April 5, 1932. L. KIRSCHBRAUN 1,852,783

APPARATUS FOR CRACKING HYDROCARBON OILS

Original Filed Feb. 18, 1920 2 Sheets-Sheet 1

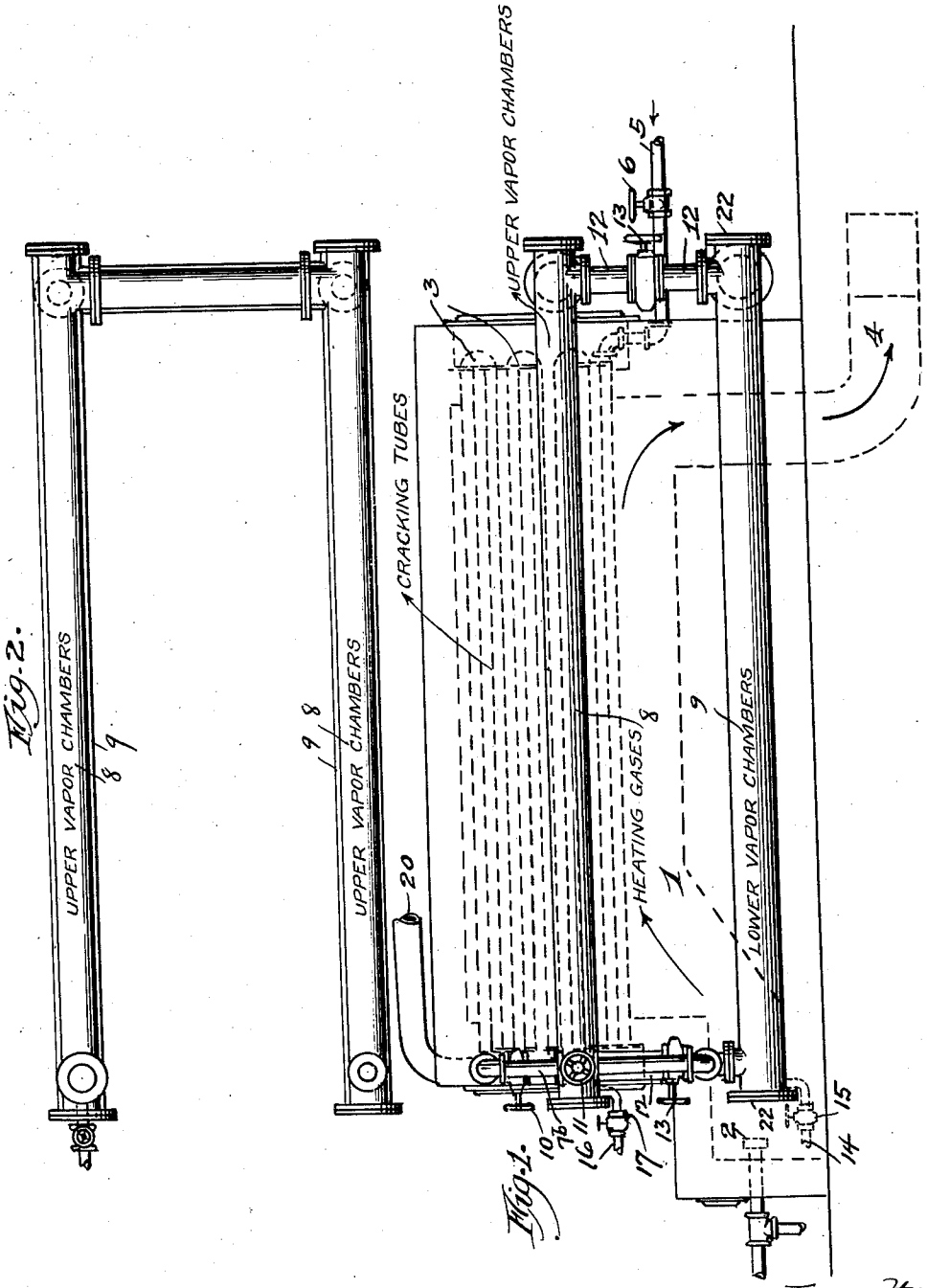

Fig. 2.

Fig. 1.

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Fig. 3.

