

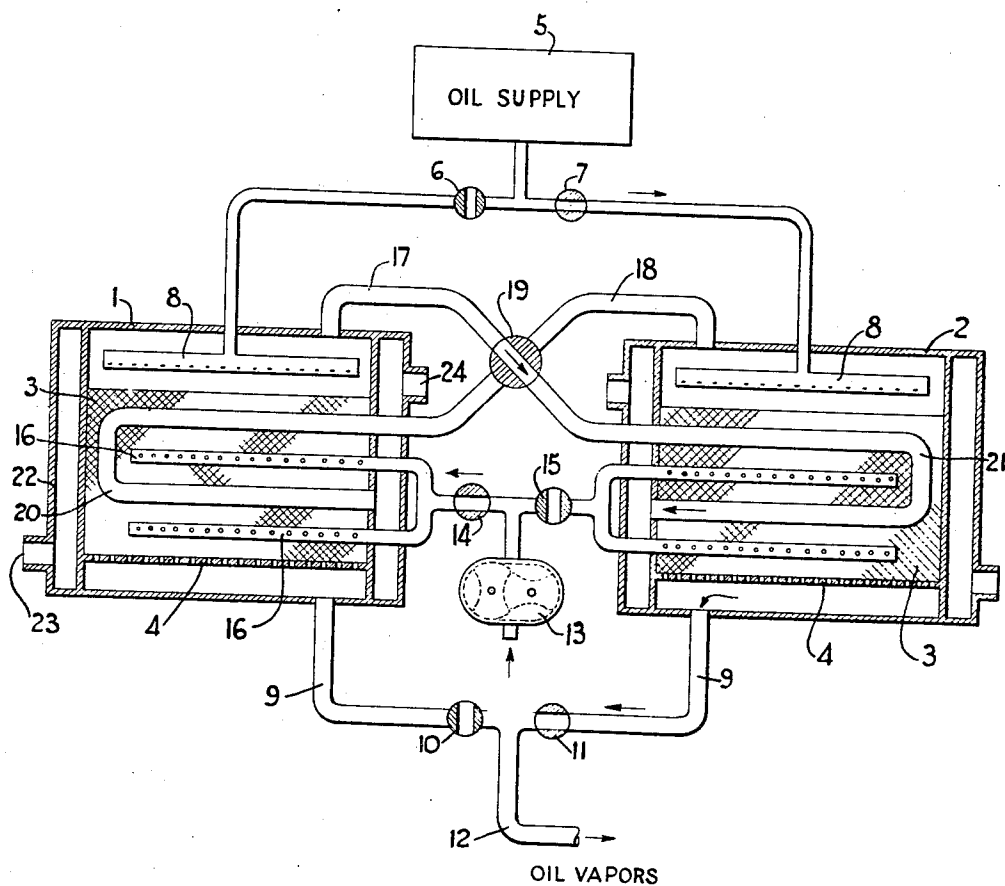
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APPARATUS FOR EFFECTING CHEMICAL REACTIONS BY THE USE OF CONTACT MASSES

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APPARATUS FOR EFFECTING CHEMICAL REACTIONS BY THE USE OF CONTACT MASSES

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This invention relates to apparatus for effecting chemical reactions by the use of catalytic or other contact masses which require regeneration or reactivation at intervals. More particularly the apparatus comprises at least two converters arranged for continuous operation with the contact mass in one converter on stream and effecting a transforming operation while the contact mass in the other converter is undergoing regeneration, the converters thereafter alternating in function. One use for which the apparatus is especially adapted is the treatment or conversion by heat and contact masses of hydrocarbon material such as mineral oil, tar, and the like.

In the refining, cracking or conversion of hydrocarbons, apparatus of the kind in question may be used either for vaporizing liquid material, or for cracking or converting material already vaporized, and the contact mass may consist of various more or less porous or foraminous bodies, such as ceramic material, fuller's earth, etc., as is well known to those skilled in the art, according to the nature of the process to be performed.

In most instances the effect of the heat, together with catalytic power as the contact mass may possess, results in some degree of cracking or decomposition, by which dry or tarry carbonaceous or resinous material is deposited in or upon the material of the contact mass, so that it is necessary, after a period of active operation, to interrupt the feed of material to the contact mass and to remove the deposited matter from the mass. The most convenient and effective way to accomplish this removal is to cause oxidation or combustion of the deposited matter, by passing through the contact mass a current of atmospheric air or other oxygen-containing gas. This combustion results in a considerable quantity of heat, which is carried away in the hot gases of combustion.

