4 Sheets—Sheet 1.

# E. LANE.

## OIL DISTILLING PROCESS AND APPARATUS.

No. 172,131. Patented Jan. 11, 1876.

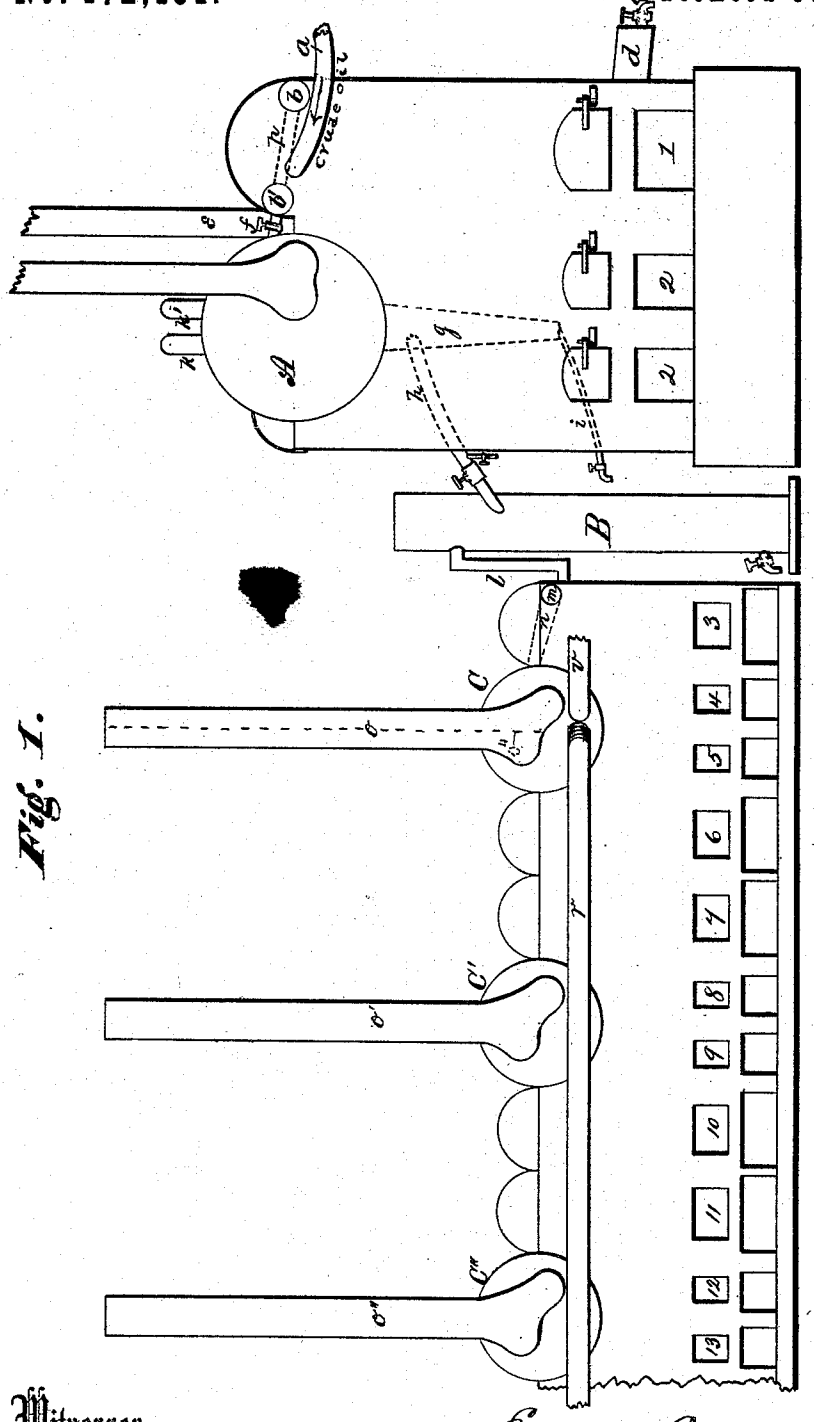


Fig. 1.

Witnesses

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# E. LANE.

