

H. B. EVEREST.

APPARATUS FOR MANUFACTURING OILS FROM PETROLEUM BY STEAM.

No. 68,426.

Patented Sept. 3, 1867.

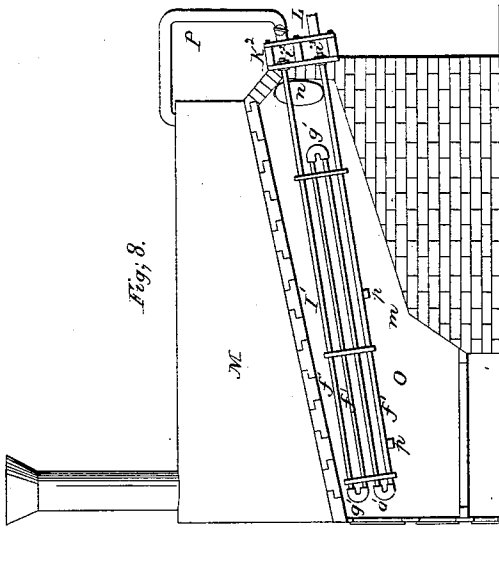


Fig. 8.

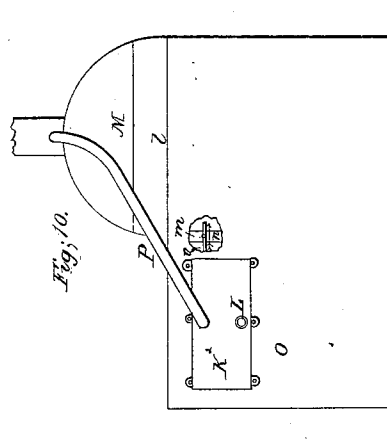


Fig. 10.

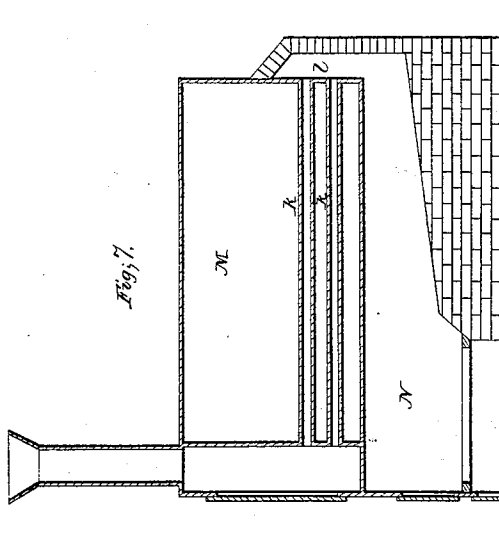


Fig. 7.

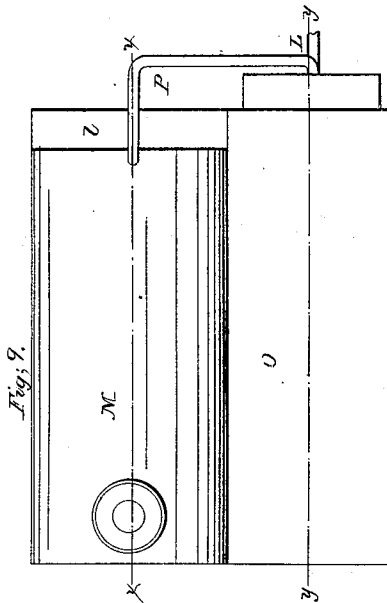


Fig. 9.

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IMPROVEMENT IN APPARATUS FOR DISTILLING PETROLEUM.

Specification forming part of Letters Patent No. 68,426, dated September 3, 1867.

To all whom it may concern:

Be it known that I, HIRAM B. EVEREST, of Rochester, in the county of Monroe, and State of New York, have invented certain new and useful Improvements in Apparatus for Distilling Petroleum; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making part of this specification.

