UNITED STATES PATENT OFFICE.

LUTHER ATWOOD, OF NEW YORK, N. Y.

IMPROVEMENT IN THE MANUFACTURE OF OILS OBTAINED FROM COAL.

Specification forming part of Letters Patent No. **28,448**, dated May 29, 1860.

To all whom it may concern:

Be it known that I, LUTHER ATWOOD, of the city and county of New York, and State of New York, have invented certain new and useful Improvements in the Manufacture of Hydrocarbon Illuminating-Oils; and I do hereby declare that the following is a full and exact description thereof, reference being had to the annexed drawings, making a part of this specification, and to the letters of reference thereon.

Thin hydrocarbon oils suitable for illuminating purposes, and such as are now burned in the "Deitz," and similar chimney lamps, are usually obtained from petroleums or natural oils, and crude oils obtained by distilling at comparatively low temperatures bituminous coals, bituminous shales, bituminous schists, peat asphaltums, rosin, and the tarry or pitchy residue remaining in the process of manufacturing adamantine or stearine candles. These natural oils and the crude oils, distillates of the above-mentioned and similar substances, it has heretofore been the practice to distill over in a cast-iron still suitable for such purposes, and to separate and set aside the first or lighter portion of the distillate, or such portion as comes over until the temperature in the still rises to about 600° Fahrenheit, for the purpose of manufacturing into illuminating-oil, with the exception, sometimes, of such exceedingly volatile part as can be steamed off during the process of manufacture. The latter portion of the distillate, which comes over at an increased temperature, is termed "heavy oil." It generally contains visible crystals of paraffine, and has heretofore been generally manufactured into lubricating-oils and candles. By repeated simple distillations of the heavy oil a further quantity of thin oil has been obtained, the heavy oil remaining containing larger proportionate quantities of paraffine. I mention this in order that it may not be confounded with my process.

My said invention consists in a method of treating these heavy oils, paraffine, fatty oils and acids, or the crude oils and natural oils from which the heavy oils are produced, as above mentioned, so that the whole or as much as desired may be converted into thin oil suitable, when purified, to burn in lamps.

My process is a practical development, embodiment, and combination of two operations peculiar to these bodies in a process of continuous distillation—viz: first, a gradual and continuous application of sufficient heat to the substance acted on to initiate chemical changes which result in the decomposition or breaking up of the heavy bodies and the formation of light and heavy oil-vapors, and comparatively small amount of fixed gases accompanied with deposition of carbon in the still; second, a continuous separation of the light thin oil-vapors and fixed gases from the heavier oil-vapors, and continuous condensation and return of the latter to the sphere of action of the heat until the whole is broken up, or nearly so, or as much as desired, by exposing the eliminated vapors in a chamber or receiver of considerable capacity situate between the point of forming the vapor and the condenser to a temperature about the boiling-point of the lighter vapors and below the boiling-point of the heavier vapors, so that the heavy vapors gradually liquefy and return to be broken up by further action of the heat, while the desired light product passes over to the condenser, where it is liquefied and separated from the fixed gases.

It will be observed that, owing to the fact of the return to the action of the heat of the heavy oil when it is nearly at the boiling-point, a comparatively small increase of temperature is necessary to break it up. This gives my process a great economical advantage over the former practice of successive plain redistillations, by which a further portion of thin oil has heretofore been obtained from heavy oils, as described in the beginning of this specification.

The apparatus I prefer to use is figured in the annexed drawings, of which Figure No. 1 is a plan view; Fig. No. 2, a front elevation; Fig. No. 3, horizontal section through dotted line *x x*, Fig. No. 2; Fig. No. 4, horizontal section through dotted line *y y*, Fig. No. 2; Fig. No. 5, transverse section through dotted line *x x*, Fig. No. 1; Fig. No. 6, vertical longitudinal section through dotted line *y y*, Fig. No. 1.

Letter A represents a cast-iron still constructed with a removable lower section for the purpose of convenient repair. The bottom of the still is heated by products of com-

bustion supplied to the chamber B from the fire-box E, the arch E′, with its piers and passages, serving to divide and distribute the products of combustion equably within the chamber B.

B′ is a short horizontal passage connecting the chamber B with the flue B^2, which is furnished with a damper, B^3, and connects with the chimney C.