## OIL DISTILLING PROCESS AND APPARATUS.

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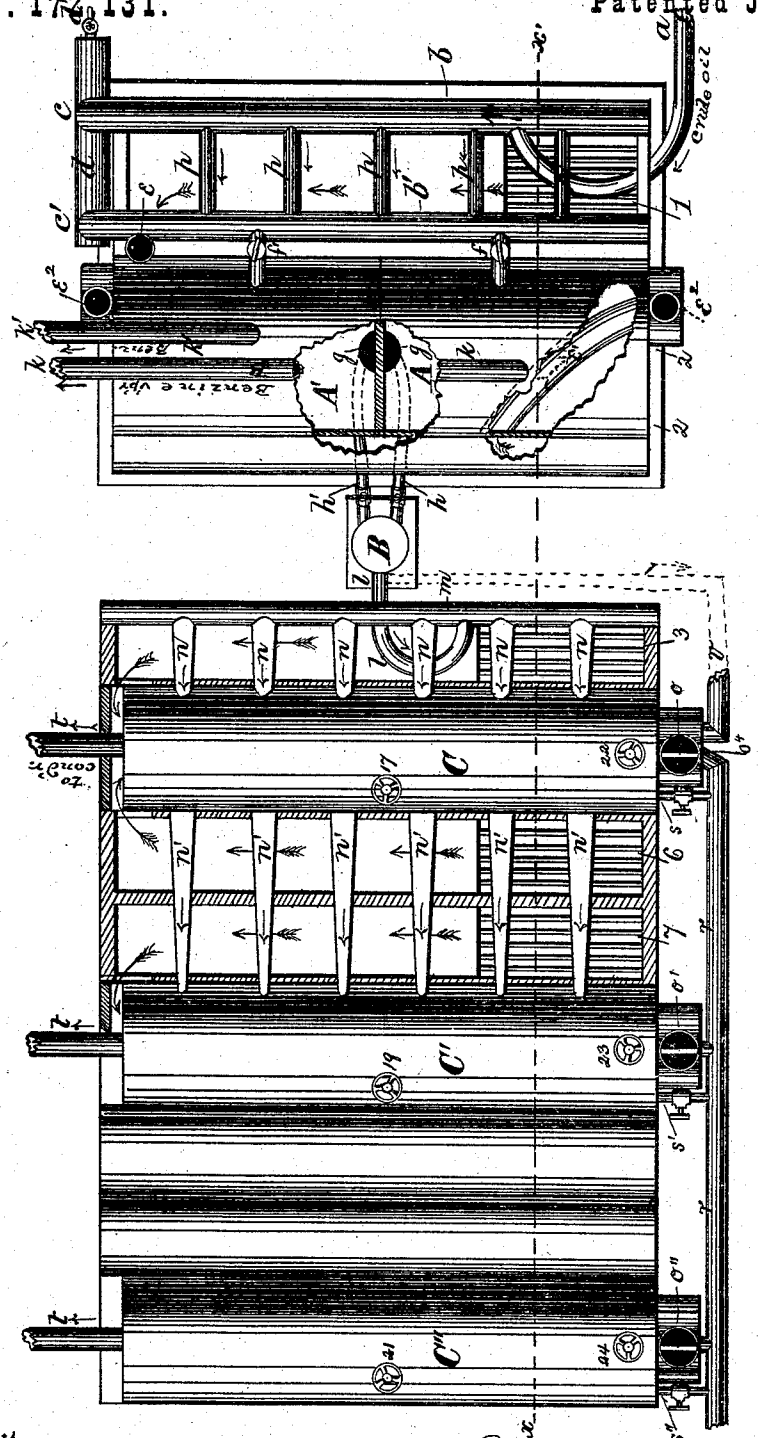
Fig. 2.




Witnesses

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## OIL DISTILLING PROCESS AND APPARATUS.

