June 9, 1925. 1,540,986

H. J. HALLE

PROCESS AND APPARATUS FOR DISTILLING OILS

Filed Sept. 17, 1920 3 Sheets-Sheet 1

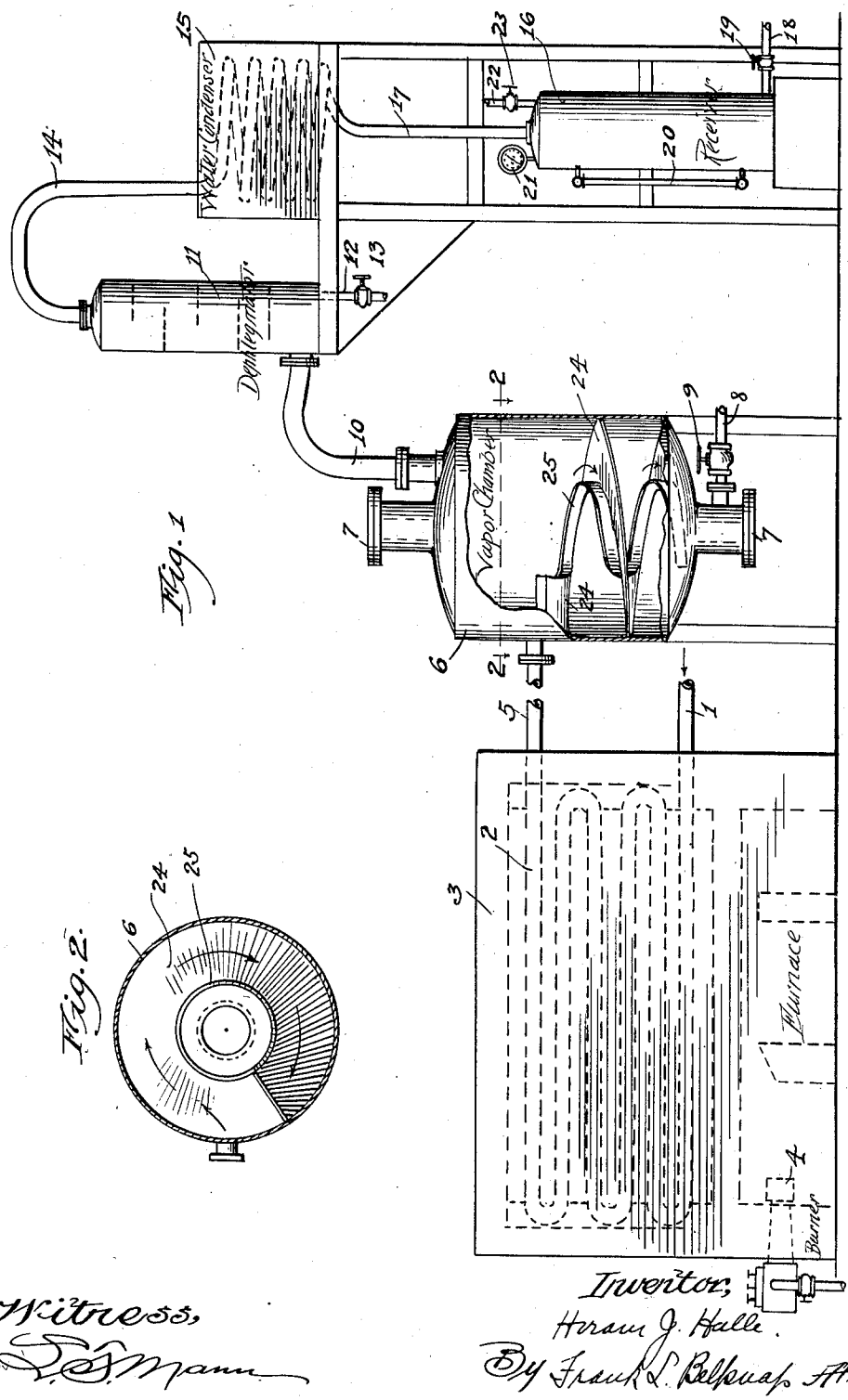


Fig. 1

Fig. 2.

