No. 645,743. Patented Mar. 20, 1900.

F. BERG.

MINERAL OIL STILL.

(Application filed Oct. 14, 1899.)

(No Model.)

FIG. II

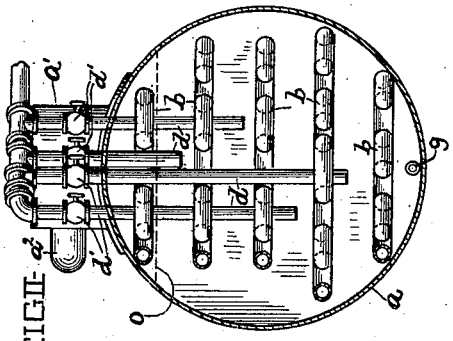
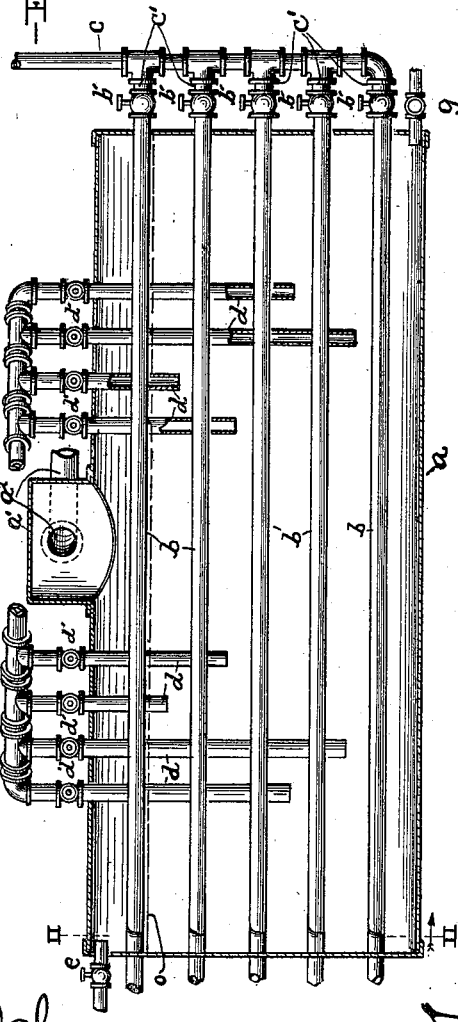


FIG. I



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UNITED STATES PATENT OFFICE.

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MINERAL-OIL STILL.

SPECIFICATION forming part of Letters Patent No. 645,743, dated March 20, 1900.

Application filed October 14, 1899. Serial No. 733,557. (No model.)

To all whom it may concern:

Be it known that I, FRIEDRICH BERG, a resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented certain new and useful Improvements in Apparatus for Vaporizing 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 pertains to make and use the same.

My invention relates to an improved apparatus for vaporizing petroleum.

The primary object of this invention is to reduce the cost of vaporizing or distilling crude petroleum.

With this object in view, and to the end of realizing other advantages hereinafter appearing, the invention comprises the hereinafter-disclosed combinations and arrangement of parts.

In the accompanying drawings, Figure 1 is a side elevation, partly in section, of a still or apparatus embodying my invention. Fig. 2 is a transverse vertical section on line II II, Fig. 1, looking inwardly.