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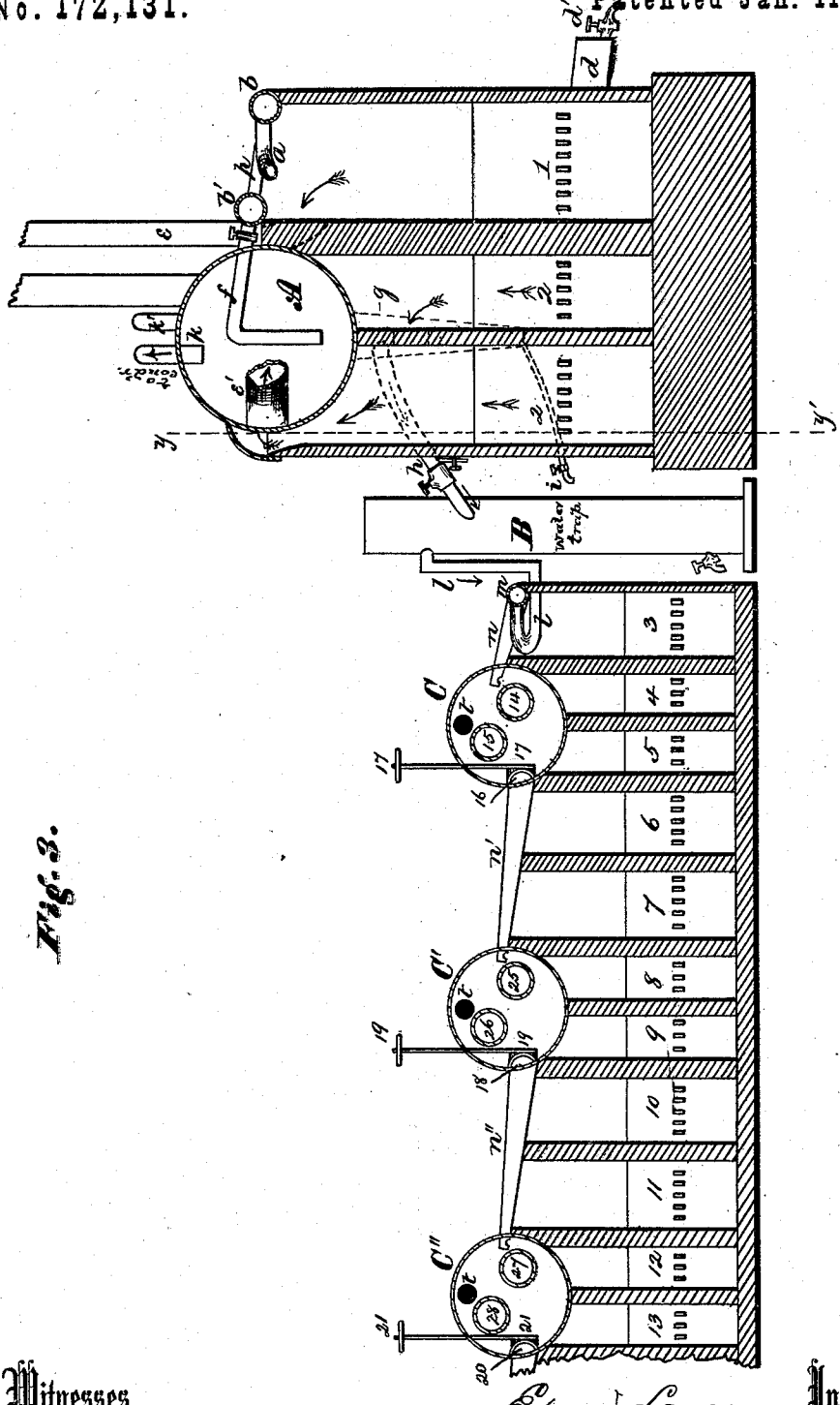


Fig. 2.

Witnesses

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## OIL DISTILLING PROCESS AND APPARATUS.