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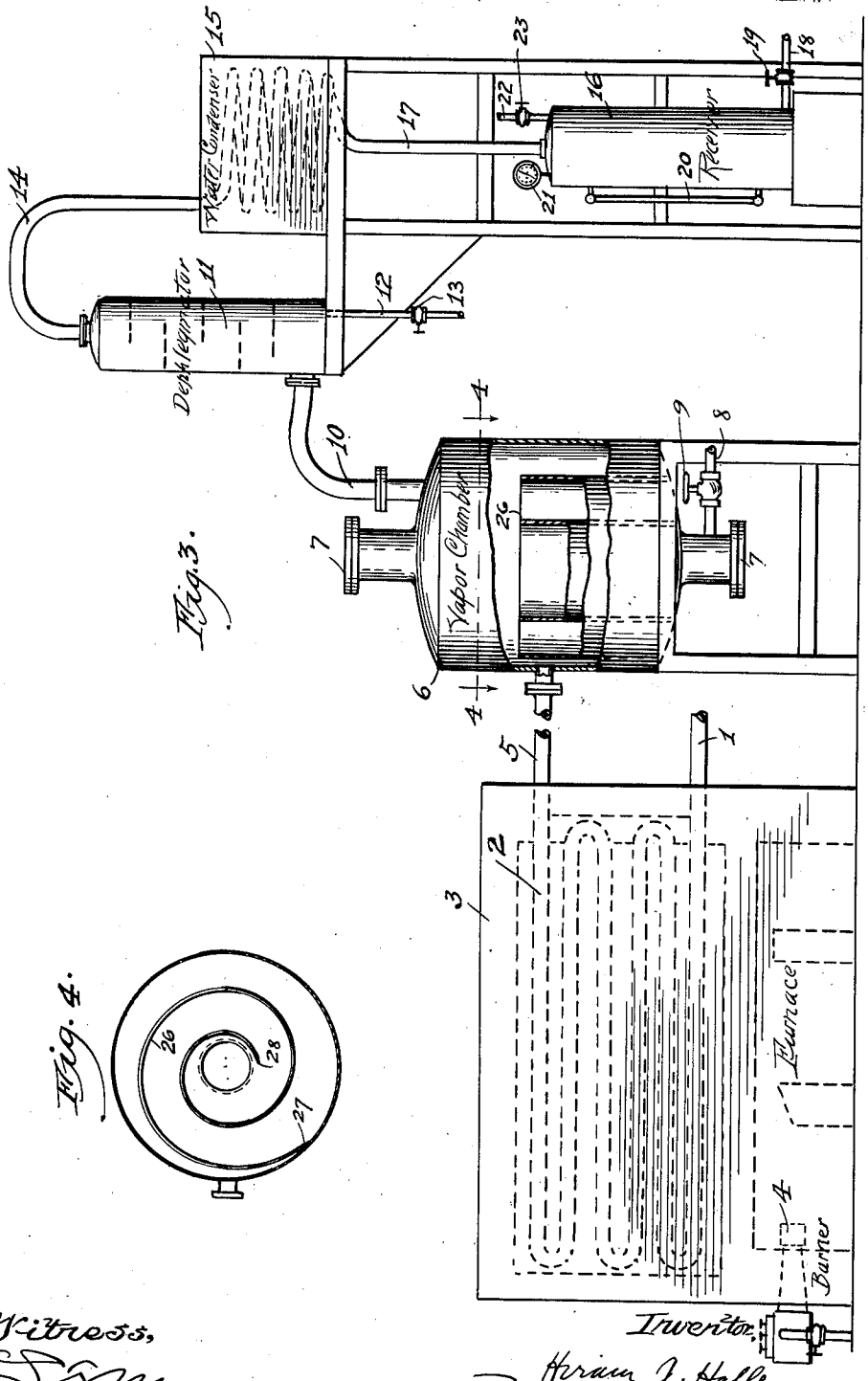


Fig. 3.

Fig. 4.

