May 8, 1934. E. HOUDRY 1,957,648

PROCESS AND APPARATUS FOR THE TREATMENT OF HEAVY OILS AND THE LIKE FOR THE CONVERSION THEREOF INTO LIGHTER PRODUCTS

Filed Feb. 16, 1931

Fig. 1.

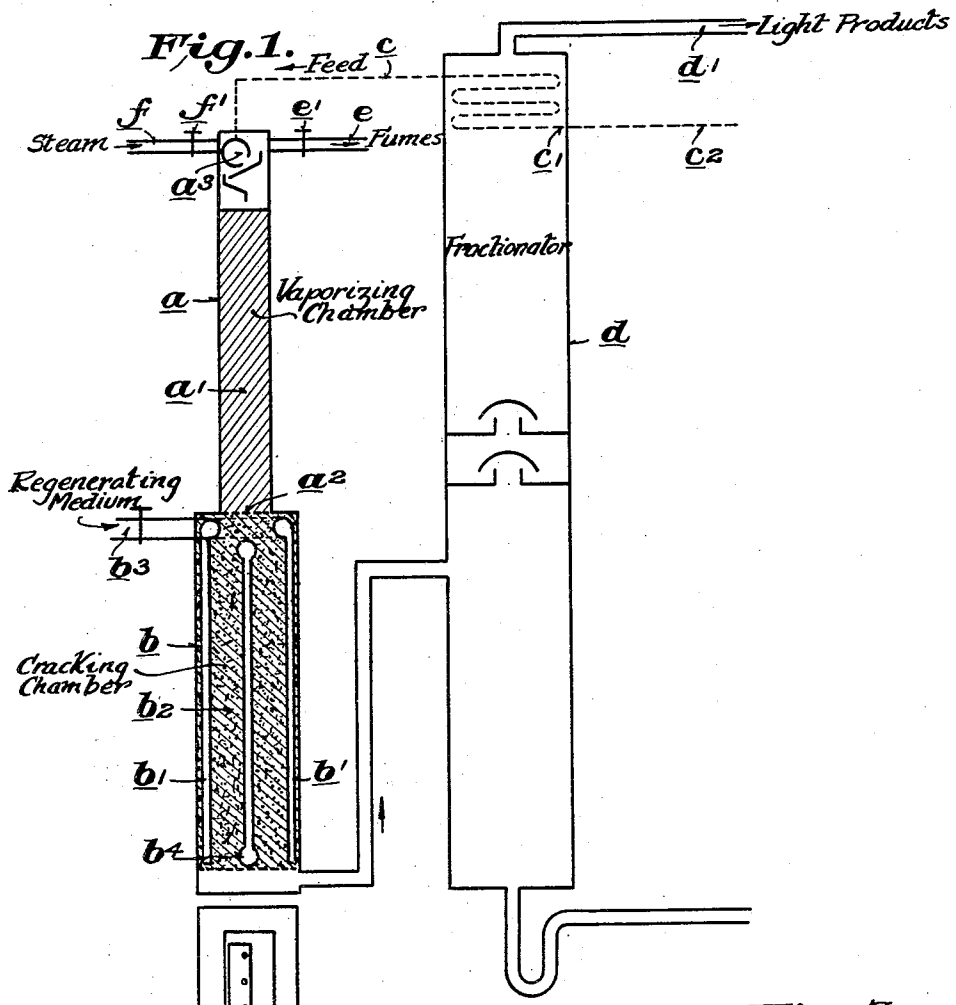


Fig. 2.

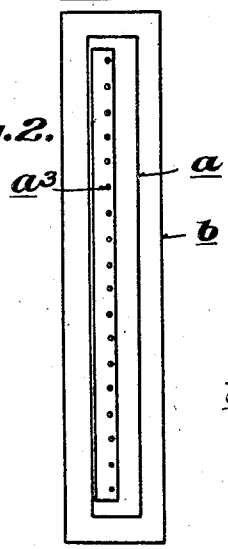
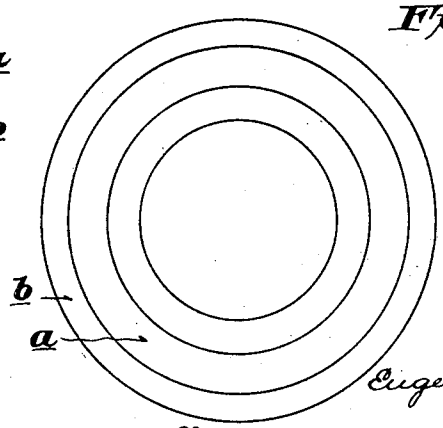


Fig. 3.