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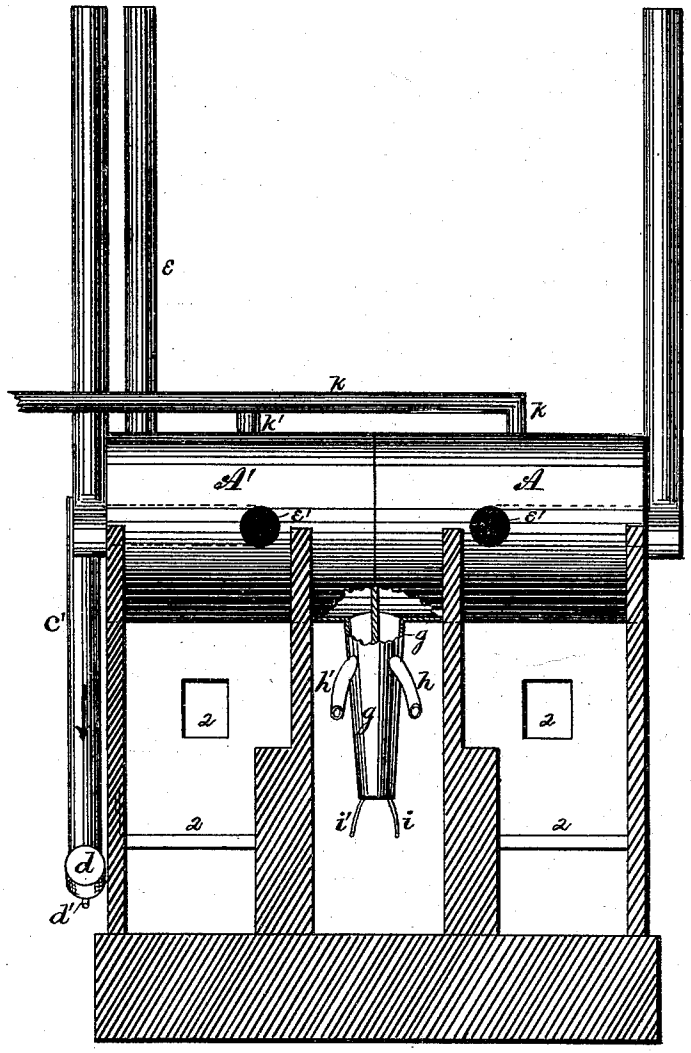
*Fig. 4.*




Witnesses

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# UNITED STATES PATENT OFFICE.

EDWARD LANE, OF SHARPSBURG, PENNSYLVANIA.

## IMPROVEMENT IN OIL-DISTILLING PROCESSES AND APPARATUS.

Specification forming part of Letters Patent No. **172,131**, dated January 11, 1876; application filed December 11, 1875.

*To all whom it may concern:*

Be it known that I, EDWARD LANE, of Sharpsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in the Process of Distilling Oil and Apparatus therefor; 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 it, reference being had to the accompanying drawings, which form part of this specification, in which—

Figure 1 is a front elevation. Fig. 2 is a top view, having four of the furnace-arches off, and partly sectional. Fig. 3 is a vertical section through line *x x*. Figure 4 is a side elevation of feeders through *y y*.

This invention relates to a process of distilling or refining crude petroleum, and to the construction of apparatus therefor; and consists in the various steps and agents, as hereinafter described and claimed, whereby the oil is successively and continuously distilled, while at the same time any gravity, from benzine up to paraffine, may be produced and collected without disturbing the continuity of the process, and all water is successfully separated before entering the stills proper.

My process consists of the following steps: First, heating the crude oil by direct furnace heat (the action of the heat separating most of the contained water) and drawing off water from the oil; secondly, distilling over the benzine, and drawing off the remaining water, both being done likewise by direct furnace heat; thirdly, effecting a continuous feed after this step into the distilling apparatus proper; fourthly, heating the oil by direct furnace heat before it passes to the stills, thus partially vaporizing it, and leaving less work to be performed by the stills; fifthly, passing it on through one or more stills, either to hasten the distillation, or to collect the various gravities separately.