Figure 1 is an elevation of that part of my improved apparatus forming the still proper; Fig. 2, an elevation of the same, looking on the opposite side; Fig. 3, a plan of the same; Fig. 4, a longitudinal vertical section of the primary retort; Fig. 5, a plan showing a modification of the capacious condensers; Fig. 6, a detailed view of the pipes in the retorts; Fig. 7, a vertical longitudinal section of the boiler in plane *x x*, Fig. 9; Fig. 8, a similar section of the superheating-furnace in plane *y y*, Fig. 9; Fig. 9, a plan of the combined boiler and superheating-furnace; Fig. 10, an end elevation of the same.

Like letters of reference indicate corresponding parts in all the figures.

This apparatus is designed for manufacturing three distinct products from petroleum under vacuum by steam in an economical and effective manner, whereby the naphtha is removed, as a distinct product, from the illuminating-oil, while the operation of distillation is made more continuous than it otherwise could be, and at the same time a valuable heavy oil obtained, thus rendering the products from petroleum, as a whole, more valuable than they otherwise would be.

My invention consists in combining two or more vacuum petroleum-stills with each other in such a manner that while the lighter hydrocarbons are being distilled from the crude petroleum in one of the stills the heavier portions are being distilled in the other, thus making the operation more continuous than it otherwise would be, the oil being fed from one retort into the other, as circumstances require, at the same time economizing in the amount of steam used for distilling purposes by passing it, in a superheated state, through the heating-pipes in the retort containing the least volatile portions of the petroleum, and after-

ward conducting it through the pipes in the second retort containing the lighter and more volatile portions of petroleum, thus making the latent heat of the steam effective after the superheat has been extracted from it.

Also, in the construction of a horizontal elongated cylindrical or elliptical vacuum-retort for petroleum-stills, as a cheaper and more advantageous form than those heretofore known or used, for containing straight heating-pipes and exposing a larger surface to the distilling action, and in furnishing attachment for several goose-necks instead of one, as in ordinary stills.

Also, in combining with a vacuum retort for petroleum one or more capacious condensers connected with the retort by numerous necks, so that the vapors arising from the oil in the retort may pass off freely and in a more direct line than they otherwise would do, and at the same time preventing the exhaust-pump from drawing the oil from the retort, as is apt to be the case where but one neck is used upon the retort, or where the ordinary condensing-coil is used.

Also, in the combination of a capacious condenser or condensers interposed between an ordinary condensing-coil and the retort, so that the direct action of the exhaust-pump upon the oil in the retort is broken or diminished, at the same time the effective condensing power of the apparatus is increased.

Also, in the employment of suitable receiving-vessels placed between the vacuum-pump and condensers in such a position that the distilled oil is deposited in them by its own gravity, thus avoiding the delivery of the distilled oils through the pump.

Also, in surrounding the upper portion of either or both of the vacuum petroleum-retorts with a jacket for applying steam or heated air externally to the same, to obviate the condensation of the oil-vapor as it rises against the upper surface of the retort.

Also, in the construction and use of an independent superheating-furnace for superheating steam, when used in combination with a steam-generator and a vacuum-still for petroleum, as hereinafter set forth.

Also, in constructing said independent superheater for steam alongside of a boiler in such

a manner that the same fire used in the superheating-furnace is conducted through a flue-space at the rear of the boiler, and thence passing through the tubes of the boiler assists in generating steam, and thus economizing the use of fuel and increasing the effective capacity of the distilling apparatus.

Also, in the construction of said superheating-furnace for steam with numerous sections of small pipes connected with main pipes for induction and eduction of the steam in such a manner as to use straight gas-pipe instead of coils, and to present a larger amount of heating-surface than is ordinarily the case, thereby insuring a suitable degree of heat for distilling petroleum, without so great danger from explosion of the superheater.

Also, in connecting the main eduction-pipe of the superheater with the numerous sections of small pipes in the interior of the retorts by means of a steam-chest bolted to the head of the retort, one portion or flue-space in said steam-chest admitting the steam to a tier of smaller heating-pipes in the retort, while the other flue-space exhausts the same.

