L. O. SHERMAN.

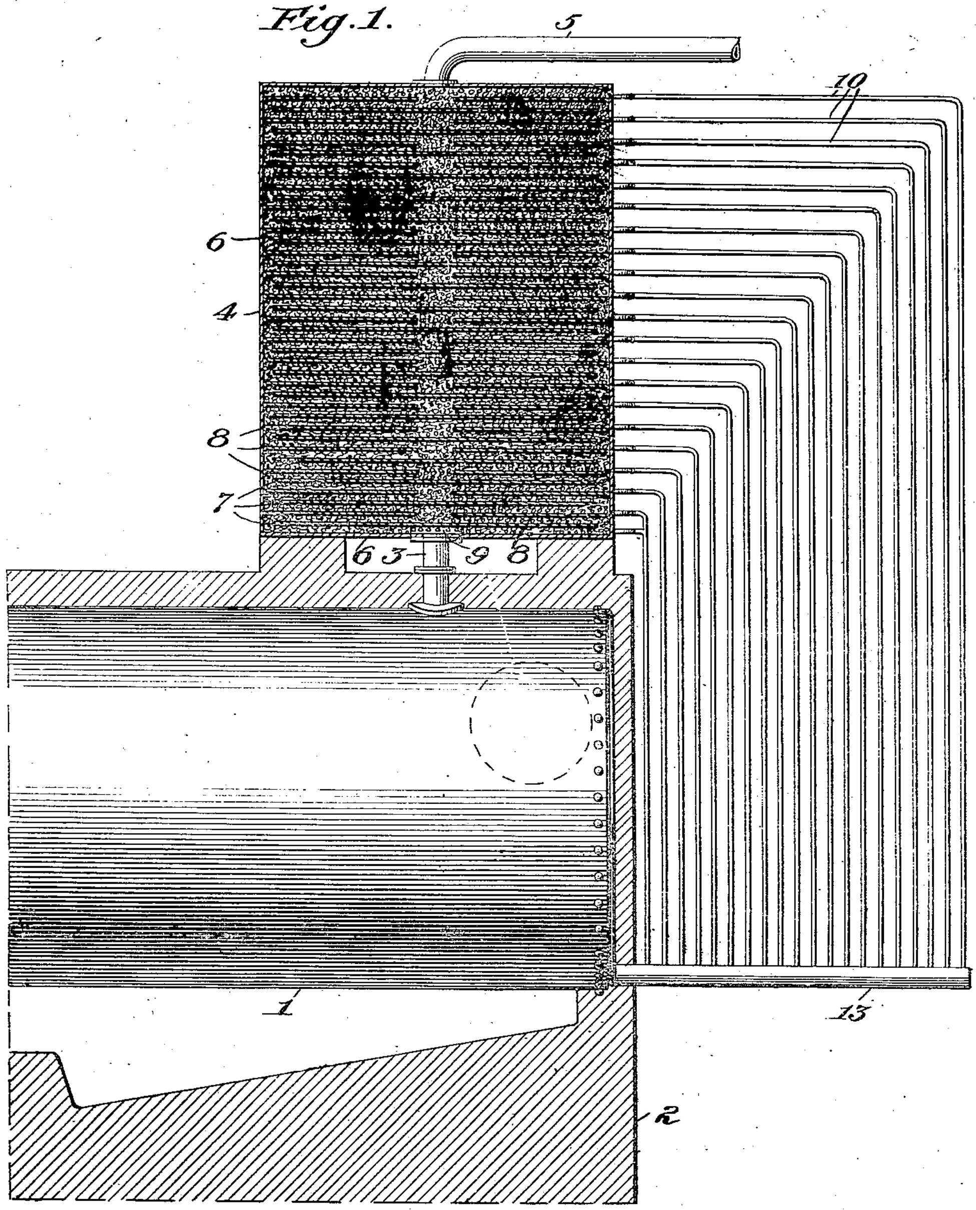
METHOD OF DISTILLING LIQUIDS.

APPLICATION FILED MAR. 18, 1909.