The object of the present invention is to produce an apparatus, of the kind in question, having simple and effective means both for heating a contact mass which is in active operation, and for economically utilizing the heat generated in another similar contact mass which is in process of cleansing or reactivation. To this end it is proposed to use a plurality of chambers containing contact masses, and to provide these chambers with heating conduits and with interconnecting means so arranged that the hot gases of combustion from one chamber may be utilized to heat another chamber, and that the

several chambers may perform their functions alternately.

Other features of the invention, and various accessory means for carrying it into practice, will be set forth hereinafter, in connection with the description of the embodiment of the invention illustrated in the accompanying drawing.

The accompanying drawing is a diagrammatic view, partly in section of apparatus embodying the present invention.

In the drawing, two conversion chambers 1 and 2 are shown, which are similar in all respects and which contain contact material 3, such as fuller's earth. The contact material is supported in each chamber by a perforated plate 4, so as to provide a space at the bottom of the chamber for the flow of gases.

The oil which is to be cracked or otherwise converted is drawn from a supply tank 5, through valves 6 and 7 which control the flow of oil to feed pipes 8 located near the tops of the conversion chambers. These feed pipes are shown as having numerous perforations for distributing the oil over the upper surfaces of the contact masses. The gases and vapors resulting from the conversion of the oil are discharged from the bottoms of the chambers through outlet pipes 9, controlled by valves 10 and 11, respectively, from which they may be conducted, through a pipe 12, to a condenser or any other apparatus.

By means such as a rotary blower 13, air for reactivating the catalytic masses may be discharged into branched air pipes 16 buried within the contact masses in the respective chambers, the flow of air to one chamber or the other being controlled by valves 14 and 15. The air pipes 16 are provided with numerous perforations, so that the air is distributed throughout the contact masses.

From the top of the chamber 1 a pipe 17 extends to a four-way valve 19, which discharges into a heating conduit 21 buried in the contact mass in the chamber 2. A similar pipe 18 extends from the chamber 2, through the valve 19 to a heating conduit 20 in the chamber 1. The conversion chambers may be provided with surrounding jackets or enclosures 22, which are provided with inlet and outlet openings 23 and 24, respectively, so that flue gases or heating fluids of any convenient kind may be used, when necessary, to heat the chambers externally during the conversion of the oil. The heating conduits 20 and 21 preferably discharge into these jackets, so as to pro-

vide either all or a part of the heating medium within the jackets.

The mode of operation of this apparatus is as follows: with the valves in the positions shown, oil is fed through the valve 7 to the chamber 2, where it undergoes vaporization and conversion in the contact mass. The vapors of the converted oil pass outwardly through the pipe 9, the valve 11 and the pipe 12.

At the same time, the contact mass in the chamber 1 is undergoing reactivation. The blower 13 discharges air suitably diluted with inert material such as flue gas, steam, nitrogen, or the like, through the valve 14 and the pipe 16, into and through the contact mass in the chamber 1. The exothermic reaction or combustion produced in this chamber causes the gases and vapors emerging from the contact mass to be highly heated, and the hot gases pass through the pipe 17, the valve 19 and the heating conduit 21. This conduit, being buried in the contact mass in the chamber 2, heats the mass and the oil therein, thus providing either a large part or the whole of the heat necessary for the performance of the endothermic cracking or other conversion which is performed in this chamber upon the oil.

The operations above described continue until the reactivation of the contact mass in the chamber 1 has been completed. The positions of all of the valves may then be reversed, whereupon conversion of the oil in the chamber 1 begins, together with reactivation of the contact mass in the chamber 2. The functions of the chambers are thus alternated, and the carbon or other material deposited in the contact masses serves as the fuel to provide the heat necessary to promote the vaporization and conversion of the oil.

It will be obvious that the oil may be fed into the conversion chambers in the form of vapor rather than of liquid, and that any usual means for conserving the heat of the emergent oil vapors, and for condensing these vapors, may be used if found advisable. The necessity of supplying additional heat through the jackets 22 will depend upon the material being treated and the degree to which it is cracked or converted, the nature of the contact mass used, and other factors depending upon the particular operation which is to be conducted in the apparatus.

The invention claimed is:

1. In apparatus of the kind specified, the combination of a plurality of chambers, each containing a contact mass, air-induction pipes buried in said mass, and heating conduits also buried in said mass, means for feeding material into said chambers alternately, means for forcing oxygen-containing gas into the air-induction pipes of the chambers alternately, to promote oxidation of carbonaceous matter deposited in the contact mass, and means for conducting the hot gases of combustion, so produced in one chamber, into the heating conduit of another chamber which is in active operation upon material fed by said feeding means.