Also, in placing in upright position and packing the sections of small heating-pipes in the retort through the head of the same in such a manner as to be easily removed for repairs.

Also, in the application of an oil-gage to a vacuum-still for petroleum, similar in construction to the gage commonly used upon vacuum-pans for sugar, and made available for observations of the quantity of oil in the retort, by placing the same at an unusual distance from the retort, and keeping the liquid in the gage at a low temperature.

As represented in the drawings, A is the primary, and A' the secondary, retorts, which are connected by a draw-pipe, *a*, with a stop-cock, Fig. 1, by which the contents of A are drawn into A'. These retorts, instead of being made upright, as usual, are horizontal and of considerable length, being either cylindrical, as shown, or any other form that will answer the desired purpose. This form enables me to insert the straight heating-pipe, hereafter described, without difficulty, and to arrange the same so as to produce a large heating-surface, as well as to attach and detach easily for repairs, &c. It also presents a larger vaporizing-surface than the ordinary upright form, and gives room for the attachment of a series of goose-necks, by which the vapor is carried off more readily. The primary retort A (and the other, if desired) has its top covered or inclosed by a jacket, *e*, Figs. 1 and 4, by which steam or hot air is let on through pipe *j* and discharged through pipe *j'*. By this means I am enabled to prevent that condensation of the vapor that would occur if it came directly in contact with the top of the retort cooled by the surrounding atmosphere. The top being always hot as well as the bottom, the vapor will retain its form and pass off. In addition to this, the heated top of the

retort serves to vaporize such particles as are carried up without being properly separated. From the tops of the retorts respectively passes a series of goose-necks, B B and B' B', connecting with corresponding series of capacious condensers, C C and C' C', submerged in a water-tank, D. Instead of the upright form of the condensers indicated in Fig. 1, the horizontal elongated form indicated in Fig. 5 may be employed. With the bottom of the series of condensers connect two separate condensing-coils of pipe, E E', resting in a water-tank, D', and these coils, passing out through the tank, connect respectively with receivers F F' for retaining the distilled oil. The position of these receivers is lower than the condensers, so that the distillate will be deposited in them by their own gravitation.

The receivers are provided at the bottom with draw-cocks *b b*, for discharging the refined oil, and with air-cocks *c c*, for admitting air to supply the vacuum in drawing the oil. From the tops of the receivers extend branch exhaust-pipes G' G², uniting in a single exhaust-pipe, G, which connects with the pump, for exhausting air from the apparatus. When the exhaust is applied it will be seen that it operates to produce a vacuum from the receivers clear back to the retorts through the parts E E', C C', and B B'.

In order to make the pump act, when desired, upon only one of the retorts and its accompanying connections, the branch pipes G' G² have cocks *d d'*, as shown. The retorts are provided each with jet-pipes H H, pierced with numerous small holes, for the injection of steam into the body of the oil, the said pipes passing out and connecting with the main pipe from the superheater, which will presently be described.

The retorts have each, also, instead of coils, a series of heating-pipes, I I, made of straight pieces, *f f*, of gas-pipe, screwing into returns *g*, and forming either single bends, as in Fig. 4, or double ones, as in Fig. 6, as may be desired, though the latter are the most effective in large stills. These pipes are placed side by side in the retorts, and rest in a vertical position, and the free ends are inserted in the head of the retort, and are held in place and packed at the same time by lock-nuts which screw on the pipe inside and out and clamp against the said head; or they may be fastened in by calking. The ends of the pipes thus arranged open into compartments *i i'* of chests K K', bolted to the heads of the retorts. The main induction-pipe L from the superheater opens into the upper compartment, *i*, of the steam-chest K'. The steam thus admitted is carried round through the pipes I into the lower compartment, *i'*, and thence it is carried by pipe L into the lower compartment of steam-chest K, when it again makes a circuit through pipes I of the retort A, and finally escapes through the exhaust-pipe L².

