are intended as illustrative and should not be construed as limiting the scope of this invention except as it may be limited by the following claims.

I claim:

1. A method for conversion of high boiling liquid hydrocarbons in the presence of a moving particle-form contact material which comprises: maintaining an accumulation of particle-form contact material in a confined seal zone, introducing a substantially inert gas into said zone to maintain an inert gaseous atmosphere therein, supplying particle-form contact material at a suitable temperature for supporting conversion of said liquid hydrocarbons into said seal zone, passing contact material as a substantially compact, continuous stream downwardly from said seal zone onto the surface of a bed of said contact material maintained therebelow in a confined mixing zone, spraying a high boiling liquid hydro-

carbon charge onto said bed of contact material in said mixing zone, passing contact material and the liquid hydrocarbon charge mixed therewith as a plurality of substantially compact streams downwardly from said bed to a plurality of distributed locations on the surface of a column of said contact material maintained in a confined conversion zone therebelow, withdrawing used contact material from the lower section of said column at a controlled rate and withdrawing gaseous hydrocarbon conversion products from the lower section of said conversion zone substantially separately of said contact material.

2. A method for conversion of high boiling fluid hydrocarbons in the present of a moving particle-form contact material which comprises: maintaining an accumulation of particle-form contact material in a confined seal zone, introducing a substantially inert gas into said zone to maintain an inert gaseous atmosphere therein, supplying particle-form contact material at a suitable temperature for supporting conversion of said liquid hydrocarbons into said seal zone, passing contact material as a substantially compact, continuous stream downwardly from said seal zone onto the surface of a bed of said contact material maintained therebelow in a confined mixing zone, spraying a high boiling liquid hydrocarbon charge onto said bed of contact material in said mixing zone, passing contact material and the liquid hydrocarbon charge mixed therewith as a plurality of substantially compact streams downwardly from said bed to a plurality of distributed locations on the surface of a column of said contact material maintained in a confined conversion zone therebelow, introducing a heated gaseous hydrocarbon charge into the upper section of said conversion zone, passing said liquid and gaseous hydrocarbons downwardly within said column to effect their conversion to lower boiling gaseous hydrocarbon products, withdrawing used contact material from the lower section of said column at a controlled rate and withdrawing gaseous hydrocarbon conversion products from the lower section of said conversion zone substantially separately of said contact material.

3. A method for conversion of high boiling fluid hydrocarbons in the presence of a particle-form contact material which comprises: maintaining a substantially compact column of particle-form contact material within a confined conversion zone, maintaining a separately confined bed of said contact material above said conversion zone, substantially continuously supplying contact material to said bed at a suitable hydrocarbon conversion supporting temperature, supplying a heated high boiling liquid hydrocarbon charge onto the surface of said bed, to become mixed with said contact material, passing mixed liquid hydrocarbons and contact material downwardly from said bed as a plurality of confined streams discharging at a plurality of points on the surface of said column in said conversion zone, said points being uniformly distributed across the horizontal cross section of said column, introducing a vaporized hydrocarbon charge into the upper section of said conversion zone above the surface of said column, passing the contact material and liquid and gaseous hydrocarbons downwardly within said column to effect conversion of said hydrocarbons to lower boiling gaseous hydrocarbon products, withdrawing used contact material from the lower section of said column at a controlled rate and withdrawing gaseous hydrocarbon conversion products from the lower section of said conversion

zone substantially separately of said contact material.

4. A method for conversion of high boiling liquid hydrocarbons to lower boiling gaseous hydrocarbons in the presence of a moving particle-form contact material which method comprises: maintaining a substantially compact column of particle-form contact material within a confined conversion zone, maintaining a separately confined bed of said contact material above said conversion zone, substantially continuously supplying contact material to said bed at a suitable hydrocarbon conversion supporting temperature, supplying a heated high boiling liquid hydrocarbon charge onto the surface of said bed to become mixed with said contact material, passing a suitable fluid cooling medium in contact with the walls confining said bed so as to maintain said walls at a temperature substantially below that of said contact material so as to prevent the substantial formation of coke on said walls, passing mixed liquid hydrocarbons and contact material downwardly from said bed as a plurality of confined streams discharging at a plurality of points on the surface of said column in said conversion zone, said points being uniformly distributed across the horizontal cross section of said column, passing liquid hydrocarbons and contact material downwardly within said column to effect conversion of said hydrocarbons to lower boiling gaseous hydrocarbon products, withdrawing used contact material from the lower section of said column at a controlled rate and withdrawing gaseous hydrocarbon conversion products from the lower section of said conversion zone substantially separately of said contact material.

