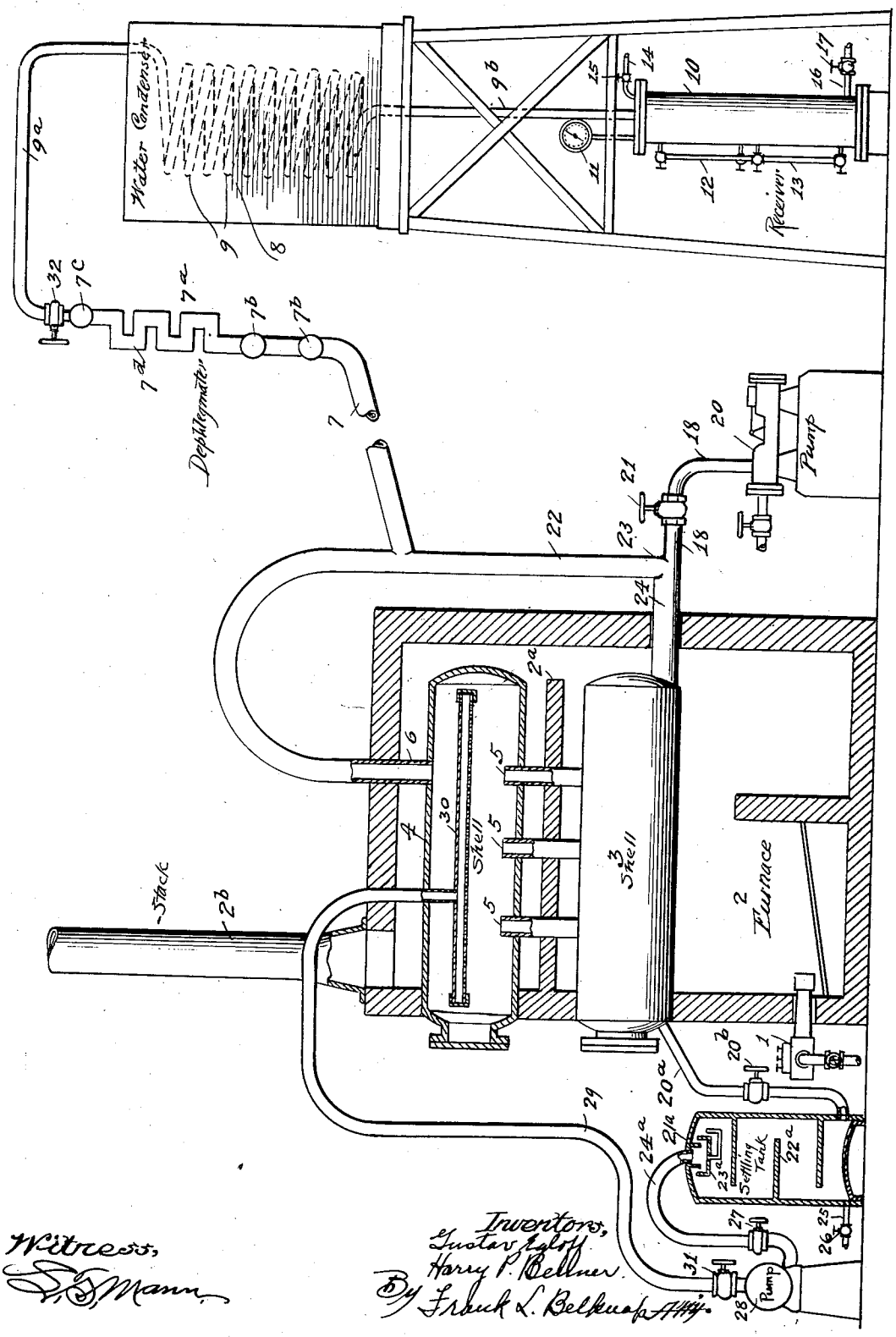
Dec. 8, 1931. G. EGLOFF ET AL 1,835,765

APPARATUS FOR CRACKING HYDROCARBON OILS

Original Filed July 6, 1920



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Patented Dec. 8, 1931 1,835,765

UNITED STATES PATENT OFFICE

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APPARATUS FOR CRACKING HYDROCARBON OILS

Application filed July 6, 1920, Serial No. 394,083. Renewed March 15, 1928.

