2 Sheets—Sheet 1.

ELLIS & KATTELL.

Distilling Liquids.

No. 68,860. Patented Sept. 17, 1867.

Fig. 1.

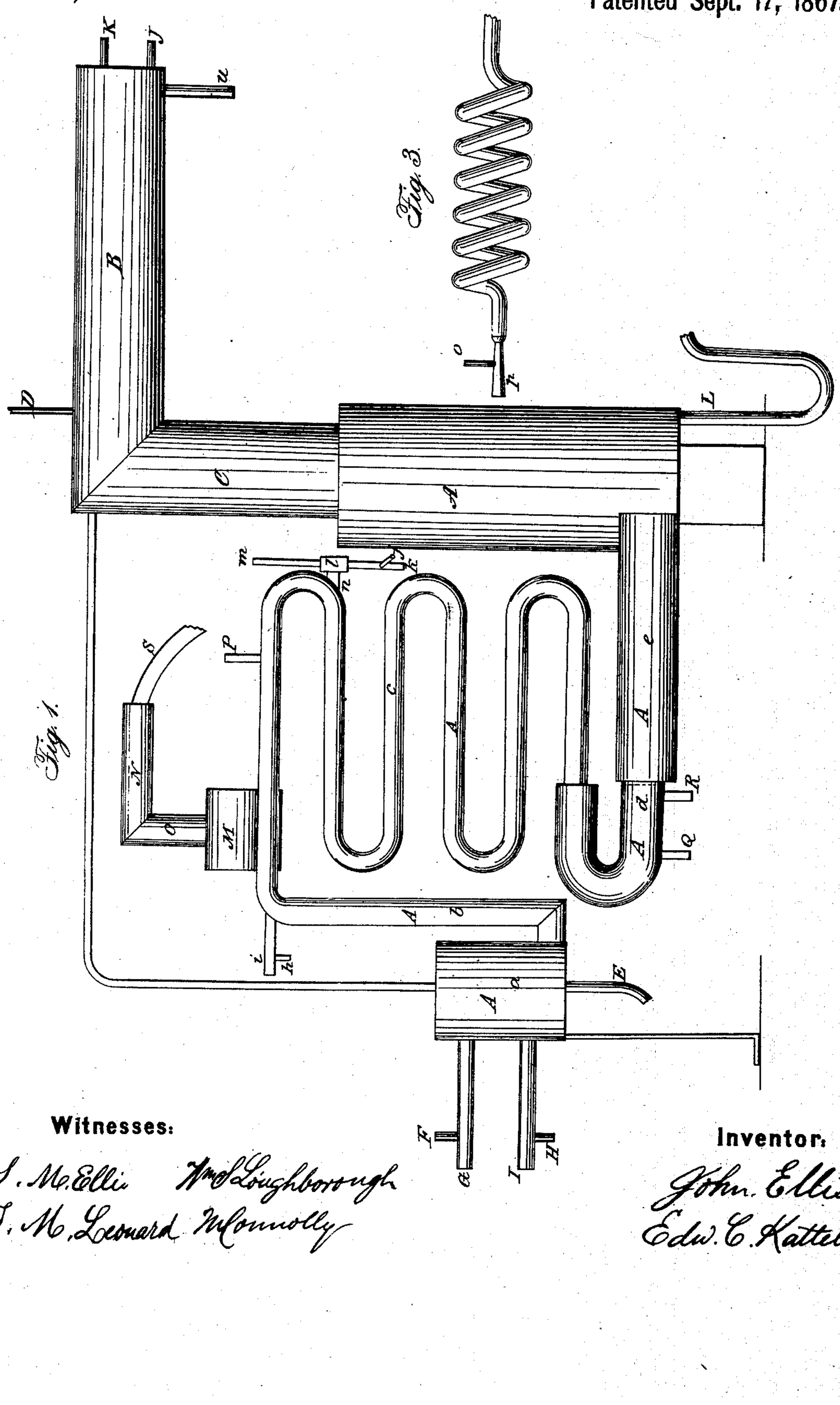

Fig. 3.

