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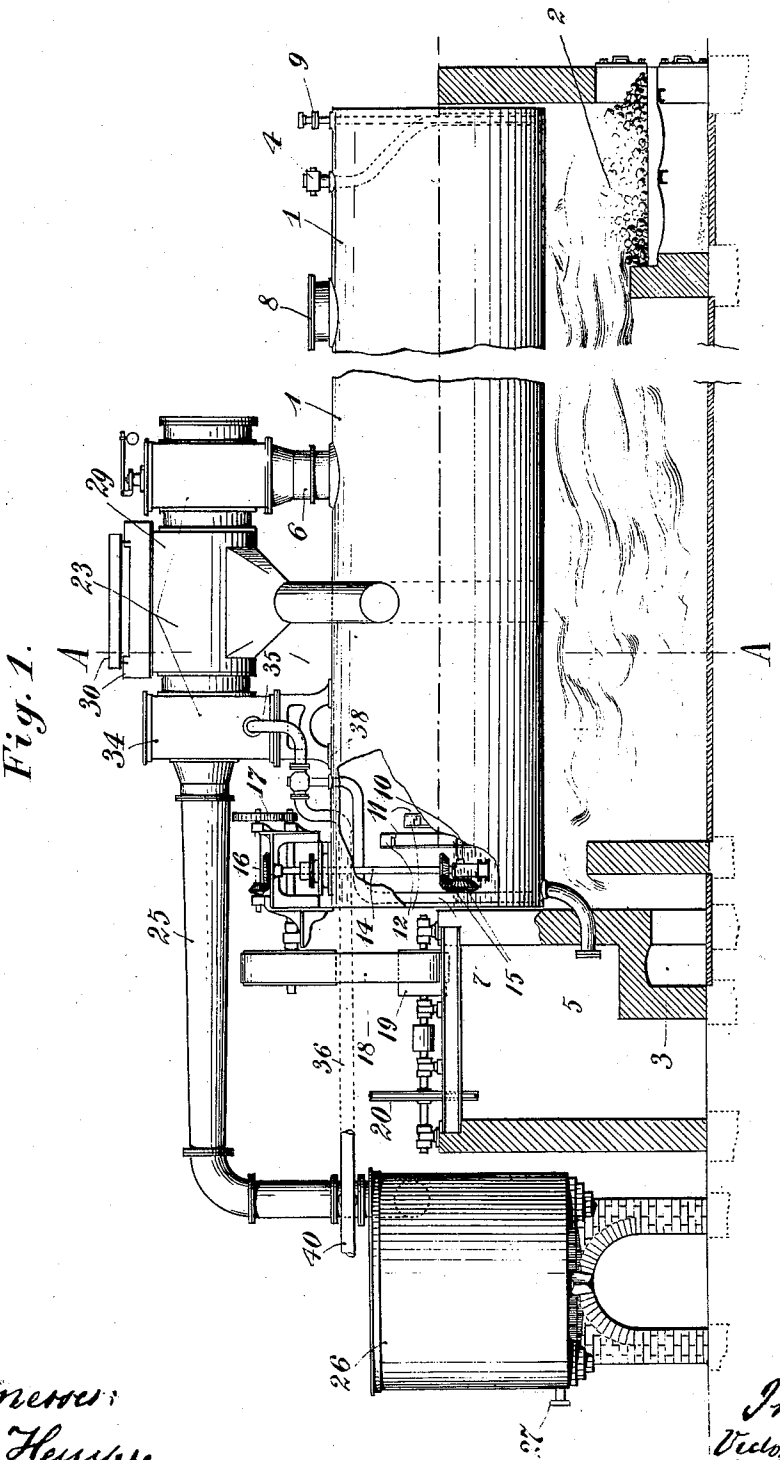
DISTILLATION OF HEAVY AND RESIDUAL OILS OF PETROLEUM.

APPLICATION FILED NOV. 16, 1906.

953,952. **Patented Apr. 5, 1910.**

4 SHEETS—SHEET 1.

Fig. 1.