D is an uptake opening out of the passage B and leading up to the flue D′, which, passing around the sides of the still, connects with the chimney C by the passage D^2, which is furnished with a damper, D^3. When the damper B^3 is closed and the damper D^3 open, the products of combustion from the chamber B are forced to pass through the flue D′, heating the sides of the still on their way to the chimney. I use the flue D′ in this manner in commencing a distillation. After the distillation has commenced, I shut the damper D^3 and open the damper B^3 in the passage B^2, which connects the chamber B directly with the chimney.

Letters F F are two man-holes for removal of residue, provided with the covers and fastenings.

Letter G is a filling-pipe provided with a stop-cock, (shown broken off,) but must be connected with a reservoir of unfinished oil.

Letter H is a funnel-pipe provided with a stop-cock, used also for filling the still.

Letter I is a weighted safety-valve on the dome of the still, through which vapors can escape when. from any cause, the worm becomes choked. The stem of the valve is fitted to receive a slotted weight, and terminates in a ring-handle, by which it may be raised up and hooked on the hook I′ when necessary to keep the passage open.

Letter J is a main or condensing pipe, connected with the safety-valve by the blow-off pipe J′. The condensable products escaping through the safety-valve and saved in the main J flow out through the small pipe J^2 into any suitable receiver, the fixed gases and vapors not condensed escaping through the discharge-pipe J^3, (shown broken off,) but to be carried up through the roof of the building, or in any suitable manner away from the vicinity of the still.

Letter K is a pipe connecting the worm-condenser with the still through the angle-valve L.

Letter M represents a vertical cast-iron chamber of cylindrical form, standing on the top of the brick-work casing of the still and near the still. This chamber I call a "separating" chamber. It connects with the still by the superior pipe N through the angle-valve O, also by the inferior pipe P, which is furnished with a stop-cock. The pipe Q, provided with a stop-cock, connects the top part of the separating-chamber with the worm-condenser through the pipe K. The separator is made in sections connected by flanges and screw-bolts for the purpose of conveniently increasing or diminishing its capacity. The worm-condenser is situated in a water-tub, R, supplied with cool water from a force-pump or a reservoir, by the inflow-pipe S, the surplus flowing out through the pipe T. The worm terminates in a small chamber, U, from the bottom of which the liquid products escape through the sealed siphon-pipe V, the fixed gases passing up through the gas-pipe W, (shown broken off,) but to be carried up through the roof or away from the vicinity of the still. The gas-pipe W is furnished with a stop-cock, to be closed when necessary, to blow steam through the chamber U and siphon V for the purpose of removing obstructions or to cleanse them.

Letters *a*, *b*, and *c* are steam-pipes, each provided with a suitable valve or stop-cock, connecting, respectively, with the dome of the still, the pipe K, and the pipe N, and by a branch coupling with a steam-pipe, *d*, (shown broken off,) but which must be connected with a steam-boiler.

Letter *e* is a draw-cock used for the purpose of discharging condensed steam from the steam-pipe.

The steam-pipe *a* is used in combination with the safety-valve outlet when open, the other openings in the still being closed for the purpose of expelling by pressure of steam the vapors and gases remaining in the still at the completion of a distillation, and also after removal of the residue, to prepare the still, when hot, for the safe reception of a charge of oil by forcing steam into the still in sufficient quantity to displace atmospheric air, as described in other Letters Patent of the United States to me.

When the angle-valve L is shut and the stop-cock in the pipe Q, which connects the separating-chamber with the pipe K, is closed, steam may be blown through the worm-condenser from the steam-pipe *b*, for the purpose of removing obstructions and cleansing the condenser. When the angle-valve O is shut and the stop-cock closed in pipe P and the pipe Q open, steam may be blown through the separating-chamber and condenser from the steam-pipe C.

For the purpose of the process herein described, the direct connection from the still to the worm-condenser through the angle-valve L is kept closed, to be opened when desirable to interrupt the process of obtaining light thin oil from heavy oil, and to run over heavy oil. In that case the connections to and from the separating-chamber are to be closed.