968,088. Patented Aug. 23, 1910.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

C. H. Potter.

M. E. Browne

Inventor:

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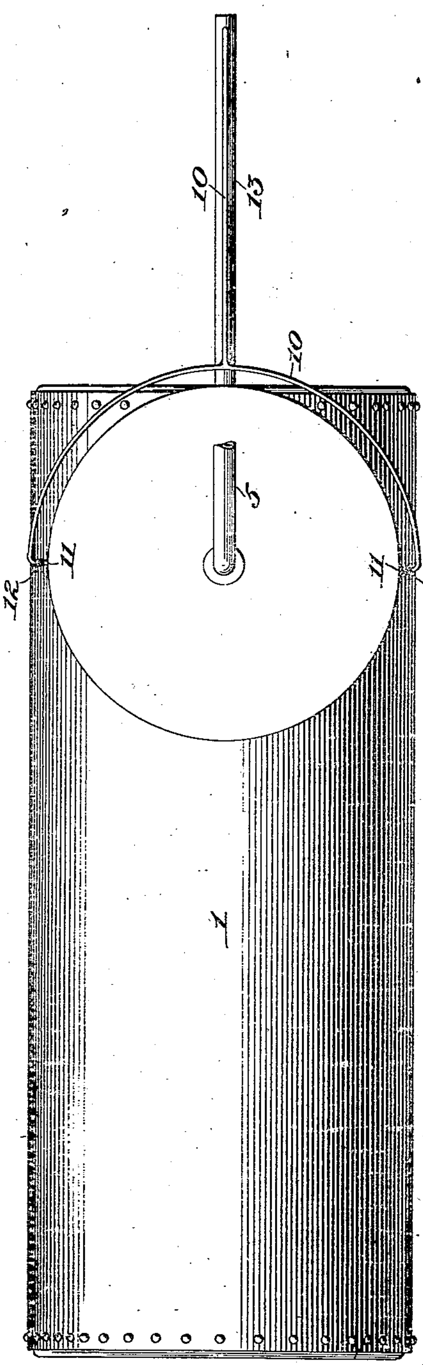

Fig. 2.

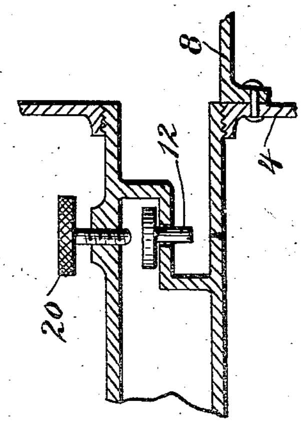

Fig. 3.

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UNITED STATES PATENT OFFICE.

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METHOD OF DISTILLING LIQUIDS.

968,088. Specification of Letters Patent. Patented Aug. 23, 1910.

Application filed March 18, 1909. Serial No. 484,280.

To all whom it may concern:

Be it known that I, LAYTON O. SHERMAN, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Methods of Distilling Liquids, of which the following is a specification.

The object of this invention is the provision of a method of distilling hydrocarbon oils and other volatile liquids under conditions yielding from crude materials a distillate of high purity and grade and nearly homogeneous character. According to the method the liquid is heated, and the resulting vapors are caused to impinge at high velocity upon a chemically inert filling or obstructive material, and the portions of the vapors thereby condensed are returned to the still and reheated therein, the condensation and reheating being repeated many times; the uncondensed portion of the vapor is withdrawn and condensed in the usual manner as a practically homogeneous distillate.

For a full understanding of my invention reference is made to the accompanying drawings wherein—

Figure 1 is a longitudinal sectional view showing a preferred form of apparatus for carrying the method into effect; and in Fig. 2 is a plan view of the same. Fig. 3 is a sectional view of a check valve.

In said drawings, 1 represents an oil still of ordinary type in the usual furnace setting 2. Near one end of the still is a vapor pipe 3 leading upwardly to a casing or drum 4, from the upper portion of which extends an outlet 5 for the vapors which escape condensation in the drum, this outlet leading to a condenser of any suitable type. Within the casing 4 is an obstructive filling 6, preferably employed in connection with baffles 7, 8, so arranged as to provide a tortuous and restricted path for the vapors.

As illustrated, the casing 4 is provided with an interior, perforated metal ring 9 surrounding the aperture of the vapor pipe 3, a layer of the filling material 6 being distributed over the bottom of the casing around the ring 9. Upon this layer is placed a disk-shaped plate 7, of slightly less diameter than the interior of the casing, providing a peripheral vapor passage. The filling material is distributed in a thin layer over this plate and covered by a disk 8, forming a tight joint with the periphery of the casing and having a central aperture. This arrangement is continued to the top of the casing, the plain and perforated disks alternating with each other, and the obstructive material filling the interstices. There is thus provided a long and tortuous vapor path, in traversing which the vapors impinge at high velocity and at high temperature upon the obstructive filling. A progressive condensation of the vapors occurs, and the condensed portions are returned to the still through pipes 10, tapped into opposite sides of the casing at 11 just above each of the baffle plates 8: each of these pipes is preferably provided with check valves indicated at 12 to prevent the liquid in the still from being forced, by excess of pressure therein, into the casing. The several pipes 10 terminate in a manifold or header 13, which conducts the condensed liquid into the still at a point below the level of the liquid therein. Obviously a check valve may be inserted in the manifold adjacent the still, instead of providing valves in the individual return-flow pipes; the latter arrangement is however considered preferable inasmuch as it permits the resistance offered by the drum to the vapors to be varied at will. Thus by closing the valves in the lower pipes (by means of the screws 20), liquid may be permitted to accumulate in the filling, and to further obstruct the movement of the vapors, this liquid being prevented by the high velocity of the vapors from flowing back into the still through the vapor pipe 3.

