Aug. 21, 1923. 1,465,752

R. YATES

MANUFACTURE OF GASOLINE

Filed July 6, 1920 2 Sheets-Sheet 1

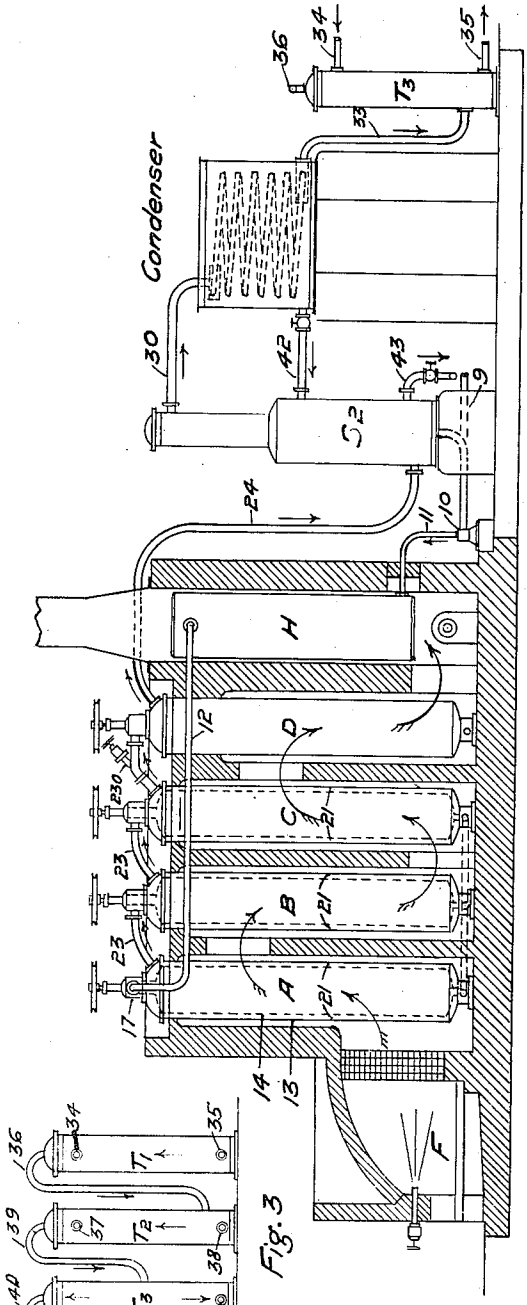


Fig. 1

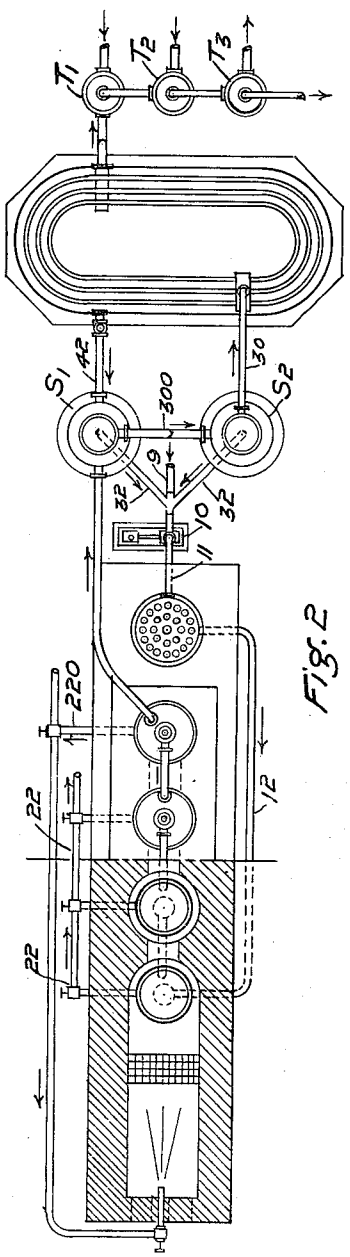


Fig. 2

Fig. 3

Inventor
Robert Yates

By his Attorney
Andrew F. Kirby

Aug. 21, 1923.