The operation of my process is as follows: The apparatus having been arranged for the operation as above described, I place the substance to be acted on in the still and gradually and continuously apply sufficient heat externally to initiate chemical changes, which results in breaking up or decomposing the substance acted on, forming light and heavy oil-vapors, with comparatively small quantity of permanent gases, and with accompanying de-

position of carbon in the still. The vapors and gases pass through the superior pipe N upward into the separating-chamber M. The separating-chamber being exposed externally to the cooling influence of the atmosphere of the still-room, and heated only by the radiated heat from the top of the still and the incoming vapors and gases, a temperature comparatively higher or lower in proportion to the relative quantity of incoming vapor, but sufficiently below the boiling-point of the major portion of the heavier or higher boiling-point vapors to gradually liquefy them is maintained internally, and as they liquefy and fall to the bottom of the separating-chamber they are continuously returned to the still through the inferior pipe P. The lighter vapors and permanent gases gradually rise to the top of the separator and pass on through the pipe Q to the worm-condenser, the liquid products passing out at V, the gases escaping upward through the pipe W.

From the above description it will be evident to those skilled in the art that the particular character of the distillate will depend on the degree of rapidity with which the operation is conducted within such limits as it can be carried on at all in the above-described apparatus. If vapors are not formed with sufficient rapidity and in sufficient quantity to keep the internal temperature of the separator up to a point about the boiling-point of the lighter vapors, they will, of course, all condense and fall back in the still. If heat is applied so actively as to form vapors rapidly enough to keep the temperature nearly up to about the boiling-point of the heavy vapors, a portion of them will be forced over and condensed with the lighter vapors. Therefore the particular degree of change resulting from any one operation will be governed by the relative quantity and degree of heat applied.

It is not material in the practical working of my process to effect the desired change in one operation, neither is it generally convenient or practical to do so; but within the limits above mentioned the slower the operation is conducted the greater will be the change effected by one distillation.

During the necessary and commonly practiced processes of purifying hydrocarbon illuminating-oils by treating them repeatedly with acids and caustic alkalies, they are subjected to redistillation, which may be performed by my process, and the operation of converting heavy oil into light oil go on with the purification process, with which it does not interfere.

When carrying on my process in this manner, after the purification is completed I prefer to distill over such portion of the purified oil as will go over at below about 600° Fahrenheit, with the still arranged so as to have direct communication with the condenser through the angle-valve L, and with the separating-chamber cut off. This portion is then fit for use. The remaining contents of the still are then run over through the separator, and, for reasons not necessary to mention here, being obvious to those skilled in the art, subjected to further treatment.

When crude oil is subjected directly to my process the light portion, generated simultaneously with the heavy bodies in the original production of the crude oil by distilling coal or other substances, passes over until the temperature of the still rises above about 600° Fahrenheit, when my process of breaking up the heavy bodies commences. The relative height of the separating-chamber is an important element in its proportion, because it favors separation of the vapor by difference of specific gravity.

The proportion, situation, and arrangement of the separating-chamber as figured in the drawings I consider best for a still such as shown with a body or boiler of about seven feet in diameter. In a still of such dimensions I carry on the operation at the rate of ten gallons per hour.

Although I prefer the apparatus herein described and figured, and consider it best adapted to carry on my process rapidly and profitably, I will nevertheless use any form of apparatus or still in which I can practically carry on my process.

The illuminating-oils resulting from my process, when purified and finished as usual with illuminating-oils heretofore manufactured from the lighter parts of the crude oils, do not differ materially from them in color or mobility; but owing, perhaps, to the greater proportionate quantity of paraffine in the source from which they are immediately derived, they possess greater illuminating-power. In the practical manufacture of these oils they may be beneficially mixed with other light oils; or when operating on crude oil the distillate of both light and heavy parts may be suffered to run into the same cistern or other receiver.

By the use of my process above described the manufacturer can, by a comparatively small number of distillations, break up or convert the whole heavy liquid and solid portions of the crude oil into light thin illuminating-oil whenever it is desirable to do so.

What I claim as my invention and improvement in the manufacture of hydrocarbon illuminating-oils is—

The production of thin oils suitable to be manufactured into illuminating-oils from the heavier parts of the crude and fixed oils and other substances within mentioned by treating them in manner substantially as hereinbefore described during one or several continuous distillations.

LUTHER ATWOOD.

Witnesses:
BRAIND. G. LATIMER,
F. C. TREADWELL, Jr.