Inventor

Eugene Houdry

By Cameron, Kerkam & Sutton

Attorneys

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PROCESS AND APPARATUS FOR THE TREATMENT OF HEAVY OILS AND THE LIKE FOR THE CONVERSION THEREOF INTO LIGHTER PRODUCTS

Eugene Houdry, Paris, France, assignor, by mesne assignments, to Houdry Process Corporation, Dover, Del., a corporation of Delaware

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5 Claims. (Cl. 196—52)

This invention relates to a process and apparatus for the treatment of heavy oils and other like products for the conversion thereof into lighter products.

It is known for converting heavy oils into lighter products to effect in various ways preliminary vaporization in suitable vessels provided with contact substances and on issue therefrom to separate the heavier products in order to treat the vapours in an apparatus wherein cracking is effected in the presence of catalysts.

These known methods involve the use of a cumbersome plant which does not enable the whole of the starting materials to be treated, a fraction of the products being normally separated in the vaporizers and on issuing from these latter, in the form of residues such as pitch and coke.

The subject of the present invention is a process and an apparatus which, not only enable the size of the plant to be considerably reduced, but render possible the treatment of the whole of the starting materials without separation of the liquid or semi-liquid products on issuing from the vaporizers.

For this purpose, according to the invention, the vaporization and the subsequent catalytic cracking are effected in a common vessel wherein the vaporization is effected in an upper element, the catalytic cracking being effected in a directly subjacent element, in such manner that the products, whatever may be their degree of vaporization, pass directly by gravity from the vaporizer into the cracking chamber. This arrangement avoids any piping between the vaporizer and the catalytic cracking chamber and it enables on the other hand the regeneration of the catalyst of the cracking chamber to be effected at the same time as that of the contact mass over which is effected the vaporization in the upper vaporizer of the common vessel.

According to a practical form of construction of the invention, the vaporization chamber superposed on the cracking chamber, is constituted by a rectilinear or annular flat casing, closed at its upper end and opening at its lower end into a flat cracking casing, of similar shape, but of larger width, the vaporization chamber receiving at its upper end the oil to be treated supplied by a distributing trunk, which is fed by a pipe which may be heated by locating one of its sections, made in serpentine form, within the dephlegmator wherein the products are treated on issuing from the cracking chamber.

The arrangement for carrying out the new process is illustrated diagrammatically and by way of example on the accompanying drawing, in which:—

Fig. 1 is an elevation;

Fig. 2 is a corresponding plan; and

Fig. 3 is a plan of a modification.

In this drawing, a is the upper element of a vessel a—b, wherein the vaporization is effected in the upper compartment or element a, whereas the catalytic cracking is effected in the lower subjacent element b. In this example, the common vessel a—b is constructed of sheet metal, the upper compartment a being closed at its upper end, whereas the lower compartment b is closed at its lower end. The compartment a which serves as the vaporization chamber is preferably of less width than the compartment b and may, in the known manner, be charged with a porous contact material a^1, located on a perforated false bottom a^2. The contact material a^1 occupies only a portion of the height of the vaporization compartment, metal devices for promoting vaporization in thin layers (inclined plates or balls) being located above the contact material. The oil to be treated is distributed along the entire length of the compartment a by a trunk a^3 to which it is led by a pipe c which may comprise a serpentine section c^1 located in the upper portion of the distillation column d, wherein the converted products are treated on issuing from the catalyst compartment b. This catalyst compartment, into which the products pass by gravity on issuing from the vaporizing compartment a, may be constructed in any known suitable manner, but preferably is in accordance with the United States patent application Serial No. 440,199½, filed by Alfred Joseph on the 31st of March, 1930. Thus it preferably comprises a series of perforated pipes b, located in the mass b^2 of catalyst, and through which can be periodically distributed with a view to regeneration of the said catalyst, for example, air or a mixture of air and some other gaseous medium as steam arriving by a pipe b^3. Likewise also (in accordance with the said United States of America application of 31st March 1930), in the body of the mass b^2 a pipe b^4 can be provided for air or water for cooling during the regeneration operation. In the event of the use of cooling water, the steam produced by the interchange of heat between the catalytic mass and such water during the regeneration period, may be recuperated in order to serve as regeneration

agent in mixture with air distributed by the pipe b^3.