1,465,752

R. YATES

MANUFACTURE OF GASOLINE

Filed July 6, 1920

2 Sheets-Sheet 2

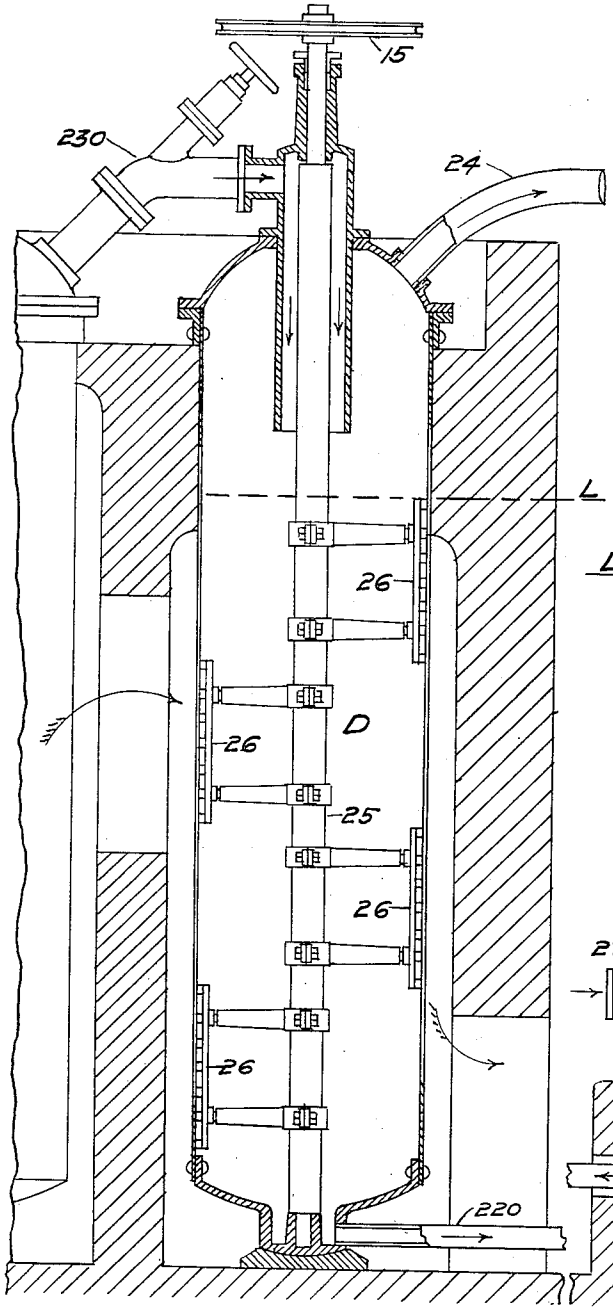


Fig. 4.

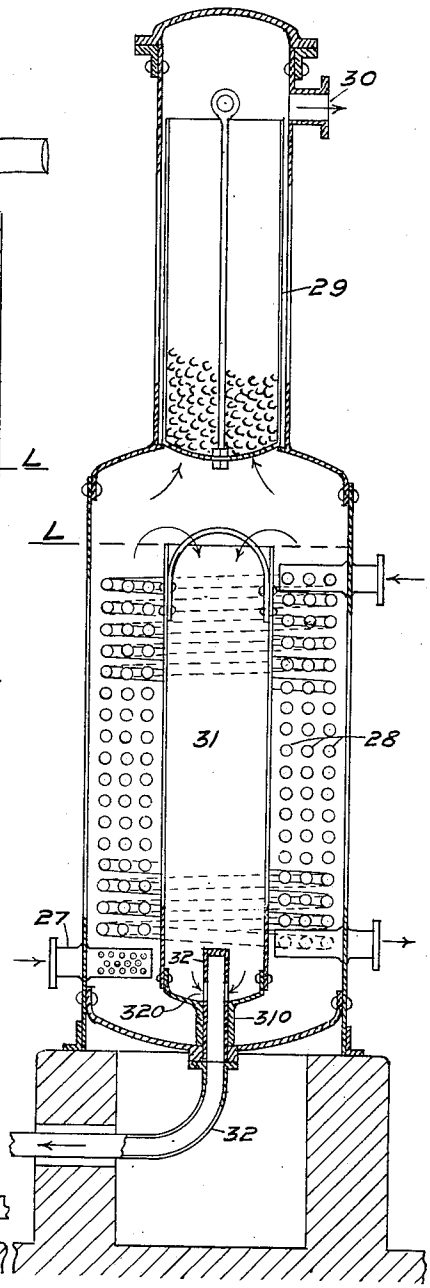


Fig. 5.

Inventor
Robert Yates
By his Attorney
Andrew Ewing Jr.