2. In apparatus for the continuous treatment of hydrocarbons, the combination of a plurality of chambers having inlet and outlet connections for the hydrocarbons and arranged to be alternately in operation and in regeneration, each chamber containing a contact mass and having distributing conduits and heating conduits buried in said mass, means for selectively forcing a regenerating medium into said distributing conduits, and means selectively to conduct the heat and fumes of regeneration from one of said cham-

bers into and through the heating conduits of another of said chambers thereby to maintain the contact mass of said last named chamber at a suitable temperature for treating the hydrocarbon fed thereto.

3. In apparatus for the continuous treatment of hydrocarbons, the combination of a plurality of jacketed chambers having inlet and outlet connections for the hydrocarbons, said chambers each containing a contact mass and arranged to be alternately in operation and in regeneration, perforated distributing members and imperforate conduits embedded in the contact masses in said chambers, means selectively to direct a regenerating medium into said distributing members, and connections whereby said conduits conduct heat and fumes from a chamber undergoing regeneration through the contact mass of an adjacent chamber which is in operation and thence into the jacket surrounding said last named chamber.

4. In conversion apparatus, in combination, two chambers in spaced relation, contact masses in said chambers, inlet and outlet connections to said chambers for the material to be treated, means for conducting a regenerating medium into one of said chambers to regenerate the contact mass therein, and means for utilizing the fumes of regeneration to impart heat to the contact mass in the other of said chambers comprising a conduit buried in said last named mass.

5. In conversion apparatus, in combination, two chambers in spaced relation, contact masses in said chambers, inlet and outlet connections to said chambers for the material to be treated, means selectively to distribute a regenerating medium through said masses whereby continuous operation may be maintained by having one chamber in regeneration while the other is in operation and by alternating said chambers as to function, and means selectively to conduct hot fumes from the chamber in regeneration within and through the contact mass of the chamber in operation but without direct contact therewith thereby to impart heat to said last named mass.

6. In conversion apparatus, in combination, two chambers in spaced relation, contact masses in said chambers, inlet and outlet connections to said chambers for the material to be treated, means selectively to distribute a regenerating medium through said masses whereby continuous operation may be maintained by having one chamber in regeneration while the other is in operation and by alternating said chambers as to function, each chamber having a hollow jacket surrounding the same and an imperforate conduit buried in its contact mass and discharging into said jacket, and connections for said conduits whereby each becomes a vent for the hot fumes of regeneration of the other chamber and heat is imparted to the contact mass which is in operation from the contact mass which is in regeneration.

7. Apparatus for effecting chemical reactions comprising two converters each containing a contact mass, connections and controls for operating said converters alternately on stream and in regeneration, means on the exterior of each of said converters forming a chamber independent of the reaction chamber but enclosing at least a portion of the latter, and means directing the hot fumes of regeneration from the converter in regeneration into heat exchange relation with the contact mass in the other converter and thence into the independent chamber of said other converter.

8. Apparatus for effecting chemical reactions comprising two converters each containing a contact mass, connections and controls for operating said converters alternately on stream and in regeneration, means on the exterior of each of said converters forming a chamber independent of the reaction chamber but enclosing at least a portion of the latter, an imperforate conduit embedded in the contact mass of each of said converters and discharging into the independent chamber thereof, and means directing the hot fumes of regeneration from the converter in regeneration into the imperforate conduit of the other converter.
9. Apparatus for effecting chemical reactions comprising two converters each containing a contact mass, connections and controls for operating said converters alternately on stream and in regeneration, means on the exterior of each of said converters forming a chamber independent of the reaction chamber but enclosing at least a portion of the latter, an imperforate conduit embedded in the contact mass of each of said converters and discharging into the independent chamber thereof, a connection from the reaction chamber of each converter to the imperforate conduit of the other converter, and control means for said connections whereby the hot fumes of regeneration may be directed from the converter in regeneration through the imperforate conduit and independent chamber of the other converter to impart heat to the contact mass of said other converter.
10. In combination, two catalytic converters, each converter providing a reaction chamber for containing a contact mass and a heating chamber at least partly surrounding the reaction chamber, a connection from the reaction chamber of each converter to the heating chamber of the other converter, and unitary control means for both said connections.
11. In combination, two catalytic converters, each converter providing a reaction chamber for containing a contact mass and a heating chamber at least partly surrounding the reaction chamber, a connection from the reaction chamber of each converter to the heating chamber of the other converter, said connections intersecting each other, and a single valve at the intersection of said connections for controlling both connections.

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