The steam-generator consists of a boiler, M,

having flue-pipes *k k*, as usual. The outer ends of the flue-pipes open into a flue-space, *l*, which is an extension of the fire-chamber *N*. Side by side with the boiler is a superheating-furnace, *O*, being separated only by a wall, *m*. This wall has an opening or passage, *n*, in which is a damper, *o*, for regulating the escape. Thus the products of combustion and the escape-heat from the superheating-furnace pass into and through the flue-pipes of the boiler with those from the fire-chamber of the boiler itself, and thus assist in generating the steam.

The superheating-furnace is made with the upward incline shown in Fig. 8. At a suitable position across this furnace are placed bars *p p*, which sustain the series of superheating-pipes *I'*. These pipes are constructed of straight pieces, *f' f'*, of gas-pipe, screwing into return bends *g'* in the same manner. The free ends of the pipes are passed through the side of a chest, *K*², and secured by lock-nuts in the same manner as in the retorts. The chest *K*² is likewise formed with two compartments, *i' i'*, into which the opposite ends of the superheating-pipe open. Into the upper compartment opens the induction steam-pipe *P* from the boiler, and from the lower compartment extends the supply-pipe *L*, before mentioned, that conducts the steam to the retorts. A circuit of the steam from the boiler is thus made through the superheating-pipes *I'* and discharged to the retorts. The superheating-pipes, in the position shown and described, are so situated as to receive the best action of the fire, and to be easily removed from place by simply slipping down endwise and passing out of the door of the furnace.

The height of the oil is indicated in the retort by an ordinary gage *R*, connected at the top and bottom by means of pipes *s s'*, with the top and bottom of the retort, as indicated in Fig. 1. I prefer to run one or both of these pipes through a body of water, for the purpose of cooling the liquid that enters the gage. In the drawings they are shown as passing through the tanks *D D'*. If desired, the other retort may be supplied with a gage in a similar manner.

The operation of the apparatus before described is as follows: The air is exhausted by means of the air-pump, as before described. The primary retort *A* is now partially—say, about one-half—filled with crude oil through supply-pipe *Q*, and the cock in pipe *a* is closed to prevent passage to *A'*. The steam from the boiler is now let through the pipes gently, and the vapor soon begins to rise. The naphtha, which is the first product, is passed through the primary apparatus *B C E* and deposited in receiver *F*, from whence it is drawn by closing cock *r* in pipe *E* and opening the discharge and air cocks *b c*, as before described. A fire is now kindled in the superheating-furnace *O*, and a part of the remaining oil is drawn from *A* into *A'*, which is accomplished by partially cutting off the exhaust from *A* by cock *d* and

turning it on to *A'* by cock *d'*. The partially-distilled oil is now kept at the proper level in *A* by feeding it from *A*, as described, and the distillation in *A'* becomes very effective, and, for a time, continuous. The distilled oil from said retorts is thus carried over at once into the receivers *F F'*, where it is discharged at pleasure.

It will be seen that the retort *A* is used first for removing the naphtha, and afterward for distilling off the lighter gravities of burning-oil by means of the latent heat contained in the exhaust-steam after it passes from retort *A'*, which latent heat would be otherwise lost. By this arrangement, also, the heated oil in retort *A* is fed into *A'* as fast as required, so that the superheat is used upon and for distilling the heavier gravities of petroleum constantly, while the latent heat which still remains in the steam after passing from retort *A'* is sufficient to remove the lighter portions from the crude oil. By this duplication of the stills I am enabled to remove the naphtha, while the operation of distilling is made more continuous than it otherwise could be; and in this respect alone there is a very great advantage over a single-acting vacuum-still, in which, by a continuous feed, the naphtha must necessarily be incorporated with the distilled oil, or else, as ordinarily, the oil deposited in charges, which is a source of difficulty.

