

Jan. 6, 1931.

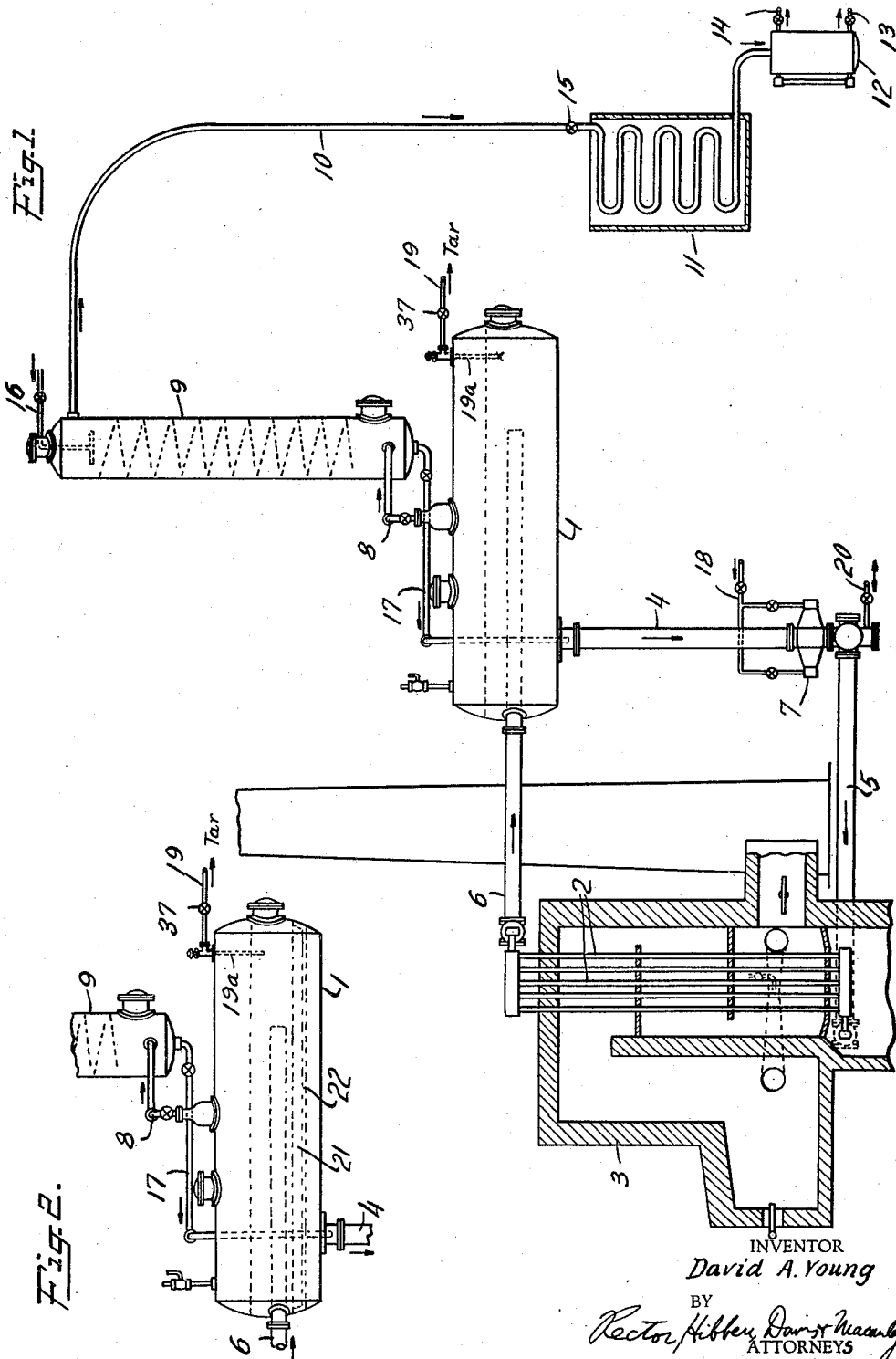
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PRESSURE STILL FOR CRACKING OILS