Witnesses:

S. McEllis Wm. Loughborough

T. M. Leonard M Connolly

Inventor:

John. Ellis

Edw. C. Kattell

2 Sheets—Sheet 2.

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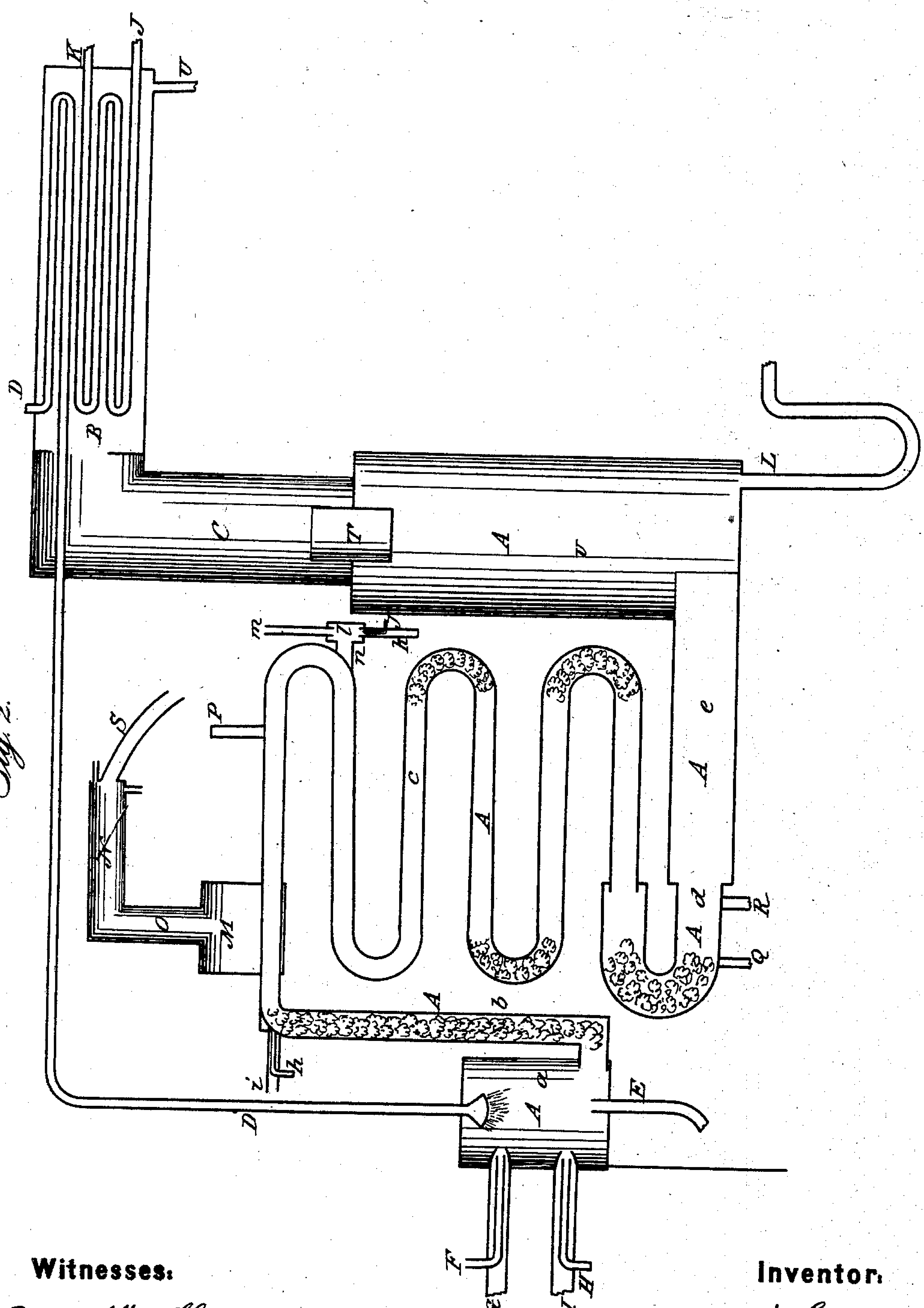

Fig. 2.

Witnesses:

S. M. Ellis Wm S Loughborough

T. M. Leonard W Connolly

Inventor:

John Ellis

Edw. C. Kattell

UNITED STATES PATENT OFFICE.

JOHN ELLIS, OF NEW YORK, AND EDWARD C. KATTELL, OF BINGHAMTON, N. Y.

IMPROVEMENT IN APPARATUS FOR DISTILLING, EVAPORATING, AND REFINING OILS AND OTHER LIQUIDS.

Specification forming part of Letters Patent No. **68,860**, dated September 17, 1867.