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PROCESS AND APPARATUS FOR DISTILLING OILS

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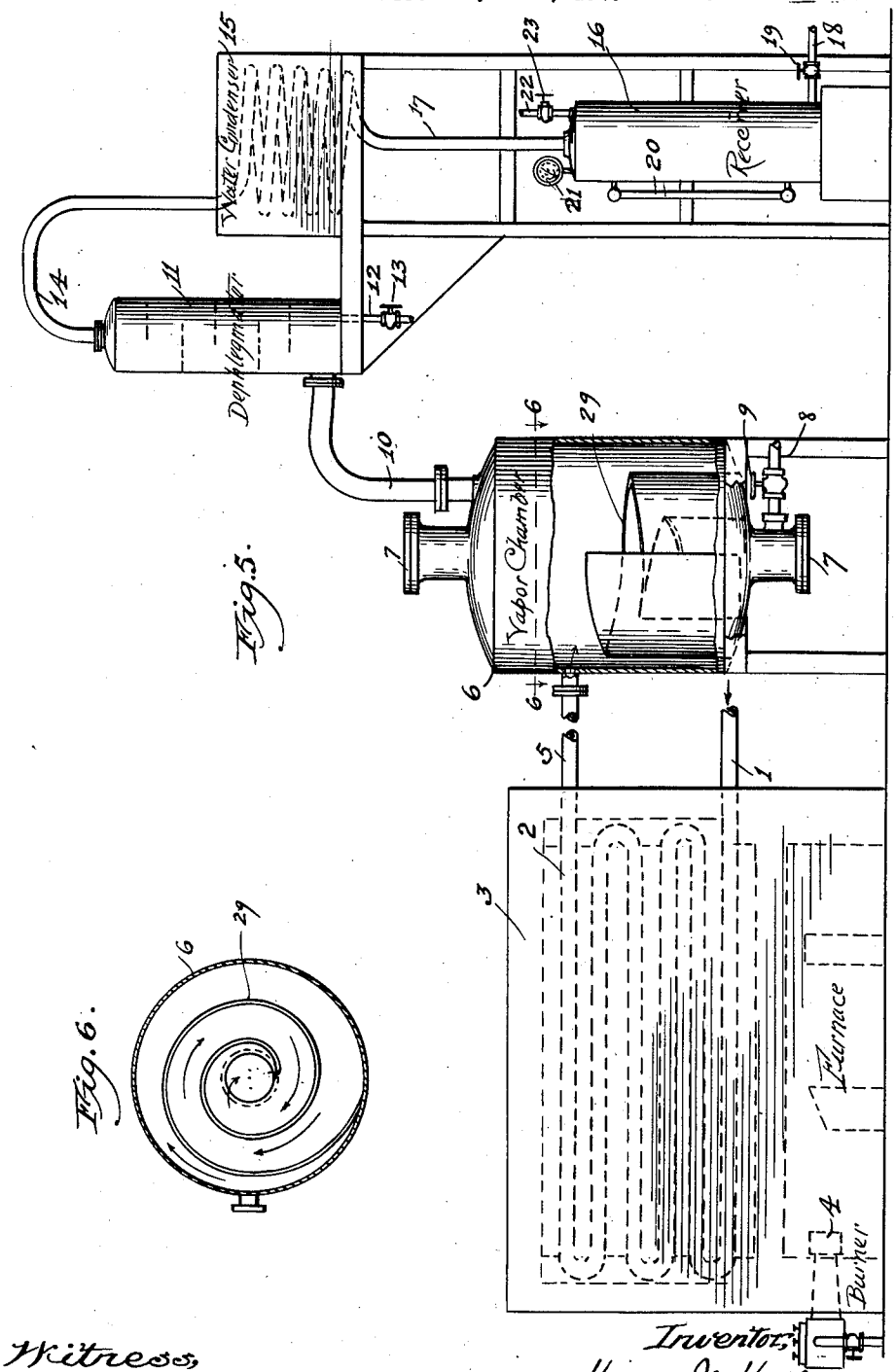


Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE.

HIRAM J. HALLE, OF CHICAGO, ILLINOIS, ASSIGNOR TO UNIVERSAL OIL PRODUCTS COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF SOUTH DAKOTA.

PROCESS AND APPARATUS FOR DISTILLING OILS.

Application filed September 17, 1920. Serial No. 410,918.

To all whom it may concern:

Be it known that I, HIRAM J. HALLE, a citizen of the United States, residing in the city of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Processes and Apparatus for Distilling Oils, of which the following is a specification.

This invention relates to a process and apparatus for distilling oils and refers more particularly to a process and apparatus for cracking comparatively heavy hydrocarbons into lighter hydrocarbons such as gasoline or the like.

Among its salient objects are to provide a process in which the oil, after being heated in a cracking zone, is directed to an enlarged vertical vapor or reacting zone where during its circuitous travel therein while being maintained in a heated state, a more thorough cracking reaction is obtained; to provide a process which is not seriously hindered by a substantial accumulation of carbon and one to which the carbon does not form a heat insulation causing a retardation of the cracking reaction; to provide an apparatus adapted to cause a greater surface exposure of the oil to the heated vapor chamber and at the same time more surface within the chamber to provide a reacting zone that is advantageous to a greater cracking reaction; to provide an apparatus the construction of which facilitates its cleaning and in general to provide a process and apparatus of the character referred to.