Filed July 15, 1927

2 Sheets-Sheet 1



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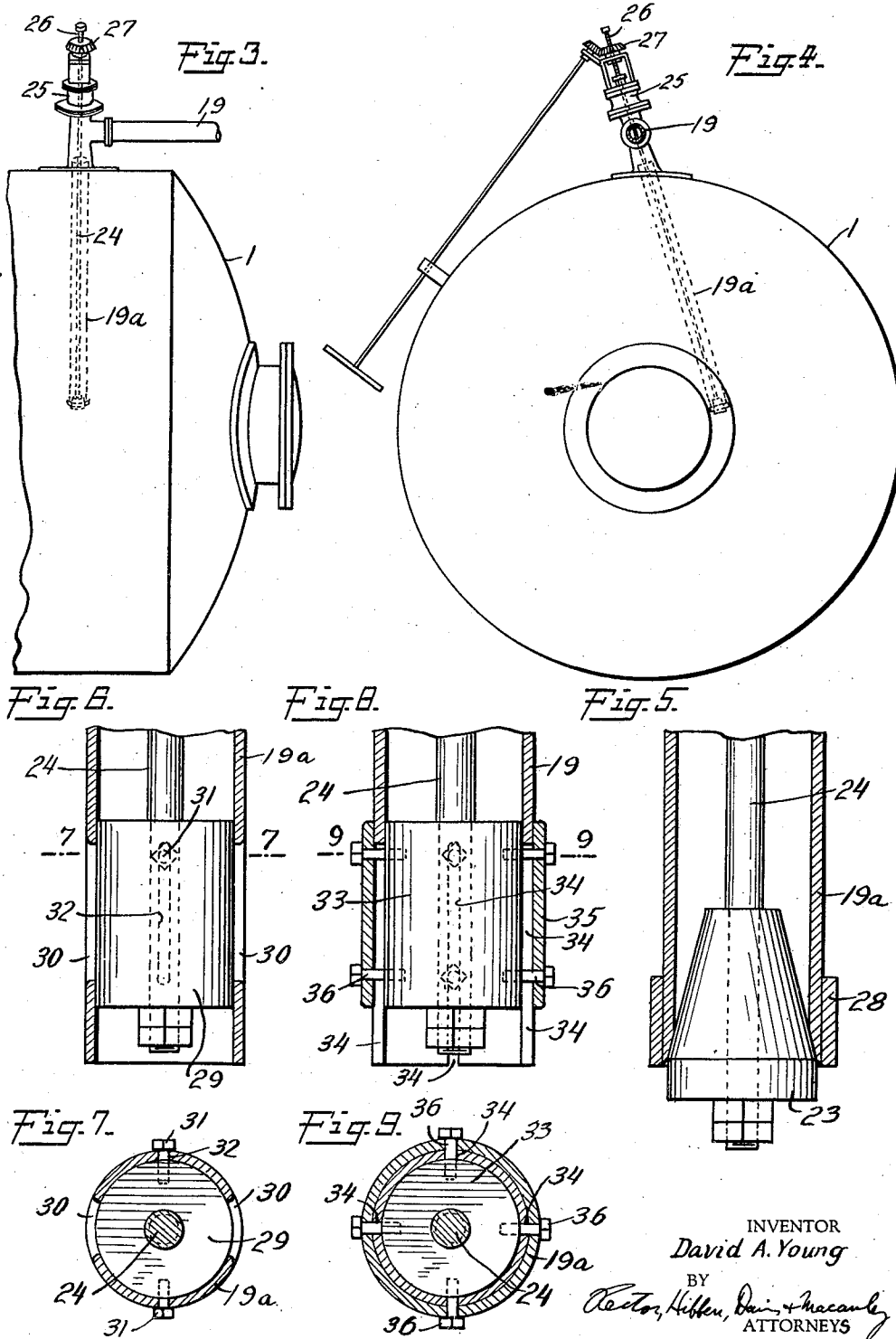
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UNITED STATES PATENT OFFICE

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PRESSURE STILL FOR CRACKING OILS

Application filed July 15, 1927. Serial No. 205,967.