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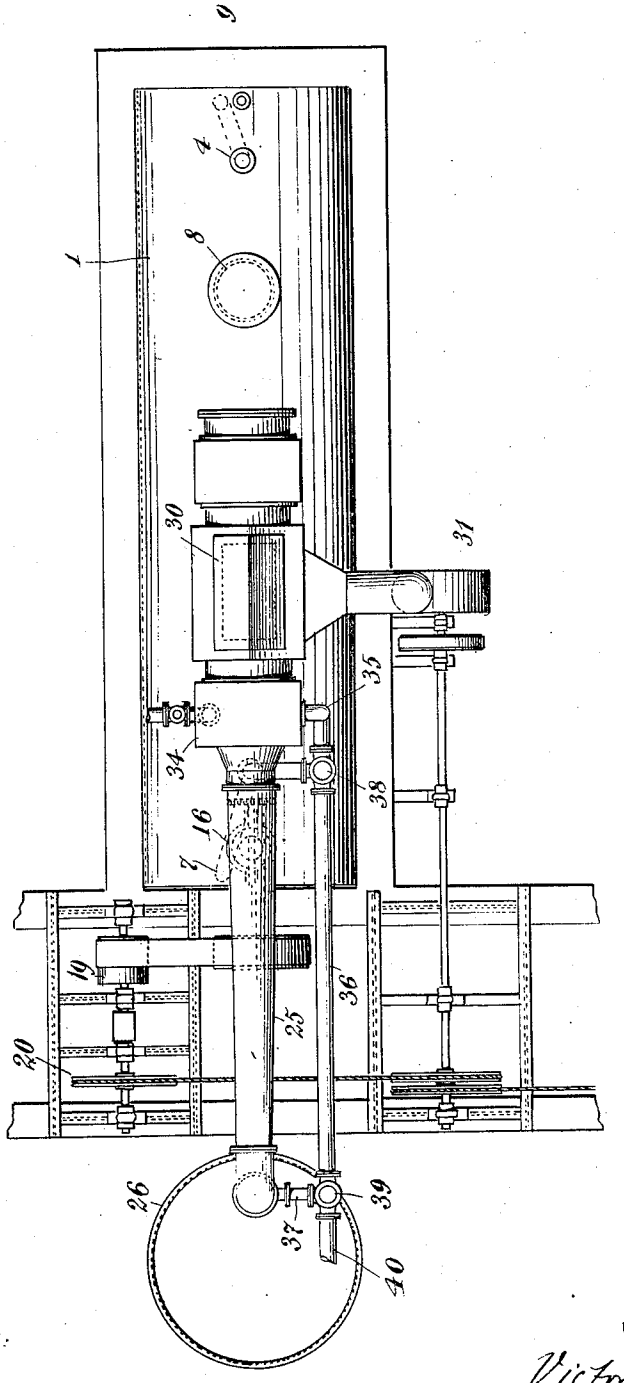
4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

Fig. 3.

