Feb. 14, 1933. C. P. DUBBS 1,897,635

PROCESS FOR CRACKING OILS

Original Filed March 9, 1923 2 Sheets-Sheet 1

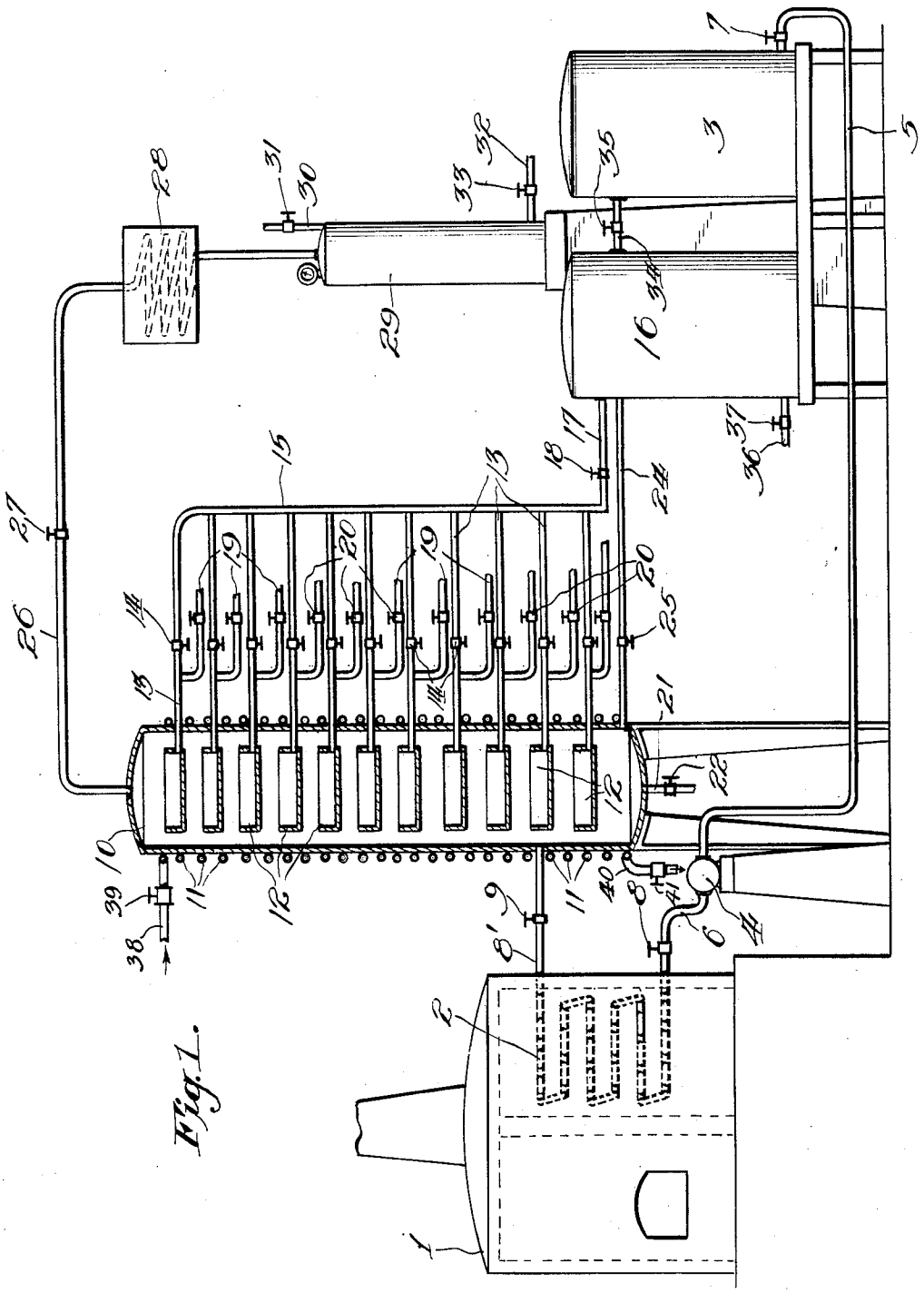

Fig. 1.

Witness:
Stephen A. Hebra

Inventor:
Carbon P. Dubbs,
by Frank L. Belknap
Atty.