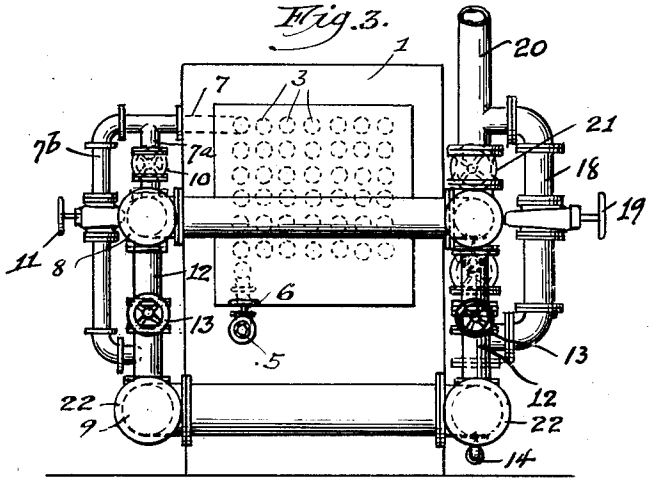
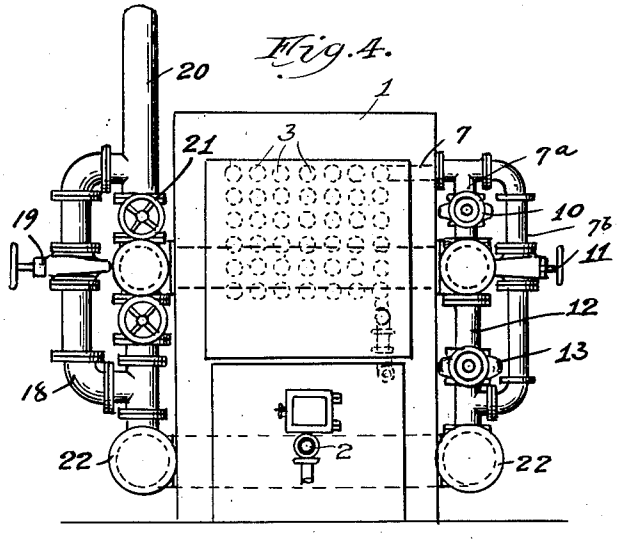


Fig. 4.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR CRACKING HYDROCARBON OILS

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My invention relates to improvements in an apparatus for cracking hydrocarbon oils and refers more particularly to the expansion tubes of a cracking system, which are constructed to reduce the accumulation of fixed carbon on the inner walls thereof and facilitate the cleaning of the same, besides combining the novel arrangement of making possible the cleaning of said chambers while the cracking process is under operation.

Among its salient objects are to provide an expansion zone adaptable to any type of still construction, one in which separate units or sections of said zone may be isolated from the system while the oil is being treated, thereby permitting the cleaning and repairing of the isolated portion; to provide a construction which reduces materially the deposition of fixed carbon upon the inner walls of the expansion chamber and one in which the precipitated carbon collects in the lower expansion chambers from which it may be readily cleaned, and in general to provide a construction of the character referred to.

In the drawings:

Fig. 1 is a side elevation of a furnace, cracking tubes and expansion tubes of an oil cracking apparatus showing the novel arrangement and construction of the expansion tubes.

Fig. 2 is a plan view of the expansion tubes shown in Fig. 1.

Fig. 3 is a right end elevation of the construction shown in Fig. 1.

Fig. 4 is a left end elevation of the construction shown in Fig. 1.

Referring to the drawings, the construction shows a furnace 1 heated by any suitable means such as a gas burner 2 and in which are mounted the cracking tubes 3. The heating vapors pass over the cracking tubes and out through the flue 4 as shown by the arrows. The raw oil is introduced through the inlet pipe 5 controlled by valve 6 and is subjected to the heat of the furnace in the cracking tubes. The cracked oil is directed through the line 7 to the vapor chambers comprising upper and lower sections 8 and 9. A T-connection is interposed in the line 7, dividing the same into two separate leads 7*a* and 7*b*. A valve 10 in the line 7*a* controls the flow of cracked oil introduced to the upper vapor chamber section and a similar valve 11 controls the supply of cracked oil introduced to the lower vapor chamber section 9.

Vertical connecting lines 12 controlled by valves 13 allow the cracked oils to circulate between the expansion tube sections when the valves 13 are open. These vertical connecting lines also furnish ducts through which the heavier residuum and precipitated carbon may flow from the upper vapor section, permitting the same to collect in the lower vapor chambers 9. A residuum drawoff pipe 14, controlled by a valve 15, and a similar residuum drawoff 16 with a valve 17, permit the heavier residual oil and fixed carbon to be taken from either the upper or lower vapor chambers.

To furnish an egress for the gases, a line 18 in which is interposed a valve 19 and a line 20 controlled by valve 21, are connected to the upper and lower vapor section, the valves 19 and 21 making it possible to isolate either of the vapor sections with relation to the vapor line 20.

From the construction explained, it is obvious that the vapor chambers may be so connected in the system by means of the valves that the cracked oil coming from the cranking tubes may be allowed to circulate through both of the vapor sections or either of the sections may be isolated from the system and the cracked oils circulated only through the vapor chamber remaining connected, the advantage of this construction being that either the upper or lower chamber may be cut entirely out of the system to be cleaned or repaired. The arrangement of the vapor chambers (that is, one section being arranged above the other) allows the heavy residual oil formed in the upper expansion chambers together with the precipitated carbon to flow by gravitation down the vertical connecting pipes into the lower expansion section. From time to time, this lower expansion section may be isolated from the system and cleaned by removing the cleaning plates 22 at the ends thereof.