The contact material a' in element a may be inert, porous, absorbent bodies in the form of small pellets, small tubes or rings made of burned clay, China clay, kieselguhr or any similar material having little or no polymerizing, depolymerizing or other catalytic activity under the conditions of operation. The cracking catalyst b^2 in element b comprises adsorbent or catalytically active material, such, for example, as activated clay with or without additional active or non-active material, also molded into bodies of substantially uniform size and thickness of wall. The operating temperatures will depend upon the nature of the oil to be treated but in most instances will be within the range of 300–550° C. While a substantially atmospheric pressure is preferred, satisfactory results are secured when operating at pressures above or below atmospheric.

It is easily appreciated that the regeneration agent insufflated by the pipe b^3, after having traversed the catalyst b^2, will rise through the contact mass a^1, and that thus the regeneration of the catalyst located in the compartment b and the regeneration of the absorbent contact mass a^1 in the vaporization chamber, can be effected simultaneously. The regenerating agent and the gaseous products derived from the regeneration escape by a pipe e, a cock e^1 enabling this outlet pipe to be cut off during the periods of treatment. The vaporizing compartment may be supplied with water or steam by a pipe f provided with a cock f^1. As shown by the diagram Fig. 3, the compartments a—b, may be constructed in the form of sheet metal casings of annular shape.

The arrangement described may be employed in combination with any known means for refining the light products leaving the column d by the pipe d^1. As stated above, the oil to be treated derived from a reservoir not illustrated, may be led to the vaporizing compartment a by a pipe c^2—c^1—c, of which a section c^1 is located in serpentine form inside the column d, with a view to a preliminary heating of the oil by means of the vapours which pass from the said column d to the refining plant.

The present invention also contemplates employing a group of casings, according to Figs. 1 and 2, arranged mutually parallel in one and the same stove, which arrangement permits continuous operation of the plant and enables the volume of the stoves to be reduced to a minimum.

What is claimed is:

1. Process for the treatment of heavy oils and other like products for the conversion thereof into lighter products, comprising vaporizing the material to be converted while in contact with absorbent material, subjecting the products to catalytic cracking, the vaporization and the subsequent catalytic cracking being effected at a conversion temperature, the vaporization being effected in an upper zone and the catalytic cracking in a directly subjacent zone in such manner that the products pass directly from the vaporizing zone into the cracking zone, without any dephlegmation and without it being necessary to subject them to a preliminary heating, and effecting the regeneration of the catalyst of the cracking zone and the regeneration of the absorbent material employed in the vaporizing zone by the same regenerating gases.

2. Process for the conversion of hydrocarbons which comprises vaporizing the hydrocarbon while in contact with inert absorbent material, moving all the liquid products by gravity together with the vapors from the vaporizing step under the same pressure and temperature conditions into contact with an adsorbent catalyst thereby to effect a cracking step, both vaporizing and cracking being effected at a conversion temperature, regenerating the absorbent and the adsorbent material together while still in place and in a single operation, and repeating the above steps.

3. In apparatus for the conversion of hydrocarbons, an evaporating chamber containing porous contact material, a cracking chamber containing adsorbent catalytic material, said evaporating chamber being disposed above said cracking chamber and opening directly into the latter whereby all of the liquid products of the evaporating chamber pass by gravity into said cracking chamber, and means for admitting regenerating fluid to said cracking chamber and for discharging it at the top of said evaporating chamber thereby to free both said adsorbent catalytic material and said porous contact material simultaneously of deposits.

4. In apparatus for the conversion of hydrocarbons, a casing providing two converting chambers in superposed relation, distributing means for the hydrocarbon material at the top of the upper or evaporating chamber, a mass of inert absorbent contact material beneath said distributing means, a mass of adsorbent catalytic material in the lower or cracking chamber, means for distributing regenerating fluid throughout said adsorbent catalytic material, and means for discharging such fluid and the products of the regenerating operation at the top of said upper or vaporizing chamber.

5. In apparatus for the conversion of hydrocarbons, a casing providing two connecting chambers in superposed relation, the upper or evaporating chamber being of less extent than the lower or cracking chamber, distributing means for the hydrocarbon at the top of said evaporating chamber, baffle means beneath said distributing means, a mass of absorbent contact material beneath said baffle means, a grid adjacent the top of said cracking chamber for supporting said contact mass, adsorbent catalytic material in said cracking chamber, means for distributing regenerating fluid throughout said adsorbent catalytic material, and means for discharging the regenerating fluid at the top of said evaporating chamber thereby to free said absorbent contact material of carbon and other deposits at the same time that said adsorbent material is regenerated.

EUGENE HOUDRY.