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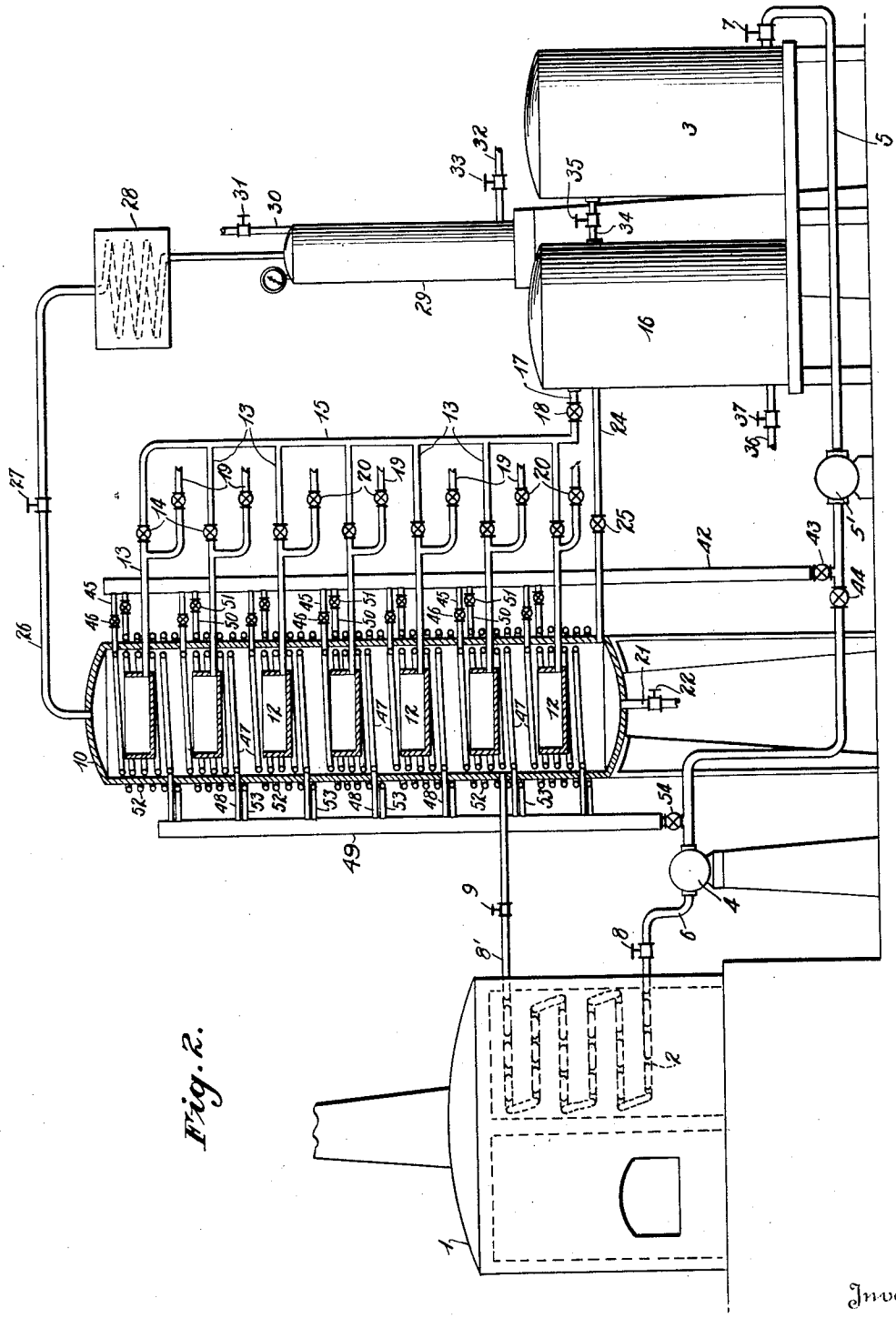

Fig. 2.

Inventor

Carbon P. Dubbs

By Frank L. Belknap

Attorney

Patented Feb. 14, 1933

1,897,635

UNITED STATES PATENT OFFICE

CARBON P. DUBBS, OF WILMETTE, ILLINOIS, ASSIGNOR TO THE UNIVERSAL OIL PRODUCTS COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF SOUTH DAKOTA

PROCESS FOR CRACKING OILS

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This invention relates to improvements in processes for cracking oil, and refers more particularly to that type of process in which the oil is subjected to cracking temperature in a suitable heating zone, preferably in a heating coil mounted in a furnace, and thence passed to a suitable expansion chamber. Generally, from the expansion chamber the oil passes to a dephlegamator where the heavier vapors are condensed as reflux condensate and separated from the lighter gasoline-like bodies.