It is also desirable to have the tubes of the lower section somewhat larger than the

tubes of the upper section so that they may accommodate the collecting residual oils and prevent the same backing up in the vertical connecting pipes. I do not wish to limit myself to the use of two sections for it may be that a construction with a plurality of horizontal sections vertically arranged one above the other, would be more efficient in operation.

The gaseous vapors after passing out through the vapor line 20 may be conducted to any suitable type of condenser and collecting reservoir (not shown).

I claim as my invention:

1. In an apparatus for cracking hydrocarbon oils, the combination with a cracking chamber and means for heating the oil therein, of an expansion chamber connected thereto comprising upper expansion sections horizontally arranged, similar lower expansion sections of larger diameter positioned beneath the upper chambers and connected thereto, means for independently connecting or cutting out either section of the expansion chamber to the system, means for supplying the cracked oils independently to either section and means for drawing off the residuum and gaseous vapors from either section.

2. An apparatus for cracking hydrocarbon oils comprising a cracking chamber through which the oils pass and means for heating said oils within the chamber, of an expansion chamber in communication with the cracking chamber and consisting of expansion sections, means establishing communication between the sections to permit a free passage of vapors and distillate from one section to the other, means for cutting off the supply of vapors to either section of the expansion chamber without disturbing the other, and means for drawing the residuum and vapors from said sections, one of said sections being larger than the other, the larger section being disposed vertically below the smaller section.

3. An apparatus for cracking hydrocarbon oils, comprising a cracking chamber, and means for heating oils therein, of an expansion chamber comprising sections and communications therebetween, for selectively passing a vapors and residuum from one section to the other, means for introducing vapors from said cracking chamber to said expansion chamber, valves for cutting off the supply of oil to either of the sections without disturbing the other, said expansion sections being of different capacities and one disposed above the other in the vertical plane.

4. In an apparatus for cracking hydrocarbon oil, the combination with a cracking chamber through which the oil passes to be subjected to a cracking temperature, of means for heating said chamber, an expansion chamber consisting of independent sections, each being horizontally disposed, the said sections lying in different vertical planes and one being of a greater capacity than the other, means of establishing communications between the sections to permit a free passage of vapors and a distillate from one section to the other, means for cutting off the supply of hydrocarbon substances to either section of the expansion chamber without disturbing the other, and means for withdrawing residuum and vapors from such sections.

5. Apparatus of the character described comprising in combination, a furnace, a heating coil comprising a plurality of serially connected parallel tubes mounted in said furnace to be heated thereby to a cracking temperature, means for maintaining a superatmospheric pressure upon the oil being heated, a pair of expansion chambers, one located at the level of, and the other below said coil, a T-connection connecting said coil with both of said chambers, valves in said T-connections whereby heated oil may be discharged into said chambers alternately, serially or in parallel, means for taking off vapors evolved in said chambers, and means for withdrawing residual oil therefrom.

6. Apparatus for cracking hydrocarbon oils, comprising a cracking chamber and means for heating oils therein, of an expansion chamber comprising sections and communications therebetween for selectively passing cracked constituents from one section to the other, means for introducing vapors from said cracking chamber to said expansion chamber, valves for cutting off the communication from said cracking chamber to one of said sections without disturbing the other, said expansion sections being of different capacities and one disposed above the other.

7. Apparatus for the heat treatment of hydrocarbon oil, to convert higher boiling constituents thereof into lower boiling point products amenable to refining for use as a motor fuel, comprising in combination a furnace, a heating coil composed of cracking tubes mounted in said furnace in parallel relation and serially connected to be heated thereby to a cracking temperature, means for maintaining a superatmospheric pressure on the oil undergoing treatment, a chamber outside said furnace comprising upper and lower tubular sections of different diameters, means for selectively introducing products from said heating coil to either of said sections to flow serially through the respective sections of said vapor chamber.

8. Apparatus for the heat treatment of hydrocarbon oil, to convert higher boiling constituents thereof into lower boiling point products amenable to refining for use as a motor fuel, comprising in combination a furnace, a heating coil composed of cracking tubes mounted in said furnace in parallel re-

lation and serially connected to be heated thereby to a cracking temperature, means for maintaining a superatmospheric pressure on the oil undergoing treatment, a chamber outside said furnace comprising upper and lower tubular sections of different diameters, means for selectively introducing products from said heating coil to either of said sections to flow serially through the respective sections of said vapor chamber and means for selectively withdrawing residual oil from said sections.

9. Apparatus for the heat treatment of hydrocarbon oil, to convert higher boiling constituents thereof into lower boiling point products amenable to refining for use as a motor fuel, comprising in combination a furnace, a heating coil composed of cracking tubes mounted in said furnace in parallel relation and serially connected to be heated thereby to a cracking temperature, means for maintaining a superatmospheric pressure on the oil undergoing treatment, a chamber outside said furnace comprising upper and lower tubular sections of different diameters, means for selectively introducing products from said heating coil to either of said sections to flow serially through the respective sections of said vapor chamber and means for selectively taking off vapors from said sections.

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