Referring to the drawings herewith, I run the crude petroleum by gravity or pumping through the supply-pipe *a* into a large pipe or tube, *b*, which is slightly inclined. A short distance from this is a similar pipe, *b'*, running parallel, but on a higher level, also inclined likewise. These two pipes are connected at intervals by lateral pipes *p*, running up from pipe *b* to *b'*. The two pipes *b b'* have extensions *c c'* downward from their lower ends, connecting with a small tank or receptacle, *d*, furnished with a stop-cock, *d'*. A fire, 1, is placed under one end of this set of pipes, and passes along, directly heating pipe *a* (furnished with expansion-joint) and pipes *b b' p*, its heat and smoke passing along till they escape through a smoke-stack, *e*, at the corner of the other end. The object of this furnace is to heat the oil almost to the temperature required in the benzine-still, and also to separate the water, (always more or less present in crude oil,) which then finds its own level, in consequence of greater specific gravity than oil, in the tank *d*, and is drawn off when necessary at the cock *d'*. Besides the pipe *b'* is the preparing or benzine still and "feeder," which is divided into two compartments, A and A'. Into the still A, from the pipe *b'*, leads a pipe, *f*, which is upwardly inclined toward the top of still A, inside, and then bends downwardly, reaching nearly to the bottom, where it is open. Likewise a similar pipe, *f'*, leads from pipe *b'* upwardly into still A', bending down in the same manner. Both pipes, *f* and *f'*, are furnished with stop-cocks outside, between the stills A A' and pipe *b'*, so that either may feed oil into its respective still, or not, as may be required in the process. The object of running the pipes nearly to the bottom is to give the water a chance to run off before it rises by the eddying or ebullition of the oil. At the bottom of stills A A', where the partition divides them, an opening in each leads down into a vertical pipe, *g*, down into which the partition continues to the bottom. Thus the two stills have no communication whatever with each other. From near the top of pipe *g* leads a feed-pipe from each compartment, *h* and *h'*, and from the bottom a water-escape pipe, *i* and *i'*, respectively. Furnaces 2 are set under each end of the still A A', at each end, the inside furnace connecting by a flue or hole in dividing-wall with its fellow at the same end. These, after directly heating their stills, pass up around the out-

side of the stills, and then back diagonally by one or more flues, $e^1$, passing through the stills, and out at the smoke-stacks $e^2$ at the ends.

The two feed-pipes *h h'* end in the trap B, which consists of a large stand-pipe, into which the pipes *h h'* empty. From a point higher than the ends of *h h'* a large feed-pipe, *l*, leads onwardly and downwardly into the remaining apparatus. This difference in level between pipes *h h'* and pipe *l* forms a trap for catching all water that could possibly have been carried over thus far. Such water is let off through a faucet at bottom of trap B. Then we have done with the water, as none passes this point. Up to this, the apparatus is only for the purpose of getting rid of the benzine and water, which is effectually done.

Leading from trap B, by an expansion-joint, the pipe *l* opens into a large horizontal tube, *m*, closed at both ends. From this, at intervals, ascend the inclined tapered pipes *n* (crossing furnace 3, which directly fires them and tube *m*) upwardly, into the first still proper C, into which they pour the oil by a hole on their under side near their ends. They lie with large ends opening into pipe *m*, and their small ends into still C. The purpose of tapering is to check or delay the flow of oil over furnace 3, so that it may be brought to the state of vapor before it enters the still C; and the purpose of upward inclination is to permit the vapor so formed to escape, by its lightness, upward into still C. Such, also, are the purposes of all the remaining inclined and tapered pipes.

The still C is cylindrical and horizontal, as are also all the remaining stills. Running through it longitudinally or laterally (I prefer the former for results) are one, two, or more flues, 14 15. Supporting it its entire length are three walls, one at each side and one in the middle. These walls give us place for two independent furnaces, 4 and 5, under the whole length of still C. The furnace 3 is at its farther end provided with a diagonal flue joining a flue from furnace 4, where both unite to carry all their heat and smoke up into flue 14 of the still C, thence on back through the flue to the front, traveling the entire length of the still twice, and then out into a smoke-stack, *o*, at the front. The heat and smoke of furnaces 5 and 6 act in like manner through the flue 15, also coming back into smoke-stack *o*, which is partitioned, as seen at $o^4$, from top to bottom, to prevent confusion of draft. Thus the still C gets the direct heat of the two furnaces 4 and 5, and the indirect heat of four furnaces, 3, 4, 5, and 6, the flues all corresponding in size to the draft required.