By means of the present apparatus, the apparatus and process is somewhat simplified by making the expansion chamber and dephlegmator one. At the same time a very fine separation is made of the various oil constituents which enter this enlarged chamber in such a way that any given quantities or cuts can be recracked, including the residuum.

By means of the present invention, a very much larger percentage of the coil can be cracked, than has been the case heretofore.

It will be understood that various forms of apparatus may be employed for carrying out my invention. I have, however, shown two embodiments suitable for practicing the invention in the accompanying drawings, in which

Fig. 1 is a side elevation, partly in section, of an embodiment wherein an extraneous cooling means may be employed, and

Fig. 2 is a side elevation, partly in section, of an apparatus wherein the combined charging stock may be employed as the cooling medium for the tower.

Referring to Fig. 1 of the drawings 1 designates the furnace in which is mounted the heating coil 2, which may take the form of a continuous coil of two to six inch tubes or may take the form of a plurality of tubes in multiple. The oil may be fed to the heating tubes from the raw storage charging tank 3 by means of the pump 4 and pipes 5 and 6 having valves 7 and 8 respectively.

The heated oil passes out through transfer line 8′ having a throttle valve 9 into a combined dephlegmator and expansion tank 10, which is surrounded with a temperature regulating coil 11 through which any desirable cooling medium can be passed for controlling the temperatures in the tank 10, and in such a way if desired, that the lower part of the tank 10 can be maintained at a higher temperature than the upper part of the tank, this may be accomplished by introducing the cooling medium to the coil at the top of the tank through the line 38 controlled by the valve 39 and withdrawing the same from the coil at the bottom of the tank through the line 40 controlled by the valve 41, it being understood that this tank 10 preferably is more or less of an extended height varying from 20 to 80 feet. The tank 10 is provided with suitable pans 12 which not only serve the purpose of baffles but also act as receptacles for collecting various cuts of reflux condensate which may condense at different temperatures in the tank 10, and it may be here noted that it may be desirable to exercise considerable care in making rather fine distinctions in temperature in various parts of the tank.

The vapors condensed in the tank 10 may be drawn off through the pipes 13 having throttle valves 14 to a manifold line 15 leading back to a combined charging and settling tank 16 through pipe 17 having a throttle valve 18.

Arrangement is made whereby the contents of any pan 12 may be by-passed which is accomplished by means of pipe 13 and by-pass pipes 19 having throttle valves 20. These pipes 19 lead to any suitable storage, not shown.

The heaviest residue in the bottom of the tank 10 may be drawn through the pipe 21 controlled by throttle valve 22 to any suitable place, or if desired, may be passed through pipe 24 having a throttle valve 25 to tank 16 depending somewhat on how much carbon and coke the heaviest part of the residue contains.

The uncondensed vapors pass out of the top of the tank 10 through the pipe 26 having throttle valve 27 to suitable water condenser 28, and thence to receiver 29. The receiver 29 is provided with gas outlet pipe 30 having a throttle valve 31 and liquid drawoff pipe 32 having throttle valve 33.

By reducing the pressure through the throttle valve 9 where, for example, the pressure may be from 200 to 300 pounds, more or less, maintained on the heating coil, to a pressure of say 30 to 75 pounds on the tank 10, a very much larger percentage of the oil will be vaporized in the tank 10 than will be the case if the tank 10 is maintained at the same pressure as the heating coil 2, as will be apparent to those skilled in the art.

It is to be understood that the pressures above given are merely illustrative, and that the differential pressures may be either more or less than those above given, or if desired, a uniform pressure may be maintained on the tank 10 and the coil 2 with the same pressure on the condenser 28 and receiver 29, or with a differential pressure by throttling down the valve 27 so that the pressure on the water condenser may be even as low as atmospheric.

It is to be particularly noted that by means of the present invention the condenser vapors can be withdrawn from the tank through the various pans shown, and retreated by mixing them with the charging stock, this being accomplished by connecting the tank 16 to the tank 3 by means of the pipe 34 having throttle valve 35. The tank 16 may also have a drawoff pipe 36 having a throttle valve 37.

The temperature of the tank 10 may be so regulated that practically nothing but gasoline of a predetermined end point, as for example, 400° F. end point may pass off into the condenser 28. This of course, is subject to the fact that some heavier particles are more or less likely to be entrained over with the light vapors. Various means may be utilized for controlling the temperature of the tank 10, for example, as shown in Fig. 2, the combined charging stock may be circulated through coils located either inside or outside of the tank.