In the drawings:

Fig. 1 is a side elevational view of the apparatus with parts in section and parts broken away.

Fig. 2 is a view taken on line 2—2 of Fig. 1 looking in the direction of the arrows.

Fig. 3 is a side elevational view of a modified form of vapor chamber interposed in the apparatus.

Fig. 4 is a view taken on line 4—4 of Fig. 3 looking in the direction of the arrows.

Fig. 5 is a side elevational view of a second modified form of vapor chamber.

Fig. 6 is a view taken on line 6—6 of Fig. 5 looking in the direction of the arrows.

An essential feature in distilling or cracking hydrocarbon oils, and particularly the heavier oils, such as California or Mexican products, is controlling of the collection of precipitated carbon in the reacting or vapor chamber so as to retard as little as possible the operation of the cracking process. In the process here disclosed additional surface is exposed to the heated oil in the vapor chambers, assisting the vaporization of the oil and affording additional surface for the collecting of the precipitated carbon, thereby preventing, to a certain extent, excessive accumulation of carbon in the bottom of the chamber, also the carbon deposition upon the vertical walls in the chamber serves to absorb and hold the heat in the chamber, in a manner not to unduly retard its operation.

Referring to the drawings in the three cracking systems shown by Figures 1, 3 and 5, the general construction is identical with the exception of the interior of the vaporizing chamber in each system.

The systems comprise an oil feed line 1 which supplies the raw oil from any convenient source not shown, and directs the same to the heating tubes 2 mounted in a furnace 3, the furnace being preferably heated by means of gas burners 4. The oil after being raised to a cracking temperature in the heating tubes is transferred through lines 5 to the vapor chambers 6 where the greater part of the cracking reaction takes place. These chambers are fitted with upper and lower removable cleaning plates 7, residuum draw-off 8 controlled by valves 9 and vapor lines 10 which direct the released vapors to the dephlegmators 11. The liquid condensate formed in these dephlegmators may be drawn off through lines 12 controlled by valves 13 and either directed back to the cracking tubes for retreatment or piped to any suitable storage. The vapors remaining in a gaseous form after dephlegmation pass over through goose-necks 14 and after being subjected to a condensing action in the water condensers 15 are collected in receiving tanks 16 as distillate. Lines 17 connect the condenser coils to the receivers. Each receiver is equipped with a draw-off line 18 controlled by a valve 19, liquid level gauge 20 pressure gauge 21 and a pressure relief pipe 22 controlled by a valve 23.

As will be noted, the general construction of the apparatus is identical in each case, the novelty lying wholly in the interior construction of the vapor chambers.

Describing first the vapor chamber shown

in Fig. 1, the heated oil on being introduced is spread upon a plate 24 spirally arranged within the chamber so that the heated oil will be coursed from the inlet line to the bottom of the chamber in a comparatively shallow stream whereby the oil has ample opportunity to vaporize; and due to the fact that a greater surface of the oil is in contact with the heated interior metal of the chamber than is obtained in the usual cracking chamber, conditions are such as to promote an increased vaporization of the oil. About the inner edge of this spiral plate is a raised lip 25 which prevents the oil from flowing directly to the bottom of the chamber instead of following the travel of the spiral plate. Besides aiding the vaporization of the heated oil, this construction is an improvement over the common vaporizing chamber in that due to its vertical position the precipitated carbon will be flushed down with the oil stream and will not collect and tend to clog the chamber as it does in a horizontal tube. Also the travel of the gases directly toward the vapor outlets lessens the tendency to pocketing of the gases.

Describing now the features of the chamber shown in Fig. 3, the oil as before is introduced in the side of the chamber and immediately contacts a coiled baffle plate 26, the outer edge 27 of the plate contacting the interior shell of the chamber and the plate so coiled that the other end 28 is positioned close to the vertical axis of the chamber. The oil on entering the vapor chamber contacts the baffle plate and circulates around the coiled path formed by same until it reaches the center of the chamber. During this circuitous route the heated oil has ample opportunity to vaporize and, as before in the preceding vapor chamber above explained, is constantly contacting with the metal surface which is heated by the oil and serves to promote vaporization. The oil, as it travels toward the center of the chamber, receives additional heat by radiation through the baffle plate from the incoming oil which is at a higher temperature. It will be noted that the heated oil will constantly circulate in the manner described until it reaches a level above the height of the baffle plate at which time the oil in the different coils of the plate will combine in the top of the chamber.