5. A method for conversion of high boiling fluid hydrocarbons to lower boiling hydrocarbon products in the presence of a moving particle form contact material which method comprises: maintaining an accumulation of particle-form contact material in a confined seal zone, introducing a substantially inert gas into said zone to maintain an inert gaseous atmosphere therein, supplying particle-form contact material at a suitable temperature for supporting conversion of said liquid hydrocarbons into said seal zone, passing contact material as a substantially compact, continuous stream downwardly from said seal zone onto the surface of a bed of said contact material maintained therebelow in a confined mixing zone, spraying a high boiling liquid hydrocarbon charge onto said bed of contact material in said mixing zone, passing a fluid cooling medium in contact with the walls of said seal zone to cool said walls below a temperature which will support substantial coking of said liquid hydrocarbon charge, passing said contact material and said liquid hydrocarbon charge mixed therewith as a substantially compact, confined stream downwardly from said bed onto the surface of a substantially compact column of said contact material maintained in a confined elongated conversion zone therebelow, introducing a vaporized hydrocarbon charge into the upper section of said conversion zone, passing said contact material and the liquid and vaporized hydrocarbons downwardly within said column to effect conversion of said hydrocarbons to lower boiling hydrocarbons, withdrawing used contact material from the lower section of said column at a controlled rate and withdrawing gaseous hydrocarbon conversion products from the lower section of said conversion zone substantially separately of said contact material.

6. An apparatus for conversion of high boiling fluid hydrocarbons to lower boiling hydrocarbons which comprises in combination: an elongated conversion chamber adapted to confine an upright column of particle-form contact material, a seal chamber adapted to confine a bed of said contact material positioned at a level above said conversion chamber, an inlet for an inert seal gas to said seal chamber, means to supply particle-form contact material to said seal chamber, a mixing chamber adapted to confine a bed of said contact material at a level between said seal chamber and said conversion chamber, conduit means for contact material flow connected between said seal chamber and said mixing chamber, said conduit means terminating below the upper end of said mixing chamber but substantially above the bottom thereof, a spray device positioned within the upper section of said mixing chamber and adapted to spray liquid hydrocarbons downwardly within said chamber, means to supply a high boiling liquid hydrocarbon charge to said spray device, a plurality of conduits extending downwardly from said mixing chamber for flow of contact material into said conversion chamber, said conduits terminating on their lower ends at a plurality of uniformly, horizontally spaced locations within said conversion chamber, means to withdraw contact material from the lower section of said conversion chamber at a controlled rate, and a separate outlet for withdrawal of gaseous material from the lower section of said conversion chamber.

7. An apparatus for conversion of high boiling fluid hydrocarbons to lower boiling hydrocarbons which comprises in combination: an elongated conversion chamber, a seal chamber adapted to confine a bed of contact material positioned at a level above said conversion chamber, a conduit for inert seal gas supply connecting into said seal chamber, means to supply particle form contact material into said seal chamber, a mixing chamber positioned at a level between said seal chamber and said conversion chamber, a conduit for solid flow extending down from the bottom of said seal chamber to a level within and intermediate the upper and lower ends of said mixing chamber, a spray device positioned within the upper section of said mixing chamber with spray openings pointed downward, a conduit connected to said spray device for supply of liquid hydrocarbon charge, at least one conduit for solid flow extending downwardly from said mixing chamber into the upper section of said conversion chamber, said conduit terminating on its lower end at a level within the upper section of the conversion chamber spaced below its upper end, a conduit for gaseous hydrocarbon introduction connecting into said conversion chamber above the level of the lower end of said last named conduit, means to withdraw contact material from the lower section of said conversion chamber, and flow throttling means associated therewith, and means to substantially separately withdraw gaseous material from the lower section of said conversion chamber.