Patented Aug. 21, 1923. 1,465,752

UNITED STATES PATENT OFFICE.

ROBERT YATES, OF PASSAIC, NEW JERSEY.

MANUFACTURE OF GASOLINE.

Application filed July 6, 1920. Serial No. 394,200.

To all whom it may concern:

Be it known that I, ROBERT YATES, a citizen of the United States, residing in the city of Passaic, State of New Jersey, have invented new and useful Improvements in the Manufacture of Gasoline, of which the following is a specification.

This invention relates to processes for reducing high boiling petroleum oils to lower boiling oils and the object is to devise a process by which the oils may be passed thru the several stages of treatment in one continuous, uninterrupted operation. Apparatus, suitable for the practice of this process is illustrated in the accompanying drawings, in which:—

Fig. 1 shows a longitudinal section of the heating chambers with the decomposing cylinders and preheater enclosed therein, in elevation; also the separators, condenser and deodorizing tanks in elevation.

Fig. 2 is a plan of Fig. 1, showing a sectional plan of one-half of the heating chambers and a top view of the other half; also a top view of the separators, condenser and treating tanks.

Fig. 3 is a front view of the deodorizing tanks.

Fig. 4 is a vertical section of the vaporizing cylinder D, of Fig. 1, showing the pressure relief valve 230, connecting the decomposing cylinders with this vaporizing cylinder.

Fig. 5 is a vertical section of the separators or primary condensers, showing the pebble basket 29, cold water coils 28, and central well 31.

Further reference is made to my United States Patent No. 1,395,075, October 25, 1921, for process and apparatus for treating petroleum oils to produce gasoline, in which the operation of the decomposing chambers herein referred to, and preferred in the operation of this process, are more fully described and illustrated.

Describing the separate parts and their several functions, similar characters referring to similar parts thruout the several views.

9 refers to a pipe supplying the original oils.

10 is a feed pump.

11 is a pipe from the pump 10 to the heater H.

H is a heater of any suitable form, by which the waste gases of combustion are utilized to heat the oil to above 200° F.

12 is a pipe conducting the heated oil from the heater H to the first decomposing cylinder A.

A, B and C are decomposing cylinders, in which high boiling oil is decomposed and reduced to lower boiling oils, under a pressure above 35 lbs. per sq. inch, and temperature of 650° to 850° F.

14 refers to rotating drums within the decomposing cylinders as shown in dotted lines. These drums have openings in the necks, thru which the oil and vapors enter the drums, and open bottoms thru which both oil and vapors leave the drums. These drums serve two purposes, first to reduce the body of oil in the cylinders to an annular sheet, between the drums and cylinders, to facilitate vaporization at moderate temperature; and secondly to retain the vapors for a period of time within the drums and within the surrounding sheet of oil, thus decomposing the oil in vapor form at moderate temperature and with the least formation of noncondensable gases and carbon.

21 refers to an annular space between the drums 14 and shell 13 of the decomposing cylinders.

22 refers to pipes for draining the decomposing cylinders when required.

220 is a pipe for drawing off the tarry residue from the vaporizing cylinder D.

23 refers to pipes conducting the vapors and oils from the annular space 21 of one decomposing cylinder into the vapor drum of the next cylinder.

230 is a pressure relief valve thru which the vapor pressure is reduced from high pressure in the decomposing cylinders A, B and C to low pressure in the vaporizing cylinder D.

D, Figs. 1, 2 and 4, is a vaporizing cylinder, wherein the high boiling oils and tarry residues passing over from the decomposing cylinders are separated and in which:—

25 is a rotating shaft, and

26 refers to sweeps suspended on arms attached to the shaft 25, to sweep the interior of the cylinder and prevent the accumulation of tar near the hot shell of the cylinder. In this cylinder the vapor pressure is reduced to below 20 pounds per square inch,

while the temperature of both vapors and oils, passing over from the decomposing cylinders is maintained, thus permitting oils held in liquid form under the high pressure in the decomposing cylinders, to vaporize under the lower pressure in this cylinder D. The temperature of the vapors may be here decreased by expansion due to reduced pressure, but this decrease is at the same time counteracted by an increase of temperature due to passing thru the contracted throat of the pressure relief valve. These reactions are however unimportant as the resultant vapors entering this cylinder D immediately pass out thru pipe 24, while the unvaporized oils and residues fall into the cylinder where they are allowed to accumulate to about the level of the line L; the oils here then slowly vaporize under action of the hot gases of combustion passing around the cylinder, the vapors then pass out of this cylinder thru pipe 24 with the lighter vapors to the separator S^1, while the tarry residue accumulating in the cylinder is drawn off thru pipe 220 at the bottom.