Pipes *n'*, similar to pipes *n*, but longer on account of crossing two furnaces, ascend from near the bottom of still C up into still C', and likewise pipes *n''* from C' to C''. Along inside still C, where it opens into pipes *n'*, is a horizontal tube or longitudinal section of tube 16, closed at both ends, communicating one way throughout with tubes *n'*, and open the other way at one point only, where it is provided with a valve or sluice, 17. The stills C' C'' are also provided with flues 25 26, and 27 28, and with tubes or sections 18 and 20, with their valves 19 and 21, respectively. The purpose of tubes 16, 18 and 20, with their valves or gates 17, 19, and 21, is to control the flow of oil, or to stop for cleaning occasionally.

Between stills C and C' are two furnaces, 6 and 7 firing pipes *n'*, but separated by a wall; furnace 6 delivering along with 5 into flue 15, and furnace 7 delivering with 8 into flue 25. Under still C' are two furnaces, 8 and 9, like 4 and 5. Under pipes *n''* are furnaces 10 and 11, like 6 and 7, so that furnaces 7 and 8 deliver into flue 25, furnaces 9 and 10 into flue 26, 11 and 12 into flue 27, and so on. If the number of flues in each still be more or less than two, the delivery can be changed accordingly.

Connected with the front end of each of the stills C C' C'', and lying outside, is a large drain-pipe, *r*. At the several connections with the stills of the pipe *r* are shut-off valves 22, 23, and 24, respectively. The purpose of this pipe and the valves is to drain a still at any time it may become necessary to stop. In that case the supply into such still is stopped, the end valve opened, and all oil allowed to run off into pipe *r*. In addition, the pipes 16 18 20 of the respective stills at their front ends connect with the pipe *r* by the pipe and stop-cocks *s*, *s'*, and *s''*, respectively.

When a still is drained, as just shown, the inclined pipes, which it has been feeding, must be drained also, and this is best done by the pipes *s*, *s'*, and *s''*.

Each still has a tube, *t*, leading to the condenser. In my apparatus it need not be at the highest point, as any point above the level of the oil will do to condense from, since there is no water present.

To give facilities for repair to the pipes *m* and *n* of the first still, I let a pipe, *v*, into end of still C, which can be connected with pipe *l*, the openings in upper ends of pipes *n* plugged, and then no oil passes through them or pipe *m*, when they can be cleaned or repaired, man-holes being provided for that purpose there as well as in every part of the apparatus that is liable to collect impurities and obstacles.

The *modus operandi* of my process as applied in the apparatus is as follows: Fire is started in furnace 1, and in furnaces 2 2 under both feeding-stills. The crude oil is taken directly from an elevated tank, or pumped, and being admitted into pipe *a*, it enters pipes *b p b'*. Here the oil is heated by direct heat nearly, if not quite, to the temperature at which it volatilizes, and it is ready to part with its benzine upon entering the feeding-still at the least increase of heat. The inclined position of these pipes causes the water to find its own level, which it does in tank *d*, whence it is occasionally drawn by cock *d'*. This is the first

important stage in my process. The cock *f* is now opened, and the hot oil permitted to flow into still A, where the heat is greater, and benzine distills over into condenser by pipe *k*. Any water that still remains in the oil is drawn off through the pipe *i*, through water-cock in pipe *h*, and at trap B. When the benzine is distilled over, the cock *f* is closed, and the oil, deprived of water and benzine, is allowed to flow off by pipe *h* through trap B into pipes *l* and *m*. This is the second step. As this single still A would give but an intermittent action, I provide for a constant flow by means of a duplicate benzine-still, A′. While the oil is flowing from still A, I open cock in *f′* and admit hot oil to still A′, in which the evolutions of still A are then repeated. The action is then alternate and constant, the stills A A′ being made large enough to accommodate the wants of the other stills. Thus a continuous feed is maintained. This is the third important step in my process.

Heretofore the crude oil has sometimes been heated by a steam-coil or worm in the oil-tank previously to entering a still; but this is objectionable, for it is extremely difficult in variable temperatures to keep the joints steam-tight, and then steam is always liable to leak into the oil. This will form water, and, if existing in undue quantity, the result is not only injury to the oil, but absolute danger to the operator and the apparatus, since the water may form steam and explode the still. Now I use direct furnace heat, and such results are impossible.