The details of construction of the interior of the vapor chamber shown in Fig. 3 and Fig. 5 are somewhat similar except that the baffle plate 29 shown in Fig. 5 is of decreasing height from its outer end to its inner end, or that part of the baffle plate which is situated in the center of the vapor chamber. From the drawing, it is obvious that the oil introduced will circulate as before about the outer surface of the baffle plate and work inward by the route shown by the arrows in Fig. 6 until it reaches the center of the chamber. Here, with accumulation of the oil, it will rise, and as it reaches the upper edges of the baffle plate will flow over and combine with the incoming oil. In a chamber of this character, the incoming oil will come in contact more quickly with the unvaporized heavy oil which has collected in the central portion of the chamber than in a vapor chamber constructed as shown in Fig. 3. A slight rise of the oil in the central portion of the vapor chamber shown in Fig. 5 will cause it to flow over the top of the inner coil, and as it rises higher and higher at successive stages, it will flow into another of the outer lanes of the coil. When it has finally reached a level substantially that of the outer edge of the baffle plate, the oil will combine directly with the body of the oil in the chamber.

A feature of this controlling of the level of the oil in the vapor chamber is the regulation which may be obtained upon the character of the distillate which is collected in the receivers. By controlling the level of the oil by means of residuum draw-off, the temperature in the vapor chamber may be controlled and the rate of vaporization to a great extent regulated.

The cleaning factor in chambers of this type is of great importance in that the carbon may collect to a considerable height in the chambers before it is necessary to shut down for cleaning.

Vapor chambers of this type may be connected in duplicate and provision made for cutting out one chamber for cleaning purposes while the other is kept in operation, thereby providing a continuous operation.

I claim as my invention:

1. The process of distilling oils consisting in heating oil to a cracking temperature, in directing the same to a vapor chamber, in causing the oil to travel in a spiral path over surfaces in said vapor chamber prior to its discharge, and in discharging vapors from the vapor chamber, in discharging oils after passage over said surfaces from the chamber, and in regulating the quantities of oil discharged from the chamber to regulate the depth of oil maintained therein.

2. The process of distilling oils, comprising heating oil in a cracking chamber, in directing the heated oil to a vapor chamber, in passing the oil in the vapor chamber in a spiral path toward the center of said chamber, in discharging vapors from the vapor chamber, and in regulating the discharge of oil in a liquid phase from the chamber to regulate the depth of the oil remaining therein.

3. The process of distilling oils, comprising heating oil to a cracking temperature, in directing the oil after heating to a vapor chamber, in causing the oil to travel

in a spiral path through the vapor chamber prior to discharge, in discharging vapors from said chamber, and in regulating the quantity of liquid oil discharged from said chamber to control the height and quantity of oil maintained in the chamber to combine with the incoming heated oil.

4. In an apparatus for distilling oils, comprising a heating chamber, means for feeding oil thereto, a vapor chamber in communication with the heating chamber, said vapor chamber being provided with a spiral passageway gradually leading from the circumference to the center thereof, means for discharging vapors from the vapor chamber, and means for discharging liquid oil from the center of said chamber.

5. In an apparatus for distilling oils, a vapor chamber, said vapor chamber being provided with a spiral passageway leading from the circumference to the center of said chamber, means for discharging vapors therefrom, means for discharging liquid oil that has passed to the center of said chamber therefrom, and means for controlling the quantity of oil discharged to permit the vapor chamber to contain a given quantity of oil to mix with the incoming oil introduced thereto.

6. In an apparatus for distilling oils, a vapor chamber, said vapor chamber being provided with a spiral baffle forming a spiral passageway leading from the circumference of the vapor chamber to the center thereof through which oil passes in contact with said baffle, a vapor discharge from said vapor chamber, and means for discharging liquid oil from the vapor chambers.

7. The process of distilling hydrocarbon oils, comprising introducing oil to a heating chamber, in discharging the oil into a vapor chamber, in causing the oil to travel in a spiral path from the circumference of the vapor chamber to the center thereof, in discharging vapors from said chamber, and in discharging liquid oil from the center of the vapor chamber.

HIRAM J. HALLE.