The embodiment shown in Fig. 2 is in all respects similar to the embodiment shown in Fig. 1, with the exception that the cooling medium comprises the combined charging stock and, instead of being passed through a single coil disposed on the outside of the tank 10, the cooling medium may be passed through selected coils disposed on the interior of the tank 10 or through selected coils disposed on the exterior of the tank 10 in any desired manner. To accomplish this, a header 42 is connected to the combined feed line 5 having interposed therein pump 5' and the supply of oil to the header 42 is controlled by the valves 43 and 44 positioned in the header 42 and feed line 5 respectively. From the header 42, there extend a plurality of outlet lines 45, each controlled by a valve 46. Each of the lines 45 communicate with a coil 47 positioned on the interior of the tank 10. The liquid introduced to the coils 47 may be discharged therefrom through the outlet pipes 48 to a common header 49, which communicates with the charging line 5 adjacent pump 4. The header 42 is also provided with a second series of outlet pipes 50, each controlled by a valve 51. The outlet pipes 50, communicate with the outer coils 52, which are vertically disposed on the exterior of the tank 10. Liquid introduced to the outer coils 52 discharges through the pipes 53 into the common header 49 and is returned through the valve 54 to the charging line 5, to be forced by the pump 4 through the heating coil. By suitably controlling the amount of liquid passed through the various coils 47 and 52 and by properly selecting the coils to which the liquid is supplied, it will be seen that the temperature in the various sections of the tank 10 can be regulated and maintained within relatively close limits. It is also to be noted that, due to the provision of the discharge lines 19, any particular fraction which has collected in any one of the pans 12 can be discharged from the system. It will thus be seen that I provide a method and means whereby only such parts of the contents of the tank 10 may be recracked as is desired, and where a refiner has various kinds of oils to use from different fields, as for example, Mid-Continent oils and Mexican or heavy Texas oils, or wants to crack kerosene, gas oil or fuel oil, he will be able by means of this apparatus to effectively do so, and positively control the character of his charging stock.

It will also be noted that he can very carefully regulate the proportions and contents of the tank 16 which enter the tank 3. By means of the present invention 50% or more of the raw charging stock may be converted into suitable gasoline.

I claim as my invention:

1. A process for cracking hydrocarbon oil comprising passing a stream of oil of restricted cross sectional area through a furnace wherein it is raised to a cracking temperature, causing such oil to flow directly and while in said restricted stream into an enlarged chamber, decreasing the temperature of the oil in said enlarged chamber by passing a cooling medium in heat interchange relationship therewith, condensing insufficiently cracked fractions from the vapors evolved from the oil in said chamber by passing additional quantities of cooling medium in heat interchange relationship with such vapors, separately removing from said chamber unvaporized constituents of the oil delivered thereto and insufficiently cracked fractions condensed from the vapors therein, uniting selected insufficiently cracked fractions removed from said chamber and unvaporized oil constituents removed from said chamber with charging oil for the process to be again passed through said furnace.

2. A process for cracking hydrocarbon oil comprising passing a stream of oil of restrict-

ed cross sectional area through a furnace wherein it is raised to a cracking temperature, causing such oil to flow directly and while in said restricted stream into an enlarged chamber, decreasing the temperature of the oil in said enlarged chamber by passing a cooling medium in heat interchange relationship therewith, condensing insufficiently cracked fractions from the vapors evolved from the oil in said chamber by passing additional quantities of cooling medium in heat interchange relationship with such vapors, separately removing from said chamber unvaporized constituents of the oil delivered thereto and insufficiently cracked fractions condensed from the vapors therein, uniting selected insufficiently cracked fractions removed from said chamber and unvaporized oil constituents removed from said chamber with charging oil for the process to be again passed through said furnace, and maintaining a lower super-atmospheric pressure in said chamber than is maintained upon the oil stream passing through said furnace.

3. A process for treating heavy hydrocarbon oils to produce gasoline-like products comprising raising the oil to a cracking heat in a heating zone, introducing the oil directly from the heating zone and prior to substantial vaporization, into an enlarged chamber, decreasing the temperature of the oil introduced to said enlarged chamber by passing a cooling medium in heat interchange relationship therewith, condensing fractions from the vapors evolved from the oil having boiling points higher than the boiling points of the gasoline-like products desired by passing additional quantities of cooling medium in heat interchange relationship with such vapors, separately removing from said enlarged chamber unvaporized constituents of the oil delivered thereto and any insufficiently cracked fractions condensed from the vapors, uniting selected insufficiently cracked fractions condensed from the vapors and unvaporized oil constituents removed from such chamber with charging oil for the process to be again subjected to the cracking heat.

CARBON P. DUBBS.