The next important point in my process is to heat the oil by direct furnace heat in its passage to the stills proper, thus partially vaporizing it, and bringing it to such a state that upon entering the still proper, (higher heat,) it will immediately part with all vapor that distils over at the temperature of that still, the heavier products passing on. To do this I fire in furnaces 3, 4, and 5 to the requisite degree, and then allow the oil to pass from trap B into pipes *m* and *n*. Here it is heated till it partially volatilizes, passing over into still C.

The tapered form of the tubes *n* retards the flow sufficiently for this to take place. Passing into still C the oil is at once freed from whatever component distils at that temperature. This being done, the valve 17 is opened, allowing the oil to enter pipe 16, which it is caused to do by the oil of lower temperature entering from the feed-pipes going to the bottom and forcing the hotter oil to rise into and flow off through pipes *n′*, where it is again raised in temperature by direct furnaces 6 and 7, and the operations of still C are repeated in still C′, the result, of course, being the distillation of a product of higher gravity; and thus, also, in still C″ oil of still higher gravity is distilled, and so on, if the number of stills be sufficient, till at last paraffine is distilled, leaving the residue always in the last still of the series, since the heavier products of each still is always carried over to the next, on account of the displacement above described, so that, therefore, none but the last one of the working series of stills will ever need much cleaning, and it can be stopped at any time without interfering with the others.

Lest it might possibly become necessary to stop the still C the pipes *n′* may be made like pipes *n*, and a connecting-pipe run from the tap B, making the apparatus then, in necessity, independent of still C. If at any time it be desired to run only the feeder and still C the valve 17 is simply shut down, thus confining the oil to the still C, and so with the others; but to obtain oils of different degrees of volatility and specific gravity different stills in accordance must be employed to preserve continuity of distillation. However, if, as is usual, kerosene be the desired product, it may be with great rapidity distilled by allowing all the stills to send their vapors into one general condenser.

The pipes *n n′ n″*, &c., may be constructed as shown, or in an independent series away from the stills, fired independently, and communicating in a manner equivalent to that shown, for it does not matter what the shape or position may be, so long as the process of heating is sustained; or the pipes *n n′ n″*, &c., might be arranged in an ascending coil or spiral, and fired as before; or, instead of pipes, a goose-necked retort might be substited with like results.

The number of flues through the stills may be varied.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is as follows:

1. The continuous process for fractionally distilling or refining crude petroleum by direct heat, consisting in the following successive steps: First, heating the crude oil, and at once withdrawing the free water; second, distilling off the lighter oils, and at the same time withdrawing further water; and, third, subjecting the remaining oil to successive heatings, alternated with evaporations and condensations at successively higher temperatures, wherein the oil is prepared by heat for each evaporation.

2. The apparatus described, consisting substantially of a set of pipes, *b p b′*, two or more feeders, A A′, acting alternately, trap B, pipes *m n*, and one or more stills, C, all combined and arranged substantially as set forth, and for the purposes described.

3. In combination with the feeders A A′, a series of pipes, *b p b′*, acted on by direct or furnace heat, and having the extensions *c c′*, all for the purpose of obtaining the water and benzine from the crude oil, substantially as set forth.

4. In combination with the feeders A A′, two or more, and the feed-pipe *l*, the water-trap B, substantially as specified.

5. In combination with an oil-still, a series of pipes, *m* and *n*, the latter inclined and acted on by furnace-heat, for the purpose of pre-

paring the oil for ready volatilization in the still, arranged and operating substantially as set forth.

6. In combination with two stills, C C′, the communicating-pipes *n′*, inclined as shown, and tapered or not, feeding out of a pipe, 16, through a valve, 17, in still C, substantially as specified.

7. In combination with the pipe *r* and the stills C, C′, and C″, having the pipes 16, 18, and 20, the drain-pipes *s*, *s′*, and *s″*, substantially as shown.

In testimony that I claim the foregoing I have hereunto set my hand this 27th day of November, 1875.

EDWARD LANE.

Witnesses:
THOS. J. MCTIGHE,
A. CORCORAN.