In the distillation of hydrocarbon oils under pressure, for the production, by cracking, of lighter and lower boiling oils from heavier and higher boiling oils, it has become common practice to prolong the period of operation by discharging, from the pressure still in which the operation is carried out, a part of the oil remaining unvaporized in the still. One such particularly advantageous method of operation is described in Letters Patent No. 1,598,136 issued to the Sinclair Refining Company, August 31, 1926; another such particularly advantageous method of operation is described in Letters Patent No. 1,634,666 issued to the Sinclair Refining Company on an application filed April 8, 1924, Serial No. 704,926. Hitherto, in such operations, it has been customary to regulate the discharge of unvaporized oil from the pressure still by means of a valve arranged in the discharge line externally of the still.

This invention relates to an improved arrangement of the regulating valve in the discharge line for carrying out this type of operation in pressure cracking stills. The invention has several important advantages; it improves the regularity of operation of such discharge lines and it also assists in keeping such discharge lines clean over practically indefinite periods of time.

Where the regulating valve is arranged in the discharge line externally of the still, particularly where the discharge line extends into the still for any substantial distance, the discharge line tends to become plugged or stopped, more or less frequently, between the regulating valve and the inner end of the line opening into the still. The unvaporized oil in a pressure cracking still usually contains a fairly large proportion of pitchy or asphaltic constituents and frequently contains a substantial amount of suspended solid or semi-solid carbonaceous material. Within the confines of a relatively small pipe, particularly where the velocity is low, these constituents tend to form deposits which build up, plugging or stopping the line. Likewise, in some cases, cracking of the oil may continue as it passes through the discharge line

and may result in the formation of coky or carbonaceous deposits in the line as a consequence.

According to the present invention, the regulating valve for controlling the discharge of unvaporized oil from the still is arranged within the still and at the extreme inner end of the discharge line. By this means, the reduction in pressure which takes place at this regulating valve in operation is made effective just as soon as the oil enters the discharge line so that the increase in velocity due to vaporization resulting from this reduction in pressure is also made effective throughout the discharge line. This increase in velocity inhibits any tendency toward the formation of carbonaceous deposits in the discharge line and, when made effective throughout the discharge line in accordance with the present invention, keeps the discharge line clean throughout its length practically indefinitely. Further, in accordance with the present invention, the operating extension for the regulating valve advantageously is carried to the outside of the pressure still through the discharge line, eliminating any necessity for a stuffing box exposed to the pressure and temperature prevailing in the still proper.

The invention will be further described in connection with the accompanying drawings, which illustrate, diagrammatically and conventionally, apparatus embodying the invention. In the accompanying drawings:

Fig. 1 represents, in elevation and partly in section and with parts broken away, a pressure still system embodying the invention,

Fig. 2 is a fragmentary elevation of a modified pressure still system,

Fig. 3 is an enlarged fragmentary view showing a discharge line and regulating valve arranged in accordance with the invention,

Fig. 4 is a similarly enlarged view normal to Fig. 3,

Fig. 5 is a further enlarged detail of the regulating valve illustrated in Figs. 1 to 4,

Fig. 6 is a view similar to Fig. 5 showing

a modified valve construction and Fig. 7 is a section on line 7—7 of Fig. 6, and

Fig. 8 is also a view similar to Fig. 5 showing another modified valve construction and Fig. 9 is a section on line 9—9 of Fig. 8.