S^1 and S^2, Figs. 1, 2 and 5, are separators or primary condensers constructed alike and performing similar functions, in which:—

27 is a nozzle thru which the vapors enter the separator; this nozzle is perforated on only one side, so that the issuing vapors give a rotative movement to the oil in the separator.

28 refers to cold water coils submerged in the oil in the separator to regulate the temperature, the cooling water for these coils is preferably drawn from the condenser tank where a uniform temperature is assured, the temperature of the oil in the separator is regulated by regulating the flow of water thru pipes 42 and 43, feeding and draining these coils (see Fig. 1).

29 is a basket filled with pebbles to scrub the vapors.

30 is the vapor outlet.

300 is a pipe conducting the vapors from the outlet 30 (Figs. 2 and 5) of separator S^1, to the nozzle 27 of separator S^2.

31 is a well receiving the overflow oil from the surrounding coil chamber. This well acts as an automatic valve by having a closed bottom with an extended neck 310, designed to slide up and down on the pipe 32 and close or open the ports 320. Oil accumulates in the separator to the line L, then overflows into the well sinking it to the position shown, this oil then discharges thru the ports 320 and pipe 32 until the buoying effort of oil surrounding the well exceeds the weight of the well where it again rises and closes the ports 320, thus controlling the discharge automatically.

32 refers to the discharge pipes conducting the discharged oils from separators S^1 and S^2 back to the feed pump 10. Two separators are preferred, to thoroughly wash and scrub the gasoline vapors before going to the condenser, though only one may be used if desired.

The condenser (Figs. 1 and 2) may be of any suitable form but should be placed so that the discharge from the coils will be above the treating tanks T^1, T^2 and T^3, to prevent acid from backing up into the coils.

This process comprises the following distinct steps connected with each other in one continuous operation: first, reducing the original oil to a synthetic crude by partial evaporation and decomposition; second, separating the unvaporized asphaltic fraction from this crude by distillation; third, separating fractions of oil boiling above the boiling point of the required gasoline, by condensing these fractions out of the resultant vapors; fourth, washing, scrubbing and condensing the vapors of gasoline.

Describing the operation of the process following the course of the oil and vapors thru the apparatus as indicated by the small arrows:—

Fresh oil is pumped from pipe 9 thru a pump 10 and pipe 11 into the heater H, where it is heated to above 200° F., then passed thru pipe 12 and dome 17 into the neck of the interior drum 14, of cylinder A, then down into the drum; here the oils are partially vaporized, the vapors filling the drum under pressure expels the oil thru the open bottom into an annular space 21 between the drum and the cylinder, where both oil and vapors are subjected to a temperature of 650° to 850° F. as they rise thru this space, then discharge thru pipes 23 into cylinders B and C, where the above described action is repeated successively. The vapors and oils now pass from the decomposing cylinder C thru a pressure relief valve 230, into the vaporizing cylinder D, where the vapor pressure is reduced from the high pressure of above 35 pounds per square inch in the decomposing cylinders to below 20 pounds in this cylinder D, thus liberating vapors that were held down under the higher pressure. The remaining high boiling oils and residues fall into the cylinder D where the oils vaporize under the high temperature and reduced pressure in this cylinder, the vapors then pass out thru pipe 24 with the lighter vapors while the accumulating residues are drawn off from the bottom of this cylinder thru pipe 220. The mixed vapors passing thru pipe 24 discharge into the separator S^1, and into a body of oil maintained at a temperature of 400° to 600° F., wherein oils boiling above this temperature are condensed out of the vapors and returned thru the feed pump 10, while vapors of oil boiling below this temperature pass up thru the basket of pebbles in the neck of the separator and

are scrubbed; then out at the top and over thru pipe 300 into separator S^2, and into a second body of oil maintained at the boiling temperature of gasoline; here oils boiling above this temperature are condensed out of the vapors and remain to return, together with the condensate from separator S^1, back thru the feed pump 10. The gasoline vapors now pass up thru a second basket of pebbles in the neck of this separator S^2, and are again scrubbed, then pass thru pipe 30 to the condenser coils. The gasoline and non-condensable gases, following the course of the arrows, pass from the condenser through the treating tanks T^1, T^2 and T^3, wherein the pressure is reduced to that only required to discharge the gases and gasoline; the entire process operating under continuous, declining pressure. Heat is supplied from the furnace F, the hot gases of combustion follow the course indicated by the feathered arrows, passing around the decomposing cylinders A, B, C, and vaporizing clyinder D, then thru and around the heater H to the stack above.