Referring to the drawings, *a* designates the oil-receiving tank of a large retort or still. Several heating-coils *b* are arranged within and in planes extending transversely of the chamber of the tank *a* and a suitable distance apart vertically. In the case illustrated five heating-coils are shown within the chamber of the tank. The lowermost coil is located near the bottom of the chamber. The uppermost coil is arranged within the upper portion of the chamber in close proximity to the upper wall of the chamber, and the intermediate coils are arranged, preferably, at equal intervals between the uppermost and lowermost coils. The said coils are imperforate and supplied with steam in any approved manner. Each coil exhausts at one end and has its opposite end terminating in a branch pipe *c'* of the steam-supply pipe *c*. The lowermost coil and each of the intermediate coils have preferably as many feet of pipe—about three hundred and thirty-five feet of pipe—as required to render possible the utilization of all of the steam that enters the coils. The uppermost coil may have a smaller number of feet of pipe than the remaining coils to accommodate its location in the extreme upper portion of the chamber of the tank. Preferably that portion of the tank's chamber that contains the uppermost coil constitutes a vapor-space next above the oil-space below. In the case illustrated, *o* designates the uppermost level of the body of oil that is vaporized within the tank or still, and it will be observed that the said level is below the uppermost coil. The tank *a* at the top has a dome *a'*, provided with a lateral vapor-outlet a^2, that is connected in any approved manner with suitable condensing apparatus. (Not shown.) Valves *b'* for controlling the supply of steam to the coils are provided, and in the case illustrated each branch pipe *c'* has a valve *b'*. Steam-pipes *d* for introducing jets of live steam into the body of oil are provided. An arrangement of valved steam-pipes capable of introducing live steam into the oil between the coils is preferable, and in the apparatus illustrated two steam-pipes *d d* are arranged to discharge downwardly a suitable distance apart between adjacent coils. There are therefore eight pipes *d* in all and a pair of pipes *d* between adjacent coils. Each pipe *d* is provided with a valve *d'* for controlling the supply of steam to the pipe. The pipes *d* are open at their lower ends, so as to discharge directly into the chamber of the tank or still. The uppermost pair of pipes *d* are preferably arranged to discharge somewhat below but near the highest level of oil. A valved oil-supply pipe *e* communicates with the chamber of the tank. A valved drain-pipe *g* is in open relation with the extreme lower portion of the said chamber and is used in draining the tank of any residuum therein.

In the operation of the retort or still the crude oil is admitted to the chamber of the tank by opening the valve in the oil-supply pipe *e*, and steam is first admitted to the lowermost heating-coil as soon or approximately as soon as the said coil is submerged in the rising volume of oil within the tank. Next steam is admitted to the lowermost intermediate coil, then to the remaining coils in the order indicated, and, lastly, to the uppermost coil, and steam is preferably admitted to each coil as soon as the rising body of oil reaches or submerges the said coil. Hence the imperforate steam-coils are preferably successively operated from the bottom of the still

or retort upwardly and are kept in operation during the operation of the still or retort. The valve of the oil-supply pipe *e* is closed as soon as the body of oil has reached the highest desired level. The steam-coils are utilized and capable of heating the oil to a temperature somewhat above the boiling-point or to about 225° Fahrenheit. The oil is gradually heated, therefore, until its temperature is about 225° Fahrenheit, and the volatile matters vaporize in the order of their volatility. As soon as the body of oil within the tank has reached the highest desired level the uppermost pair of pipes *d* are operated to discharge live steam into the body of oil and cause the temperature of the oil to rise to about 300° Fahrenheit. The jets of live steam do not only further heat the oil, but are invaluable in facilitating the generation and escape of vapors arising from the body of oil during the vaporizing process. The live steam is especially serviceable in agitating and forcing or facilitating the separation of the vaporized products or distillates from the remaining unvaporized body of oil. The uppermost pipe or pipes *d* are operated until the level of the body of oil descends below the outlet of the said pipe or pipes, and then the pipes *d* next below are operated, and so on until the lowermost pipes *d* are operated to complete the process. It will be observed, therefore, that by my approved apparatus live steam is discharged continuously or substantially continuously into the upper portion of the gradually-decreasing body of oil.

The valves *d'* of the pipes *d* accommodate full control of the operation of the pipes. As already indicated, the heating-coils *b* are operated during the vaporizing process and all of the said coils are kept in operation, notwithstanding the lowering of the level of the body of oil. The operation of the uppermost heating-coil during the entire vaporizing process is important, in that it maintains the upper wall of the tank's chamber adequately heated during the entire heating process to effectually prevent any condensation of vapors that arise from the body of oil and impinge against the said wall. In other words, the vapor-space of the tank above the oil-space is kept adequately heated during the operation of the apparatus to prevent the return through condensation of any vapors arising from the body of oil.