Referring to Fig. 1, the pressure still illustrated comprises a bulk supply drum 1, a battery of heating tubes 2 arranged in a furnace 3, and circulating connections 4, 5 and 6 including a circulating pump 7 for circulating oil from the bulk supply drum upwardly through the heating tubes and back to the bulk supply drum. Vapors from the bulk supply drum 1 escape through vapor line 8 to the reflux tower 9 located above the bulk supply drum and vapors remaining uncondensed escape from the reflux tower through vapor line 10 to the condenser 11 arranged to discharge into the receiver 12. The distillate product is discharged from receiver 12 through connection 13 and uncondensed vapors and gases through connection 14. The pressure in the system may be maintained and regulated by means of valve 15 in the vapor line between the reflux tower 9 and the condenser 11 or by means of suitable valves arranged beyond the condenser 11 or the receiver 12. Raw oil is introduced into the upper end of the reflux tower 9 through connection 16, and is preheated as it flows through the reflux tower 9 at the same time assisting in cooling and condensing the heavier part of the vapors passing there-through. Admixed raw oil and reflux condensate flow back to the pressure still from the lower end of the reflux tower 9 through return line 17. A part of the cool raw oil is also supplied through connection 18 to assist in cooling and lubricating the bearings of the circulating pump 7, being forced into the circulating still charge through the pump bearings. Discharge line 19 is provided for the discharge, during operation, of unvaporized pitch-laden oil or tar from the pressure still. Connection 20 is provided for initially charging the still at the beginning of a run and for pumping out the still at the end of a run.

In the modified pressure still system illustrated in Fig. 2, a bed 21 of fuller's earth, or similar absorbent material, is arranged in the bulk supply drum 1 on a screen 22 extending entirely across the bulk supply drum between the circulating connections 4 to the battery of heating tubes and the circulating connection 6 from the battery of heating tubes. With this arrangement, the charge of oil circulating in the pressure still is caused to circulate and recirculate through the bed of fuller's earth, or the like, as it circulates and recirculates through the heating tubes. Otherwise, the arrangement of this still system is in general the same as that illustrated in Fig. 1.

The present invention relates particularly

to the arrangement of the discharge line 19 and of the regulating valve in this discharge line, and is illustrated somewhat more clearly in Figs. 3 and 4 than in Figs. 1 and 2.

As shown in Figs. 3 and 4, the discharge line 19 extends into the drum 1 of the pressure still (the extension is designated 19a) and the regulating valve for controlling the discharge of unvaporized oil from the body of oil in the still drum is located within the drum and at the inner end of the extension 19a. Instead of passing directly through the wall of the drum 1, the operating extension for this valve passes to the outside of the still through the discharge line, as shown in Figs. 3 and 4.

The valve proper, that is the closure means at the inner end of the discharge line, may be of several differing forms. The form illustrated in Fig. 5 has been found particularly simple and effective. As shown, it consists of a conical plug 23 adapted to seat in the end of the discharge line extension 19a movable toward and away from this seat by an operating extension 24 carried to the outside of the pressure still through the extension 19a and through a stuffing box 25 arranged in the discharge line externally of the still. The operating extension 24 may or may not be keyed against rotation and adjustment of its position is provided by a threaded stem 26, to which it is connected, passing through a rotatable nut 27. The end of the extension 19a forming a seat for the plug 23 may be reinforced by a ring 28.

The closure means, in the form of valve illustrated in Fig. 6 and 7, consists of a plug 29 sliding within the end of the discharge line extension 19a over a number of ports 30. This plug may be guided by pins 31 moving in slots 32 in the extension 19a. The closure means, in the form of valve illustrated in Figs. 8 and 9, consists of a plug 33 sliding within the end of the discharge line extension 19a over a number of ports or slots 34. A sleeve 35 carried by a number of pins 36 extending through the ports or slots 34 is also arranged to slide externally over the end of the discharge line extension 19a in conformity with motion of the plug 33 therein.