8. An apparatus for conversion of high boiling fluid hydrocarbons to lower boiling hydrocarbons which comprises in combination an elongated conversion chamber adapted to confine an upright column of particle-form contact material, a closed seal chamber positioned at a level above said conversion chamber, an elongated conduit extending vertically upward from said seal chamber for gravity flow of contact material into said

seal chamber, a conduit for supply of an inert seal gas connected to said seal chamber, a closed mixing chamber positioned between said seal chamber and said conversion chamber, a conduit for solid flow extending from the bottom of said seal chamber into said mixing chamber and terminating on its lower end below the upper end of said mixing chamber but substantially above the bottom thereof, a spray device positioned within the upper section of said mixing chamber with spray openings pointed downwardly, a conduit connected to said spray device for supply of a high boiling liquid hydrocarbon charge, a jacket defining a jacketed space around at least the upwardly extending walls of said mixing chamber, conduit means for supply of a cooling fluid to said jacketed space and conduit means for withdrawal of cooling fluid therefrom, at least one conduit for solid flow extending downwardly from said mixing chamber into the upper section of said conversion chamber, said conduit terminating on its lower end at a level within the upper section of the conversion chamber spaced below its upper end, a conduit for gaseous hydrocarbon introduction connecting into said conversion chamber above the level of the lower end of said last named conduit, means to withdraw contact material from the lower section of said conversion chamber, and flow throttling means associated therewith, and means to substantially separately withdraw gaseous material from the lower section of said conversion chamber.

9. An apparatus for conversion of high boiling liquid hydrocarbons to lower boiling hydrocarbons in the presence of a moving particle-form contact material which comprises in combination: a substantially vertical, elongated conversion vessel closed on either end, a mixing chamber above said conversion vessel adapted to confine a bed of contact material, a jacket defining a closed jacketed space around the vertical walls of said mixing chamber, a conduit associated with said jacket for cooling fluid introduction to said jacketed space and conduit means for fluid withdrawal therefrom, a contact material supply conduit extending upwardly through the top of said mixing chamber from an intermediate level therein, a spray device in the upper section of said mixing chamber adapted to spray liquid downwardly within said chamber, conduit means for supply of liquid hydrocarbons to said spray device, a plurality of conduits extending downwardly from said mixing chamber for flow of contact material into said conversion chamber, said conduits terminating on their lower ends at a plurality of uniformly, horizontally spaced locations within said conversion chamber, means to withdraw contact material from the lower section of said conversion chamber at a controlled rate, and means to separately withdraw gaseous material from the lower section of said conversion chamber.

10. A method for conversion of high boiling liquid hydrocarbons to lower boiling gaseous hydrocarbons in the presence of a moving particle-form contact material which method comprises: maintaining a substantially compact column of particle-form contact material within a confined conversion zone, maintaining a separately confined bed of said contact material in a second confined zone, supplying heated contact material to said bed at a temperature sufficiently high to supply the heat required for said hydrocarbon conversion, supplying a high boiling liquid hydrocarbon charge onto the surface of said bed to become mixed with said contact material, passing mixed liquid hydrocarbons and contact material from said bed as a plurality of streams discharging at a plurality of points on the surface of said column in said conversion zone, said points being uniformly distributed across the horizontal cross-section of said column, withdrawing used contact material from the lower section of said column at a controlled rate to promote downward movement of said mixed liquid hydrocarbons and contact material within said conversion zone, thereby effecting conversion of said hydrocarbons to lower boiling gasiform hydrocarbon products, and withdrawing gasiform hydrocarbon conversion products from said conversion zone.

drocarbon charge onto the surface of said bed to become mixed with said contact material, passing mixed liquid hydrocarbons and contact material from said bed as a plurality of streams discharging at a plurality of points on the surface of said column in said conversion zone, said points being uniformly distributed across the horizontal cross-section of said column, withdrawing used contact material from the lower section of said column at a controlled rate to promote downward movement of said mixed liquid hydrocarbons and contact material within said conversion zone, thereby effecting conversion of said hydrocarbons to lower boiling gasiform hydrocarbon products, and withdrawing gasiform hydrocarbon conversion products from said conversion zone.