To all whom it may concern:

Be it known that we, JOHN ELLIS, of New York, in the county of New York and State of New York, and EDWARD C. KATTELL, of Binghamton, county of Broome, and State aforesaid, have invented certain new and useful Improvements in Desiccating, Evaporating, and Continuous Oil-Refining Apparatus; and we do hereby declare that the following is a full and complete description of the construction and operation of the same, reference being had to the accompanying drawings, making a part of these specifications, in which—

Figure 1, Sheet 1, is a side view of the apparatus as it naturally stands. Fig. 2, Sheet 2, is a vertical longitudinal section of the same. Fig. 3, Sheet 1, represents a device to be hereafter noticed.

Like letters of reference refer to like parts in the views.

Our improvements relate to a process for desiccating or evaporating saccharine, saline, and alkaline, and other aqueous solutions, and for distilling and refining petroleum, turpentine, &c., by the use of steam and superheated steam, and especially to a process by which petroleum or any of its products, or turpentine, can be rapidly passed through the retort or retorts, most intimately mixed with steam or superheated steam, at a temperature far above that of boiling water, if necessary, owing to our retort being so constructed as to allow no accumulation of water resulting from the condensation of steam in it, thereby enabling the refiner to remove even heavy kerosene from petroleum by the use of superheated steam applied directly to the oil, which result, so far as we know, has never been successfully accomplished by the use of any other apparatus.

In Fig. 1, Sheet 1, A A A A A A is a retort, composed externally of chambers and of pipes or tubes, the internal arrangement of which is shown in Fig. 2, Sheet 2. B is a horizontal, or nearly horizontal, condenser.

C is an ascending pipe arising from the retort, which helps to form the goose-neck. D D is an oil-supply pipe, which conveys oil into the top of chamber *a*. E is a steam-pipe, which enters the bottom of chamber *a*.

F is another oil-supply pipe, which, before it reaches the chamber *a*, enters steam-pipe G. G is a steam-pipe, which conveys steam or superheated steam into chamber *a*.

H is a steam-pipe, for conveying steam to chamber *a;* but before it enters the chamber it enters oil-supply pipe I. I is an oil-pipe, for conveying oil into chamber *a*. J is a pipe for conveying cold water into condenser B. K is the exit-water pipe, or the other end of pipe J. L is a pipe through which the unvaporized portion of the oil or liquid being distilled leaves the retort.

The red lines and parts denoted by them are intended to show either how a part of the apparatus can be used without the rest of it, or a different mode of using it.

h is a steam-pipe, which enters the oil-supply pipe *i* before the latter reaches the tubular part of the retort. *j* is a steam-pipe, which enters oil-pipe *k*, and both discharge their contents into the short piece of larger pipe *l*. *m* is an ingress-oil pipe, entering pipe *l*. *n* connects *l* with pipe *c*.

M is a chamber, in which, when it is used, pipe *c* of the retort terminates, without passing through. Chamber *a* and pipe *b* are not used in connection with this chamber.

N is a condenser, connected by pipe O with chamber M. P is an oil-supply pipe, used in connection with chamber M and its attachments. Q is a steam-pipe entering pipe *d*. R is a pipe for the exit of the unvaporized portion of the oil when chamber M is used.

The internal construction of the various parts described will be shown in Fig. 2, Sheet 2.

By referring to Fig. 2, Sheet 2, it will be seen that the interior of the ascending part of the retort *b* contains curled wire. The wire at this point is not important—it may be inserted or omitted. The bends in the pipes *c* are also stuffed with curled wire. Here it is of great service, as it divides the current or currents of oil or other liquid passing and the steam, intimately mixing the steam and oil or liquid, and furnishing heated surfaces. It will be seen that oil-pipe D, entering condenser B, passes horizontally nearly to the extreme end of the condenser, when, by a return bend, it

returns and passes out through the goose-neck, after which it passes over and down to the chamber *a*, where it discharges its contents directly opposite steam-pipe E. Oil-pipe F, entering the steam-pipe G, extends nearly or quite to its end. The steam-pipes H, *h*, and *j*, entering, respectively, oil-pipes I, *i*, and *k*, it will be seen stop a little short of the end, and the ends of the oil-pipes I and *i* are somewhat contracted at, and especially beyond, the ends of the steam-pipes, which is not the case with oil-pipe *j*. It will further be noticed that residuum or discharge pipe L does not rise in the least above the level of the bottom of the retort, and it should always be slightly depressed, so as to afford no chance for the lodgment of water on the floor of the retort; and care is requisite that this point or end of the retort should never be higher than the farther end of the part of the chamber of the retort marked *e*. It should be a little lower, otherwise water will accumulate beneath the oil; violent explosions, from the conversion of water into steam, will result; the temperature will be reduced and more steam will be condensed, and the successful operation of the process will be seriously interfered with. The pipe L should be a large pipe, so as to afford a free exit to the unvaporized fluid. This is especially important in the evaporation of saccharine and saline aqueous solutions.