Temperatures and pressures herein given, also the number of similar parts and their arrangement, as shown on the drawings, are not to be considered as specific to this invention, but subject to change according to requirements.

Claims:

1. A process for manufacturing gasoline by reducing high boiling petroleum oils to lower boiling oils, comprising: decomposing the oil in both oil and vapor form in cylinders, having a rotating drum within each cylinder, the oil and vapor entering the drum under vapor pressure, the vapors filling the drum and expelling the oil into an annular space between the drum and cylinder, circulating the oil around the annular space to prevent local overheating, and subjecting it to a moderate decomposing temperature in contact with the heating surface of the cylinder, also subjecting the vapors within the drum to the same moderate decomposing temperature as the oil, and for a period of time sufficient to effect decomposition, while protecting these vapors from overheating by the surrounding sheet of oil in the annular space; then reducing the vapor pressure to liberate vapors previously held down as oil under the higher pressure and precipitating unvaporized high boiling oils and asphaltic residue out of the vapors into a vaporizing cylinder, and maintaining a vaporizing temperature therein to vaporize these high boiling oils; drawing off the asphaltic residue from this cylinder and conducting the vapors of both high and low boiling oils to a separator.

2. A process for manufacturing gasoline by reducing high boiling petroleum oils to lower boiling oils, comprising; decomposing the oil in both oil and vapor form in cylinders, having a rotating drum within each cylinder, the oil and vapor entering the drum under vapor pressure, the vapors filling the drum and expelling the oil into an annular space between the drum and cylinder, circulating the oil around the annular space to prevent local overheating, and subjecting it to a moderate decomposing temperature in contact with the heating surface of the cylinder, also subjecting the vapors within the drum to the same moderate decomposing temperature as the oil, and for a period of time sufficient to effect decomposition, while protecting these vapors from overheating by the surrounding sheet of oil in the annular space; then reducing the vapor pressure to liberate vapors previously held down as oil under the higher pressure and precipitating unvaporized high boiling oils and asphaltic residue out of the vapors into a vaporizing cylinder, and maintaining a vaporizing temperature therein to vaporize these high boiling oils; drawing off the asphaltic residue from this cylinder and conducting the vapors of both high and low boiling oils to a separator; here condensing out of these vapors oils boiling above 500° to 600° F. by passing them thru a body of oil maintained at this temperature in said separator, at the same time washing and refining the vapors of lower boiling oils thru said body of oil, then conducting these vapors of lower boiling oils thru a scrubbing medium to a second separator; here, again passing these vapors of lower boiling oils thru a second body of oil maintained at the boiling temperature of the required gasoline and condensing out oils boiling above this temperature, washing and further refining the vapors of gasoline in this second body of oil then conducting them thru a second scrubbing medium to the final condenser, while drawing off the higher boiling fractions of oils from both mentioned separators and returning them to the decomposing cylinders with the original fresh oil, the entire process operating continually under declining pressures.

3. In a process for manufacturing gasoline by reducing high boiling petroleum oils to lower boiling oils, passing the vapors and unvaporized oils from decomposing cylinders into a vaporizing cylinder and reducing the vapor pressure in this cylinder to liberate vapors previously held down as oil under the higher pressure; precipitating high boiling oil and asphaltic residues out of the vapors into this vaporizing cylinder and circulating this oil and residue to prevent carbon forming on the shell; while circulating the hot furnace gases around outside of the cylinder and maintaining high temperature therein to vaporize and separate the high boiling oils out of the asphaltic resi-

dues; drawing off the asphaltic residues from the bottom of the vaporizing cylinder and conducting them to a furnace or a storage tank, while conducting all of the vapors of both high and low boiling oils to a separator, here separating out of these vapors oils boiling above the boiling temperature of the required gasoline and returning such high boiling oils to the decomposing cylinders while conducting away and condensing the gasoline vapors.

Signed at New York, in the county of New York and State of New York, this 2d day of July, A. D. 1920.

ROBERT YATES.