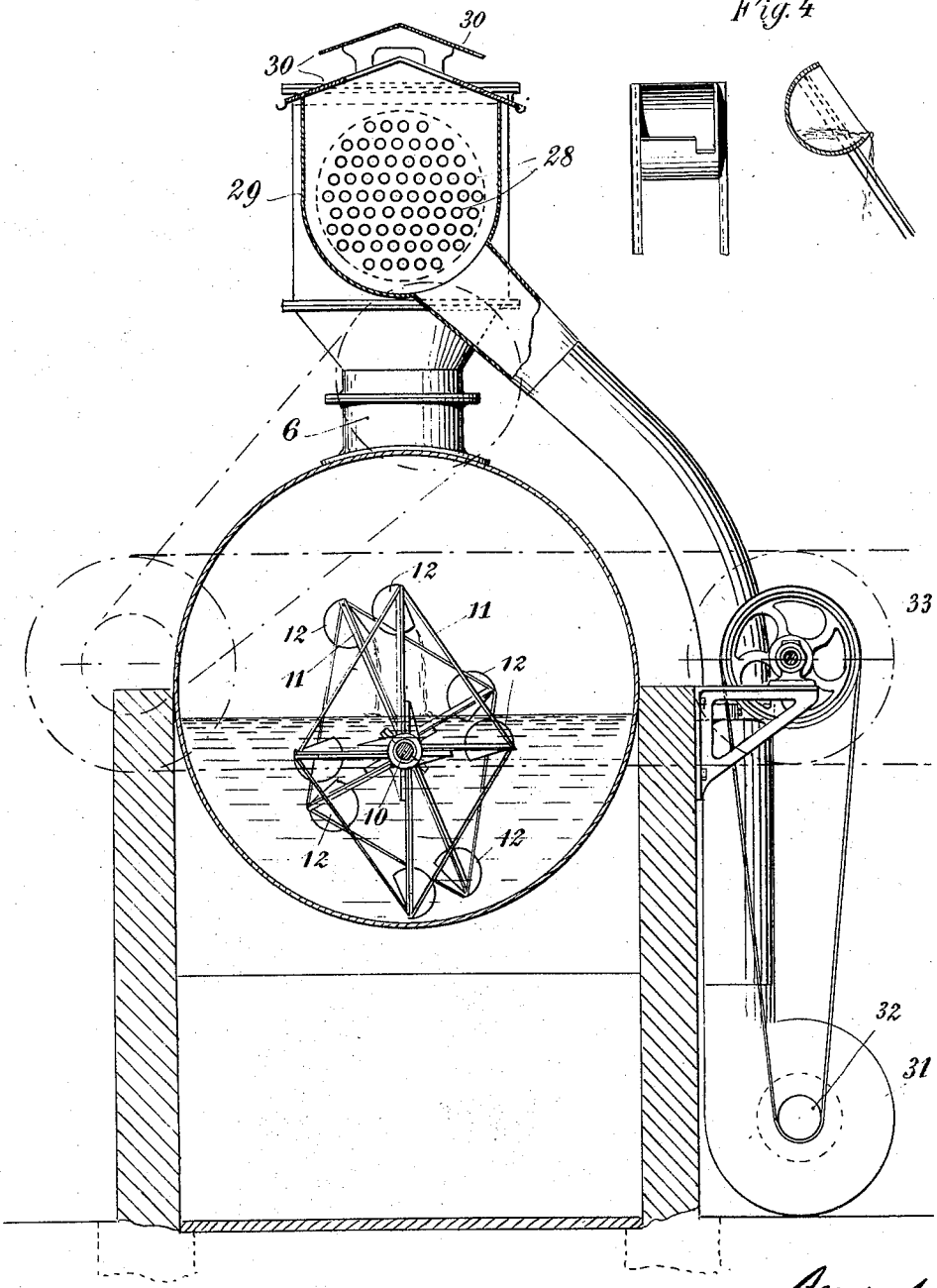

Fig. 4

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4 SHEETS—SHEET 4.