Among the salient objects of our invention are to provide an apparatus for thermal and pressure distillation of heavy hydrocarbon oils to produce light oil therefrom by means of a double pressure still, a carbon settling tank and spraying oil over the surface of the oil in the upper still of the double pressure stills; to provide an apparatus for producing light oils from heavy oils by means of pressure distillation in a double pressure still while pumping raw oil into the lower still of the double pressure still; to provide an apparatus for thermal and pressure distillation of hydrocarbon oils to produce gasoline or other light oils therefrom by means of mixing the relatively cool dephlegmated oil with raw oil and pumping same to the bottom of the lower still of the double pressure stills; to provide an apparatus for pressure distillation in which the carbon and heavy oil from the lower pressure still are drawn into a settling tank having baffle plates therein to settle out the carbon and draw the carbon free oil by means of a pump and spraying said oil upon the liquid of the upper still of the double pressure stills; to provide an apparatus for the pressure distillation of hydrocarbon oils to produce light oils by means of a double pressure still, a carbon settling tank, a pump to circulate the oil from said settling tank to the upper still of the double pressure stills, a diverting of the dephlegmated oil to the bottom of the lower still of the double pressure stills and to pump raw oil continuously into the system through the lower pressure still of the double pressure stills, and in general to provide an improved apparatus of the character referred to.

In the drawing, the single figure illustrates a view partly in side elevation and partly in vertical section of our novel form of apparatus used in carrying out our process.

Referring to the drawing, 1 designates a gas burner, 2 the furnace provided with a bridge wall 2*a* and stack 2*b*. In the furnace is mounted the still which, as shown, may consist of a pair of cylindrical shells 3 and 4, the former mounted below and the latter above bridge wall 2*a*. These shells 3 and 4 are connected by means of the pipes or conduits 5, the upper ends of which preferably project above the bottom of the shell 4. To the upper end of the shell 4 is connected a goose-neck or vapor line 6 which is connected by pipe 7 to a dephlegmator 7*a*. This dephlegmator 7*a* consists of the cross headers 7*b* and 7*c* connected by right angle pipes 7*d*. The vapors pass from the dephlegmator 7*a* by means of line 9*a* to coil 8 seated in water condenser 8. The coil 9 is connected by pipe 9*b* to receiver 10. This receiver 10 is provided with pressure gauge 11 and liquid level gauges 12 and 13. It is also provided with gas outlet 14 controlled by throttle valve 15 and liquid draw off 16 controlled by throttle valve 17.

Charging stock or fresh oil is fed to the shell 3 from charging line 18 connected to pump 20 leading to any suitable source of supply. A valve 21 may be interposed in the charging line if desired. The reflux condensate which falls back from dephlegmator 7*a* passes through pipe 7 into branch 22 which is connected as shown at 23 to charging line 18. It is to be noted that line 22 is of larger diameter than charging line 18 for the reason that there is more reflux condensate than fresh oil normally fed into the still. The feed line 24 is preferably somewhat larger than the line 22. The vapors which are generated in shell 3 pass up through pipes 5 into the upper portion of the still or in other words the shell 4. Preferably the shell 3 is normally kept three quarters full of liquid. The temperature to which shell 4 is subjected is normally high enough so that the vapors in shell 4 will be superheated. Oil is continuously drawn off through line 20*a* controlled by valve 20*b* into the bottom of the carbon settling tank 21*a*. This tank 21*a* is provided with baffles 22*a* and 23*a* which tend to cause the carbon to precipitate out into the bottom of this tank. This carbon settling tank is provided with manhole plate (not shown) so that it can be readily cleaned out. The heavier oil containing a maximum amount of carbon is drawn off through line 25 controlled by valve 26. The cleaner oil passes through line 24*a* controlled by valve 27 to pump 28 whence it is returned by line 29 into the upper