In operation, the still is charged with oil and brought to operating conditions of temperature and pressure in the usual way. These operating conditions will, of course, depend to a large measure on the character of the raw oil as well as on the character of the products desired. For the production of gasoline or gasoline-containing pressure distillate from gas oil, for example, pressures in the neighborhood of 100 to 300 pounds per square inch may be used and the distillation may be carried out at corresponding temperatures. After the still is brought to operating conditions of temperature and pressure, the introduction of raw oil is be-

gun and, in pressure still systems of the type illustrated, the introduction of raw oil into the upper end of the reflux tower may be regulated to condense and return to the pressure still those components of the vapors heavier than desired as components of the distillate product. Likewise, either shortly after the still is brought to operating conditions of temperature and pressure or some time later, the discharge of unvaporized oil through the discharge line 19 is begun. It will be understood that the lower end of the discharge line extension 19a is arranged somewhat below the normal liquid level in the drum of the pressure still. Where a bed of absorbent material is used, as in the apparatus illustrated in Fig. 2, the lower end of the discharge line extension 19a is advantageously arranged intermediate the liquid level in the still and the top of the bed.

Up to the time when the discharge of unvaporized oil through line 19 is begun, this line 19 is kept closed by means of the valve at the inner end of the line within the still drum. The block valve 37 is provided in the discharge line 19 simply for emergency use. When it is desired to begin the discharge of unvaporized oil, the valve at the inner end of the discharge line extension 19a is gradually opened until the desired rate of flow is established. Thereafter, during the operation, it may be closed or partially closed or further opened as required to maintain or vary the rate of discharge of unvaporized oil from the body of oil in the pressure still.

The reduction in pressure effected by the regulating valve at the inner end of the discharge line, in operation, results in a partial vaporization of lighter components of the discharged oil which in turn increases the volume of oil and consequently the velocity with which it flows through the discharge line, and, in the apparatus of the present invention this increase in velocity is effective throughout the discharge line, from its extreme inner end, to assist in maintaining flow and preventing deposition which might tend to plug or stop the line.

Some of the advantages of the invention may be realized by arranging the regulating valve on the inner end of the discharge line within the still drum and carrying the operating extension of the valve to the outside of the still through a stuffing box arranged directly in the still shell; but the arrangement more particularly described in connection with the accompanying drawings, with the operating extension of the valve carried to the outside of the still through the discharge line, is particularly advantageous.

In the apparatus illustrated, it will be noted that the discharge line extends into the drum downwardly from above the normal liquid level and opens downwardly into the

body of oil in the still. This arrangement of the discharge line also assists in preventing stopping or plugging due to deposition of carbonaceous solid or semi-solid material therein, for example, as compared to a discharge line opening into the bottom of the still drum or opening upwardly into the charge of oil therein. The present invention is of special value and application in connection with pressure still systems in which the discharge line is so arranged as it provides for arrangement of the regulating valve in the discharge line at the extreme inner end of the discharge line even though the discharge line extends inwardly into the still drum for a substantial distance.

Where the regulating valve has been arranged in the discharge line externally of the still drum, particularly where the discharge line has extended into the still drum for a substantial distance, the relatively slow velocity of the unvaporized oil passing through the discharge line before reaching the regulating valve has tended to cause stopping or plugging of the discharge line at a point between the regulating valve and the interior of the still necessitating, when any such stopping or plugging occurred, premature shut down of the pressure still with consequent loss of time in useful production. This invention eliminates premature shut down of pressure cracking stills due to this cause.

I claim:

1. In a pressure still for cracking hydrocarbon oils having a drum adapted to contain a body of oil and a line for discharging unvaporized oil from such body extending a substantial distance into said drum, a valve for controlling the discharge of oil through said line located within said drum and at the inner end of said line having an operating extension to the outside of said drum passing through the wall of said drum within said line.

2. In a pressure still for cracking hydrocarbon oils the improvement comprising a drum adapted to contain a body of oil, a line for discharging unvaporized oil from such body, said line being arranged to extend from a substantial distance within said drum and below the normal liquid level of the body of oil therein to a point external of the pressure still, means for maintaining super-atmospheric pressure on the pressure still including a valve for controlling the discharge of oil through said line, said valve being located within said drum and at the inner end of said line, and an operating extension from said valve to the outside of said drum.

In testimony whereof, I have subscribed my name.

DAVID A. YOUNG.