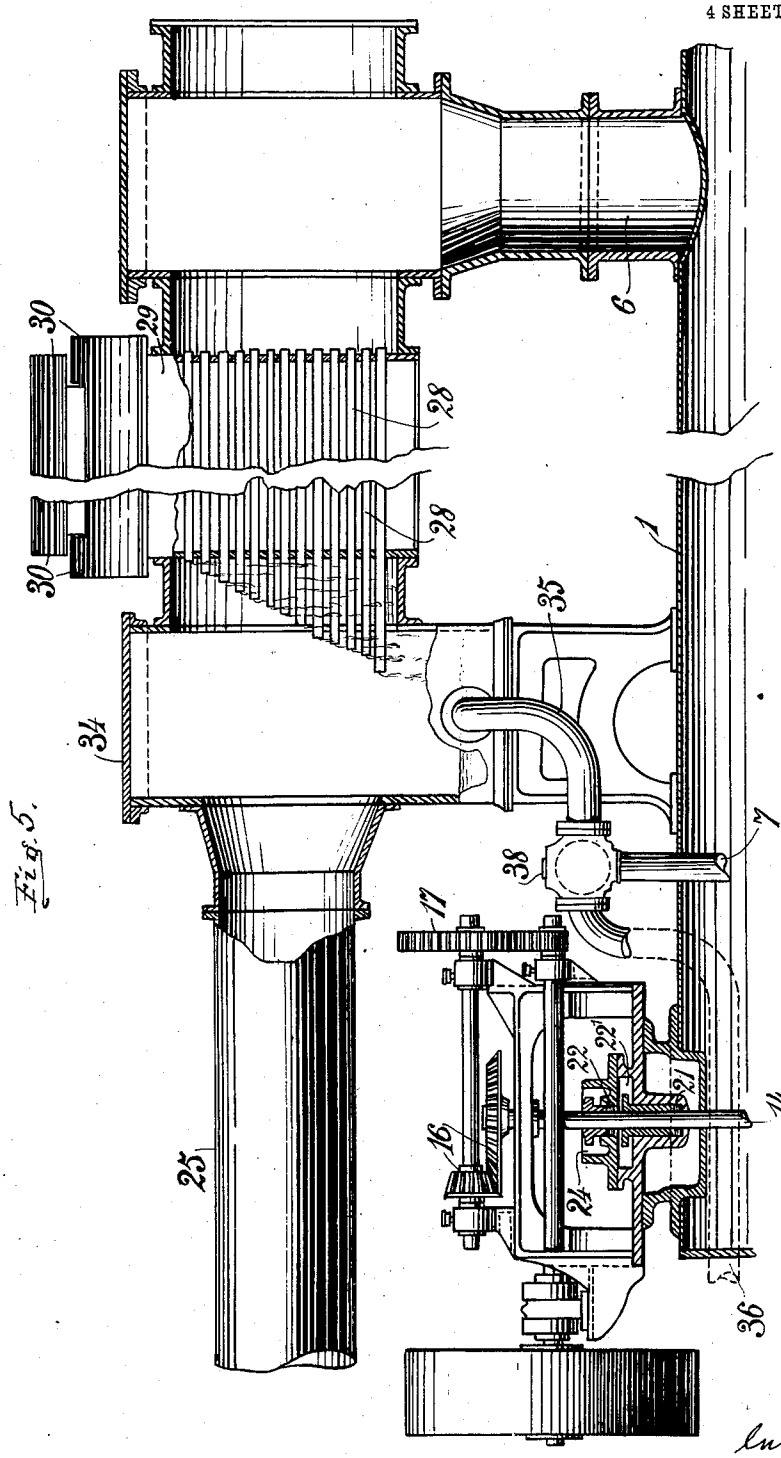

Fig. 5.

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UNITED STATES PATENT OFFICE.

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DISTILLATION OF HEAVY AND RESIDUAL OILS OF PETROLEUM.

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Application filed November 16, 1906. Serial No. 343,767.

To all whom it may concern:

Be it known that I, VICTOR HUGLO, a citizen of the Republic of France, residing at 18 Rue Vergniaud, Lille, in the Department of Nord, France, have invented certain new and useful Improvements in or Relating to the Distillation of Heavy and Residual Oils of Petroleum; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to apparatus for the distillation of petroleum, and it is especially applicable for use in the distillation of heavy and residual oils of petroleum.

The principal objects of my invention are to provide means whereby a uniform heating of the mass of oil undergoing distillation is obtained thereby preventing the occurrence of decompositions which result in impure products: to provide means for condensing the vapors of distillation whereby the cooling energy employed may be varied and may be proportional to the quantity of heat carried by the vapors, to provide means for condensing out of the vapors arising from the boiler those only of a predetermined temperature, to provide means for eliminating at the desired moment certain portions of the distilled vapors and for returning certain condensed vapors to the boiler for future heating, and to provide means for obtaining liquids of uniform density.

Referring to the drawings: Figure 1 is an elevation partially in section of the distilling apparatus. Fig. 2 is a plan view thereof. Fig. 3 is a section on the line A—A of Fig. 1. Fig. 4 is a detail view of one of the buckets. Fig. 5 is a longitudinal section of the condenser-separator on a larger scale.

1 indicates a boiler, 2 the furnace therefor and 3 a flue for conveying gases from the boiler to the chimney. The boiler is provided with a filling-pipe 4, a drain pipe 5, a man-hole 8, and a gage pipe 9 closed by a suitable valve. Mounted within the boiler is an agitating device, the shaft 10 of which is rotatably mounted in suitable bearings carried by the boiler 1. A plurality of frames 11, preferably of a diamond shape having one diagonal of lesser length than the other, are fixed side by side to the shaft 10, and are duplicated throughout substantially the length of the shaft. The frames 11 are provided at each corner with a bucket 12, preferably approximately semi-cylindrical with its chord-face open. These buckets are fixed to the frames 11 and are provided with a recess 13 in the discharge-edge of the bucket and at the side thereof nearer the furnace.

Motion is transmitted to the shaft 10, from a shaft 14, by means of a pair of intermeshing bevel gears 15 one of which is fixed to each shaft. The shaft 14 is rotatably mounted at its lower end in a suitable bearing fixed within the boiler, and at its upper end the shaft 14 is mounted in a bearing fixed to the boiler and having tandem stuffing boxes 21 and 22, and a chamber 22′ intermediate the stuffing-boxes and adapted to collect any vapor that might escape from the stuffing-box 21. This bearing is also provided with a water cup 24 adapted to be supplied, in any suitable manner, with water to prevent the heating of the stuffing-box 22. The stuffing boxes are provided with suitable packing, preferably asbestos. The chamber 22′ is provided with a discharge pipe not shown in the drawings.