By the use of my improved apparatus for vaporizing crude petroleum the time and expense required to separate the naphtha and the lighter illuminating products from the body of oil are considerably less than the time and cost incurred in employing apparatus requiring firing under and destructive to the still or retort. The wear upon the apparatus is reduced to a minimum, and the fuel required in the generation of the steam necessary for the operation of the said apparatus is much less than the cost of fuel necessary in employing fires below the still or retort for heating the latter. Also the heating of the still by fire beneath the still's bottom results in a much greater heating of the bottom of the said still than necessary. An excessively-high temperature is detrimental, because it causes chemical combinations of ingredients or compounds contained in the oil, and it is obvious, of course, that such combinations would have to be destroyed or broken up in the subsequent purification of the oil. In vaporizing petroleum by my improved apparatus chemical combinations within the body of oil are avoided, because no portion of the body of oil is subjected to a temperature high enough to bring about the formation of chemical combinations. It is obvious also that the heavier ingredients in the oil—such, for instance, as paraffin or lubricating stock—that remain in the still are not injured in the still when the remaining products are carried by the lowest possible temperatures, and of course the said heavier stock is necessarily injured, as already indicated, when the still's bottom is subjected to excessive heat, as is the case in the commonly-employed apparatus involving fires below the bottom. An excessive heating of the still's bottom furthermore results in the deposition or formation of a considerable layer of carbon upon the said bottom, which carbon obstructs the transmission of heat to the body of oil and necessitates greater firing, and thereby not only requires labor to clean out the still after every distillation, but aids the already-excessive heat that has already been deleterious to the treatment of the oil and destructive to the apparatus. Also heretofore where live steam has been introduced into the bottom of the still or retort heavier distillates were driven off with the lighter distillates, and this is of course objectionable, because such heavier distillates would render the lighter distillates impure and lower the fire test of the lighter distillates.

The number of heating-coils *b* and steam-discharging pipes *d* varies according to the size of the retort or still. In a still or retort about ten feet high and twenty-six feet long the preferred number of coils and pipes employed is that illustrated.

I would remark also that the process of treating the petroleum within the retort or still hereinbefore described is made the subject of an application for United States Letters Patent, Serial No. 725,832, filed August 2, 1899.

What I claim is—

1. A retort or still for vaporizing petroleum, comprising an oil-receiving tank having a vapor-outlet at the top, heating-coils arranged at different elevations, respectively, within the tank, means for supplying and controlling the supply of steam to the said coils, and means for discharging and controlling the discharge of live steam into the tank at different elevations, substantially as and for the purpose specified.

2. A retort or still for vaporizing petroleum, comprising an oil-receiving tank having a vapor-space above the oil-space and next below the upper wall of the chamber of the tank, a vapor-outlet leading from the vapor-space, heating-coils arranged at different elevations, respectively, within the oil-space, means for supplying and controlling the supply of steam to the said coils, a heating-coil arranged within the vapor-space near the aforesaid wall, means for supplying and controlling the supply of steam to the last-mentioned coil, and valved steam-pipes arranged to discharge live steam into the tank at different elevations, respectively, substantially as and for the purpose specified.

3. A retort or still for vaporizing petroleum, comprising an oil-receiving tank having a vapor-outlet at the top; several heating-coils arranged a suitable distance apart, vertically, within the tank; means for supplying and controlling the supply of steam to each coil, and means for discharging and controlling the discharge of live steam into the tank at different elevations, substantially as and for the purpose set forth.

4. A retort or still of the character indicated, comprising an oil-receiving tank having a vapor-outlet at the top, heating-coils arranged within and in planes extending transversely of the tank and a suitable distance apart vertically and one of the said coils being arranged in close proximity to the upper wall of the tank's chamber, and valved steam-pipes arranged to discharge downwardly into the tank at different elevations, respectively, substantially as and for the purpose set forth.

Signed by me at Cleveland, Ohio, this 7th day of September, 1899.

FRIEDRICH BERG.

Witnesses:
C. H. DORER,
A. H. PARRATT.