T is a trap, formed by a circular piece of pipe, descending for a short distance below the upper plate of the body of the retort, and ascending into pipe C, leaving an annular chamber above, between it and pipe C. Two or three holes are drilled or punched through the head of the retort, back of this tube, to allow any fluid which may condense in this chamber to flow back into the retort.

U is a pipe, through which the uncondensed vapors, gases, and fluids which are condensed in condenser B escape from the condenser. S performs the same office for condenser N.

Fig. 3, on Sheet 1, represents a spiral pipe, with a steam-pipe, *o*, passing into and nearly to the end of oil-pipe *p*, which is attached to the end of the coiled pipe. This figure is introduced to show one way in which a pipe can be bent or constructed so that when oil and steam or superheated steam pass through it together, the oil, from its superior gravity, will tend to pass repeatedly through the current of steam, in a manner substantially the same as is represented in the tubular portions of retort A A A A A.

Having thus described the various parts of our apparatus, we will now proceed to show the various methods of operating the whole or different parts of it; but before doing this we will state that if we simply desire to remove naphtha or gasoline, saturated or common steam is all that will be required; but in all cases, if we desire to remove the heavier oils from petroleum, or to evaporate the water from an aqueous, saccharine, or saline solution, superheated steam will be required. Either of the oil-supply pipes named or noticed in the above description may be connected with the pipe D as it leaves the head of the condenser, or at any point after, or even before it leaves the condenser.

First method or process: The oil or any other fluid from which we desire to remove its lighter portions by evaporation may enter pipe D before the latter passes through the horizontal surface of the condenser. While passing through pipe D in the condenser the oil or fluid is heated quite hot. Passing out through the goose-neck it either flows in pipe D to the rose in chamber *a*, and is there precipitated in small streams onto a current of steam or superheated steam from steam-pipe E, or pipe D is connected with oil-pipe F, and the oil flows through F into chamber *a*. Steam or superheated steam passing at the same time in the inclosing-pipe G comes in contact with the oil, and forces it into the chamber against any pressure which may exist, and intimately mixes with it; or, again, pipe D may connect with pipe I, and the oil be discharged into chamber *a* through the latter pipe, when it is forced by steam or superheated steam passing in pipe H into the chamber, the vacuum caused by the current of steam even raising it from a tank of a lower level, if desired. Only one of the various methods named for passing oil into chamber *a* will be required at the same time. It is better not to have chamber *a* more than eight inches in diameter, and fifteen or eighteen inches at most. Twelve inches high is enough. When the oil and steam or superheated steam, from either of the sources named, enter this small chamber they are intimately mixed, causing a perfect foam under pressure. The heaviest part falls to the bottom of the chamber, and is immediately driven up pipe *b* by the pressure of steam and vapor; passes through the upper horizontal pipe or portion of pipe *c*, and, in passing down through the return bends of pipe *c*, the tendency of the oil at every turn is to pass through the current of steam, owing to it being heavier; also, in passing through the curled or spiral wire at the various bends the oil and steam are most intimately mixed and kept in a perfect foam until they reach the free chamber *e*, with its connecting vertical chamber *v*, when all, or nearly all, pressure is removed, the oil and steam having, by their confined passage through the previous parts of the retort, become of a uniform temperature. The steam and vapor from the oil or other fluids freely separate from the portions incapable of vaporization or too heavy for the degree of heat used, and pass up through chamber *v*, trap T, and pipe C into condenser B, where they are condensed by the inflowing oil or other fluid in pipe D and cold water through pipe J,

one or both; and the condensed water and oil, or naphtha, according to the fluid passing through the apparatus, escape from the condenser through pipe *u*, while the unvaporized portions of the fluid pass out at the lowest port of the chamber *v*, or *v* and *e*, for the two are really but parts of one chamber. The opening into pipe L should be a little lower than the floor of the retort, and the pipe should descend, as represented, a good distance below the retort and return, so that its outlet reaches to within, say, a foot, more or less, of the bottom of the retort, in order that the ascending column of fluid may counteract any slight pressure which may at any time exist in the retort. This pipe, if large, will always be a safety-valve in case any obstruction in the condenser or its pipes should cause pressure in the retort.