The shaft 14 may be driven by means of a pair of intermeshing bevel gears 16 one of which is fixed to the shaft 14 and the other is fixed to one end of a shaft, the other end of which has fixed thereto a gear 17, driven by any suitable means, that shown, consisting of a spur gear in mesh with the gear 17 and mounted on a counter-shaft which also carries a band-wheel driven from a pulley 19 by a belt 18 the pulley 19 being driven in any suitable manner.

The vapors generated in the boiler 1 pass outward therefrom through a pipe 6 into a condenser-separator 23. The condenser-separator is formed with an inlet dome communicating with the pipe 6, a vapor-cooling chamber communicating with the inlet dome and an exit chamber 34 communicating with the vapor-cooling chamber.

The vapor-cooling chamber comprises a casing 29, the front and rear plates of which traverse the chamber connecting the inlet dome with the exit-chamber, and open-ended tubes 28 which are supported as shown by the front and rear plates of the casing 29. The vapors arising from the boiler pass through the tubes 28 wherein the vapors are subjected to the cooling medium as hereinafter described. The casing 29 is provided in its lower portion with an opening com-

municating with the discharge of a fan 31 adapted to blow air commingled with water on the tubes 28, and at its top the casing 29 is provided with an escape-opening for the cooling medium. A cover 30 is located above the opening in the top. The fan 31 may be driven by a pulley 32 actuated from a counter-shaft 33, which in turn may be actuated in any suitable manner.

The exit chamber 34 has connected thereto a pipe 25, which also connects with a refrigerator 26 of any suitable type, the end 27 of the coil of which is shown in Fig. 1. A pipe 35 connects the exit chamber 34 with a three-way valve 38 which communicates by means of a pipe 7 with the boiler and communicates also by means a pipe 36 with a three-way valve 39 by means of which the condensate formed in the exit chamber 34, if not returned to the boiler, may be delivered into either a coil by the pipe 37 or into a receiving vat (not shown) of any suitable character.

Regarding the operation it may be said that the oil in the boiler undergoing distillation, would be raised to a higher temperature at the furnace end, than at the end remote therefrom, were it not that the agitating device which I have provided agitates and moves the liquid thereby producing throughout its mass uniformity of temperature and density. At the beginning of distillation, when the boiler is substantially full, the simple stirring which the buckets produce in the liquid is sufficient. When however the volume of liquid in the boiler decreases, becoming denser, the buckets raise the liquid and discharge it out of the openings 13, each bucket thus pouring the liquid within reach of the next bucket nearer to the furnace. The mass of liquid is thus gradually carried from the end of the boiler remote from the fire to that near the fire, thereby producing uniformity of temperature and density throughout the mass of liquid. This uniformity of temperature throughout the mass of liquid prevents irregular distillation and it also prevents the occurrence of decompositions which produce impure products. When the surface of the liquid in the boiler is below the level, to which the buckets are elevated by the revolving shaft 10, the liquid, lifted by them falls in a fine shower upon the mass of liquid, and the lighter particles which are at their boiling point become more easily disengaged from the heavier particles which would otherwise keep them imprisoned. It will also be noted that owing to the shape of the buckets they carry into the mass of liquid a volume of steam.

As the buckets on the short diagonals of the frames are nearer the shaft 10 than are the buckets on the long diagonal, it will be seen that the liquid at varying depths in the boiler is stirred, lifted and shifted along the boiler toward the fire-end thereof. It will be observed that the frames 11 vary in their transverse positions along the shaft 10, so that the corresponding buckets of the frames do not all lift and discharge their contents at the same time. This arrangement avoids the shocks that might arise were the buckets to all lift and discharge liquid at the same time.

In heating the mass of liquid in a boiler, there occurs what I term the natural or "cracking" action, that is to say a decomposition due to a want of stability of a group of hydrocarbons which become decomposed at a given temperature, products of a higher series of smaller specific gravity, and other products of a lower series of greater specific gravity being generated. The "cracking," which is almost spontaneous, generates an enormous quantity of vapor composed of heavier and lighter products. These products being generated in a temperature which renders them unstable, may become again decomposed and give new series. It is these multiple decompositions which produce carbon and give an abundant coloring matter which in a short time spoils all that has been distilled.

My apparatus meets the foregoing described conditions in a manner to avoid the bad results indicated as the following will more clearly show.