11. A method for conversion of high boiling liquid hydrocarbons to lower boiling gaseous hydrocarbons in the presence of a moving particle-form contact material which method comprises: maintaining a substantially compact column of particle-form contact material within a confined conversion zone, maintaining a separately confined bed of said contact material in a second confined zone, supplying heated contact material to said bed, supplying a high boiling liquid hydrocarbon charge onto the surface of said bed to become mixed with said contact material, passing a suitable fluid cooling medium in contact with the walls confining said bed so as to maintain said walls at a temperature substantially below that of said contact material so as to prevent the substantial formation of coke on said walls, passing mixed liquid hydrocarbons and contact material from said bed onto the surface of said column in said conversion zone, withdrawing used contact material from the lower section of said column at a controlled rate to promote downward movement of said mixed liquid hydrocarbons and contact material within said conversion zone, thereby effecting conversion of said hydrocarbons to lower boiling gasiform hydrocarbon products, and withdrawing gasiform hydrocarbon conversion products from said conversion zone.

12. A method for conversion of high boiling liquid hydrocarbons in the presence of a particle-form contact material which comprises: maintaining a substantially compact column of particle-form contact material within a confined conversion zone, maintaining a separately confined gravity flowing stream of varying depth of said contact material above said conversion zone, said stream being of a minimum depth of at least about one-quarter inch and of a maximum depth not greater than about 5 inches substantially continuously supplying contact material to said stream at a suitable hydrocarbon conversion supporting temperature, supplying a heated high boiling liquid hydrocarbon charge onto the surface of said stream, to become mixed with said contact material, passing mixed liquid hydrocarbons and contact material downwardly from said stream as a plurality of confined streams discharging at a plurality of points on the surface of said column in said conversion zone, said points being uniformly distributed across the horizontal cross-section of said column, withdrawing used contact material from the lower section of said column at a controlled rate and withdrawing gaseous hydrocarbon conversion products from said conversion zone substantially separately of said contact material.

13. A method for conversion of high boiling fluid hydrocarbons in the presence of a moving parti-

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cle-form contact material which comprises: maintaining an accumulation of particle-form contact material in a confined seal zone, introducing a substantially inert gas into said zone to maintain an inert gaseous atmosphere therein, supplying particle-form contact material at a suitable temperature for supporting conversion of said liquid hydrocarbons into said seal zone, passing contact material from said seal zone onto the surface of a bed of said contact material maintained in a separate confined mixing zone, supplying a high boiling liquid hydrocarbon charge onto said bed of contact material in said mixing zone, passing contact material and the liquid hydrocarbon charge mixed therewith as a plurality of substantially compact streams downwardly from said bed to a plurality of distributed locations on the surface of a column of said contact material maintained in a confined conversion zone therebelow, passing said liquid hydrocarbons and said contact material downwardly within said conversion zone to effect conversion of said liquid hydrocarbons to lower boiling gasiform hydrocarbon products, withdrawing used contact material from the lower section of said column at a controlled rate and withdrawing gasiform hydrocarbon products from said conversion zone.

14. An apparatus for conversion of high boiling fluid hydrocarbons to lower boiling hydrocarbons comprising, an elongated vertical conversion chamber closed on its ends, a closed seal chamber positioned above said conversion chamber, a conduit for inert gas supply connecting into the upper section of said seal chamber, an elongated vertical feed conduit extending upwardly from said seal chamber, a contact material supply hopper connected to the upper end

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of said conduit, a closed mixing chamber positioned between said seal chamber and said conversion chamber, a conduit for solid flow extending downwardly from the bottom of said seal chamber and terminating within said mixing chamber at a level spaced substantially above its bottom, a spray device having downwardly facing spray openings positioned within said mixing chamber near the lower end of said last named conduit, a conduit connected to said spray device for supply of liquid hydrocarbon charge thereto, a plurality of conduits extending downwardly from said mixing chamber for flow of contact material into said conversion chamber, said conduits terminating on their lower ends at a plurality of uniformly, horizontally spaced locations within said conversion chamber, means to withdraw contact material from the lower section of said conversion chamber at a controlled rate, and a separate outlet for withdrawal of gaseous material from the lower section of said conversion chamber.

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