The employment of the series of goose-necks *B B'* instead of the ordinary single goose-neck insures a more effective discharge of the vapor, and also, by presenting a larger surface, prevents the drawing over of the contents of the retorts. The interposition of the capacious condenser or condensers *C C'* between the coils *E E'* and the retorts is of much advantage in this respect, for it furnishes, so to speak, a break to the action of the exhaust of the pump between the said coils and goose-necks, which obviates the tendency to draw out the oil.

When the oil in retort *A'* has been reduced to the desired consistency it is discharged through pipe *S*, Fig. 2.

My object in this invention is to afford an easy and effective separation of petroleum into products more valuable, as a whole, than have been heretofore produced from crude oil. These products, as I use the apparatus, consist, where Pennsylvania well oils are used, gravity 45° Baumé, of naphtha, say, ten to twelve per cent., pure hydrocarbon oil for illumination, say, forty-four to forty-eight per cent., heavy green oil, valuable for currying and oiling leather, say, thirty-six to thirty-eight per cent.

It has been the object heretofore to produce from petroleum the largest possible amount of kerosene or burning oil. This apparatus will not effect that result; neither do I desire to produce seventy-five, eighty, or ninety per cent. of illuminating distilled oil; but by long and diligent experiments I have discovered that the separation of petroleum into the con-

stituent parts named, and into about the proportions named, results in greater profit to the manufacturer than otherwise, and the within-described apparatus is especially constructed to bring about the desired result.

Now, what I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of two or more vacuum petroleum-stills, so arranged that the oil is fed from one retort into the other as it increases in specific gravity during the distillation, and economizing the use of steam used in the vaporization of the oil in the retorts, by passing it first through the heating-pipes in the retort containing the heavier oils, and afterward conducting it through the heating-pipes in the retort or retorts containing the oils of lighter specific gravity, as herein set forth.

2. The construction of a horizontal elongated cylindrical or elliptical vacuum-retort for petroleum, arranged and operating in the manner and for the purpose herein set forth.

3. Connecting the retorts of a vacuum-still with the condenser or condensers by two or more goose-necks, so as to distribute the exhaust in the retort or retorts, and thus prevent drawing the oil over, at the same time facilitating the escape of the vapor, as herein set forth.

4. So combining the capacious condenser or condensers with the retort or retorts and the condensing coil or coils that said capacious condenser or condensers will serve as a check to diminish the direct action of the exhaust-pump upon the oil in the retorts, as set forth.

5. Placing the receiving-vessels F F' in such a position as to allow the distilled oil to be discharged by its own gravity and without passing through the pump, as set forth.

6. Surrounding the upper portion of the retort or retorts by a jacket, or its equivalent, for the reception of steam or hot air to prevent condensation, as described.

7. The use, in combination with a vacuum still or stills for petroleum and a steam-generator, of an independent superheating-furnace for heating the steam, as specified.

8. The construction of said superheating-furnace, in combination with a steam-boiler, substantially as and for the purpose set forth, when and in connection with a vacuum petroleum-still.

9. The construction of a superheater for distilling purposes with numerous sections of small straight pipes for advantage of heating-surface, with facility of building and repairs, as shown.

10. Connecting the main induction and eduction steam-pipes L L', leading from the superheater to the still, with the sections of small heating-pipes within the retorts by means of a steam-chest, K', bolted to the head of the still, substantially as and for the purposes set forth.

11. Placing the small sections of heating-pipes in the retort in upright position, substantially in the manner and for the purpose set forth.

12. The application of an oil-gage to a vacuum petroleum-still, arranged and operating substantially as set forth.

13. The combination of a steam-generator, superheating-furnace, and vacuum apparatus, as a whole, constructed and operating substantially in the manner set forth.

14. The separation of petroleum into the constituent parts specified and about the proportions named by means of an apparatus as herein described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HIRAM B. EVEREST.

Witnesses:

R. F. OSGOOD,
JAY HYATT.