The vapors generated in the boiler 1 pass through the pipe 6 into the inlet dome of the condenser-separator 23, and thence through the tubes 28 into the exit-chamber 34, reaching the latter in either liquid or vapor form. Within the tubes 28, the vapors are cooled by means of a volume of commingled air and water that is blown upon the exterior of the tubes by the fan 31, in the orifices of which are arranged regulating dampers and into which can be injected, by means of sprayers, variable quantities of water and air. Vapors, the condensing temperature of which is such that they will be condensed by a given temperature of the nest of tubes 28, liquefy therein and falling in the exit chamber 34 may be returned to the boiler for further heating and distillation by the pipe 6 which preferably dips into the liquid to avoid back action, or this distillate may be led off by the pipe 36 to the branches 37 or 40, the former, as before stated, connecting with a coil and the latter with a vat. The other vapors present in the nest of tubes 28 and whose condensing temperature is below that of vapors just considered, pass in vapor form through the pipe 25 to the refrigerator 26 for condensation.

The greater the quantity of air and water that is blown upon the nest of tubes, the lower will be their temperature, and then

only those vapors which condense at a comparatively low temperature will pass through the tubes 28 to the refrigerator 26. The other vapors, having a higher temperature of condensation will be condensed in the condenser-separator 23. If a lesser quantity of commingled air and water be blown upon the tubes 28, their temperature will be higher than those which were heretofore higher, and vapors, whose temperature of condensation is assumed to have been condensed in the condenser-separator, will pass to the refrigerator 26. It is thus possible by regulating the output of the fan to successively supply to the refrigerator 26 vapors of different densities. It is also easy with my apparatus to keep the cooling proportioned to the heat contained in the vapors discharged by the boiler.

It will be noted that the tubes 28 project into the exit chamber 34 to varying distances, each horizontal group of tubes ending on a vertical plane back of that plane upon which the next lower group of tubes terminate. This arrangement prevents the vapor escaping from a lower tube from becoming charged with the liquid falling from a higher tube.

It will thus be seen that my invention prevents superheating of certain parts of the liquid, the decomposition of certain products, the renewed combination of gases and vapors in a nascent state and the defective cooling of the vapors.

By the use of my invention, I obtain pure products by rendering homogeneous the mass of liquid submitted to heating and by eliminating, at the desired moment, certain portions of the vapor. These results I obtain by means of the agitating mechanism which acts on the liquid mass during distillation, and also by means of the condenser-separator, and its auxiliaries, the working conditions of which can be instantaneously and easily altered within wide limits so that out of the whole mixture of vapor escaping from the boiler at a given moment, only those vapors of a temperature determined beforehand will be condensed and eliminated.

By the use of my invention, I obtain not only a higher efficiency but also purer products. Thus for instance carbonization and decomposition by heat of the thick fatty mass that would otherwise collect at the bottom of the boiler is prevented by stirring or agitating. Thus the generation of products which are the cause of the slightly blue coloring of the distillate is prevented and a colorless liquid is obtained. Again by means of my condenser-separator and its accessories, which may be cooled in varying degrees heavier products can be separated from lighter ones, and the former can be returned to the boiler and the lighter vapors alone pass to the refrigerator; thus distillates of uniform density can be obtained, and the return to the boiler of the heavier products does not prevent the maintenance therein of a homogeneous mass because of the action of the agitating device.

Having thus fully described my invention what I claim as new, and desire to secure by Letters Patent of the United States, is:

1. The combination with a boiler of a receptacle connected therewith, the receptacle consisting of an inlet dome, an exit chamber, and a nest of tubes connecting the inlet dome and the exit chamber, the lower tubes projecting beyond the upper tubes, a pipe connecting the exit chamber with the boiler, and a passage connecting the exit chamber with a condenser, and means for cooling the tubes.

2. The combination with a receptacle of a boiler, a rotatable shaft mounted longitudinally therein, frames mounted upon the shaft, buckets fixed to the frames, the buckets of a frame being at unequal distances from the shaft and the frames being arranged to stagger the alinement of the buckets, and means for actuating the shaft.

3. The combination with a receptacle of a boiler, a rotatable shaft mounted longitudinally therein, frames mounted upon the shaft, buckets fixed to the frames, the buckets of a frame being at unequal distances from the shaft and the frames being arranged to stagger the alinement of the buckets, each bucket having a side way pouring recess at the side nearest to the fireplace and means for actuating the shaft.

In testimony whereof I affix my signature.

VICTOR HUGLO.

In the presence of—
PAUL FOLLIN,
THEODORE REDIG.