The filling material which I prefer to use is chemically inert toward the vapors, in the sense that it is not capable of entering into combination with the sulfur or any other constituent thereof. It is possible however that it may exert a catalytic action in breaking down the unsaturated bodies, particularly after it has become to some extent coated with deposited carbon. My preferred filling material consists of pebbles graded between the sizes of three-eighths and three-fourths inch.

The practice of the method, assuming a hydrocarbon oil to be treated, is as follows. The oil vapors pass into the lower portion of the casing 4 and traverse the same at high velocity, being partly condensed in and imparting their heat to the filling material. As the operation proceeds a temperature gradient is established from bottom to top of the casing, the rate of fall of temperature varying with the size of the casing, the character of the filling, the character of the liquid distilled, and the stage of the operation. For example in distilling a hydrocarbon oil through a casing or drum approximately seven feet in height by five feet six inches in diameter, provided with thirty six baffles and with a filling of pebbles graded between three-eighths and three-fourths inch, I have found a temperature difference between the bottom and top of the casing which varies from 15° centigrade in the early stages of the operation to 100° centigrade or even more during the later stages, this difference of temperature increasing regularly as the operation proceeds and being approximately proportionate to the specific gravity and boiling point of the liquid in the still. This rapid fall in temperature results in a fractionating effect, which becomes more pronounced in proportion as the boiling point of the residual liquid in the still rises. The condensed liquid returns to the still and is there reheated and again vaporized, this reheating and vaporization being repeated many times, and at each repetition being accompanied by a splitting up of the unsaturated bodies and a setting free of combined sulfur. The reheating is rendered highly effective by the provision of means whereby the condensed vapors are returned to the lower portion of the still and are thereby thoroughly commingled with the residual body of oil, and heated to its boiling point, before they again undergo vaporization.

It is found in practice that the operation results in a disappearance of the so-called grease, the distillate being greaseless and short and practically free from bloom. This term "grease" is used to designate the fatty portion of the product, which is not volatile. The presence of this "grease" is determined in practice by pouring some of the product to be tested on a sheet of white writing-paper. If the product is free from "grease," it will entirely evaporate, leaving no line of demarcation between that portion of the sheet which has been moistened and that which has not. It is further observed that the capillarity of the distillate is largely increased, resulting in a material particularly adapted for burning with wicks. That the grease is destroyed and not merely separated is clearly evident from the fact that the residue remaining in the still is found to contain less grease than the residues from similar oils which have undergone distillation in ordinary stills. The distillate is also nearly homogeneous in character. The above characteristics of the distillate have proven highly valuable in practice for certain purposes, notably in its use as a substitute for turpentine for all painting purposes.

By the expression "obstructive filling" herein employed, I mean a filling which by its obstructive effect upon the outflowing vapors will serve to increase the vapor pressure in the still and hence the temperature of the vapors themselves to an extent sufficient to effect a substantial separation of sulfur and grease as above described.

I claim:

1. The method of distilling crude hydrocarbon oils, which consists in heating the oil in a still, causing the so-produced oil vapor to pass through a deep layer of a granular filling chemically inert to the vapor and offering such resistance to the passage of the vapor as to raise the vapor pressure within the still and the temperature of the issuing vapor to a point above that due to the normal boiling point of the oil and sufficient to eliminate grease and sulfur, returning the liquids resulting from condensation of vapor in the filling to the liquid in the still and beneath the surface thereof, and condensing the vapor, whereby there is produced a greaseless and sulfur-free distillate.

2. The method of distilling crude hydrocarbon oils, which consists in heating the oil in a still, causing the so-produced oil vapor to pass through a deep layer of a granular filling chemically inert to the vapor and offering such resistance to the passage of the vapor as to raise the vapor pressure within the still and the temperature of the issuing vapor to a point above that due to the normal boiling point of the oil and sufficient to eliminate grease and sulfur and to cause the deposition of carbon on the inert filling, returning the liquids resulting from condensation of vapor in the filling to the liquid in the still and beneath the surface thereof, and condensing the vapor, whereby there is produced a greaseless and sulfur-free distillate.

In testimony whereof, I affix my signature in presence of two witnesses.

LAYTON O. SHERMAN.

Witnesses:
HORATIO FORD,
E. L. GAFFINA.