end of the shell 4. This line 29 terminates in a perforated pipe 30 extending horizontally through the shell 4. A valve 31 is preferably interposed in line 29. The hot oil which passes through the perforated pipe 30 is in part vaporized and the unvaporized portion can pass out through pipes 5 into the shell 3 flowing counter-current to the ascending vapors. The lines 22, 24, 20*a*, settling tank 21*a*, pipe 24*a* and pipe 29 are preferably lagged or insulated so as to prevent as far as possible any reduction in temperature of the oil passing therethrough.

The following description of the operation of the process may be given. The shell 3 is charged and kept charged to approximately 75% of its capacity with say a mid-continent gas oil of 32° Baumé gravity. The oil temperature in the shell 3 may be 750° F. while the vapors that pass to shell 4 may be subjected to a vapor temperature of 820° F. A pressure of 105 pounds may be maintained on the entire system by suitably regulating the valves in the receiver 10 and the residuum draw-off valve 26. If desired, a differential pressure may be maintained by regulating the valve 32 interposed between line 9*a* and dephlegmator 7*a*. By regulating this valve 32 a pressure of 100 lbs. may be maintained on the still and dephlegmator and a pressure of 50 lbs. on the water condenser and receiver or atmospheric pressure on the latter. These shells 3 and 4 may each be of 6′ diameter and 30′ long with the rest of the apparatus approximately the proportionate size shown in the drawing. By means of this process, 65% of the gas oil may be converted into pressure distillate having a gravity of 51 Baumé and upon the basis of raw oil treated 36% of oil may be thus converted into 58 Baumé gravity gasoline.

The following modification of the process may be described. Instead of filling the shell still 3 three quarters full of oil, the oil may be fed in sufficient quantity into the still so as to maintain a liquid level of approximately 70% of the total capacity of the entire still. In other words the liquid level of the oil will be maintained in shell 4 slightly below the perforated pipe 30. In certain cases it may be desirable to carry out the modified process, as for example in refractory or oils difficult to crack such as Pine Island gas oil, kerosene, steam still bottoms or Mexican gas oil, it is advisable to have a maximum heating area per gallon of oil treated compared to the dephlegmation surface; for there are easily cracked oils such as heavy asphaltic in the character of the type of Iola crude, fuel oil from wayside fields of Kansas, residuums or the like which require much less radiating surface in relationship to heating surface for equivalent production of result from said hydrocarbon oils.

With reference to the novel form of apparatus it is to be noted that the double pressure still shown permits of the use of smaller units which have a much greater factor of safety than a single shell of the same capacity. In addition a maximum heating area is obtained for a given capacity and also by means of this apparatus the vapors can be readily superheated.

We claim as our invention:

1. An apparatus for cracking oil, comprising a furnace, a pair of shell stills therein, and a plurality of communications between said stills, means for supplying raw oil directly to the lower still, the vapors passing through said communications into the upper still to be superheated therein, means for discharging unvaporized oil from the lower still, to a settling zone wherein the oil's free carbon content is precipitated, and means for delivering the carbon free oil to the upper still to contact with the ascending vapors during its passage to the lower still.

2. An apparatus for cracking oil, comprising a furnace, a pair of shell stills therein, and a plurality of communications between said stills, means for supplying raw oil directly to the lower still, the vapors passing through said communications into the upper still to be superheated therein, means for withdrawing oil from the lower still, a settling zone through which said oil passes, means for delivering the carbon free oil from said settling zone to the upper still to contact with the ascending vapors during its passage to the lower still, means for discharging vapors from the upper still, and means for returning reflux condensate to the lower still.

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