Second method or process: In this process the chamber *a*, with the oil and steam pipes entering it, and ascending pipe *b* are not used; but pipe D connects with oil-pipe *i*, and the steam enters through pipe *k*, and the oil and steam or superheated steam, as the case may be, flow together directly into the upper horizontal portion of pipe *c*, and down through the bends and horizontal portions and curled wire into chamber *e* and *v*, and the vapors separate and pass to be condensed, and the unvaporized portions of the fluid escape precisely as described in the first process.

Third method or process: The oil enters from pipe D through pipe *m*, and the steam or superheated steam through pipe *j*; or the oil enters through pipe *k* into the transverse short pipe *l*, when the steam and oil, most intimately mixed, pass through pipe *n* (which is but a part of pipe *c*) into pipe *c*, and through this pipe into chamber *e v*, with the same results as described in previous processes.

Fourth method or process: The oil enters the upper portion of pipe *c* through pipe P. The steam or superheated steam enters pipe *q*. The oil descending meets the steam ascending through pipe or pipes *c* and *d*, and the vapors, with the steam, pass up to chamber M, through that to condenser N, where they are condensed, and fluid and uncondensed gases flow out through pipe S, whereas the oil or fluid not vaporized flows down to the lower end of pipe *d*, and is there allowed freely to escape. When this process is used the retort commences at the red cross-line back of the pipe R and ends in the chamber M. The other ports represented are not used.

Either one of the methods described can be used for the drying or evaporation of saccharine, saline, or alkaline solutions. In such cases superheated steam will be required, and the condensation, as far as practicable, should be done by the inflowing fluid to be evaporated either passing the fluid through the condenser in pipes or the vapor through the fluid in pipes. The trap T can be used or omitted.

The goose-neck should not be too high—barely high enough to prevent the force of the steam and vapor throwing over insoluble substances.

For the processes for throwing oil into a retort or a pipe against pressure, even bringing it, if necessary or desirable, from a lower level, and intimately mixing it with the steam at the point of entrance, by either passing the steam-pipe within the oil-pipe or the oil-pipe within the steam-pipe, as represented in the drawings, by steam-pipes H *j* F *h*, and the steam or vertical pipe in Fig. 3, and by oil-pipes I *k* G *i*, and the horizontal oil-pipe entering the spiral pipe in Fig. 3, and which are carefully described in the above specifications, we intend hereafter to apply for a separate patent.

What we claim as our improvements, and desire to secure by Letters Patent, is—

1. The above-described process for desiccating or evaporating saccharine, saline, alkaline, or other aqueous solutions by the use of superheated steam, as described.

2. The construction of a retort, or a part of a retort, of a pipe or pipes, so arranged that when either steam or superheated steam and oil or other liquids are passed or forced through it or them in the same or in opposite directions, the fluid will naturally, from its superior gravity, repeatedly pass through the current of steam, thus thoroughly mixing it with the steam in a comparatively confined space, heating it uniformly, and vaporizing it, as occurs in the tubular portion of our apparatus, and as will result if a spiral pipe is placed in a horizontal position, or approaching that position, and steam and oil passed through it.

3. The forcing or driving of petroleum or other liquids, by the use of steam or superheated steam applied directly to the liquid, either in a pipe or a retort, upward, either vertically or at any inclination, or in any direction upward, in such a manner that the same oil or fluid will not return to pass through the same part of the pipe or retort again until it leaves the retort.

4. The constructing of a retort, or a part of a retort, either of a single pipe or of pipes so bent or connected by return bends that portions lie parallel, or nearly so, with each other, as shown in the drawings and described in the specifications.

5. A horizontal flat-bottomed chamber connecting with a vertical chamber and receiving the lower end of a pipe from a tubular retort.

6. So constructing a retort where either steam or superheated steam is to be used in direct contact with the oil or other fluids that there shall be no chance for water from condensed steam to collect in the retort, owing

to the escape-pipe for the unvaporized portion of the oil or fluid being either on a level or lower—better lower—than the lowest part of the retort, which is so far free from pressure as not be forcibly cleared by the current of steam or vapor.

7. The forcing of oil through a rose into a retort into contact with a current of superheated steam.

8. The water-pipe K, passing back and forth, in combination with a horizontal condenser, substantially as represented in the drawings.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

JOHN ELLIS.
EDWD. C. KATTELL.

Witnesses to signature of John Ellis:
M. CONNOLLY,
WM. S. LOUGHBOROUGH.

Witnesses to signature of Edwd. C. Kattell:
S. M. ELLIS,
T. M. LEONARD.