

H. W. C. Tweddle.

Distilling Hydrocarbon Oils.

N^o 72126

Patented Dec. 10, 1867.

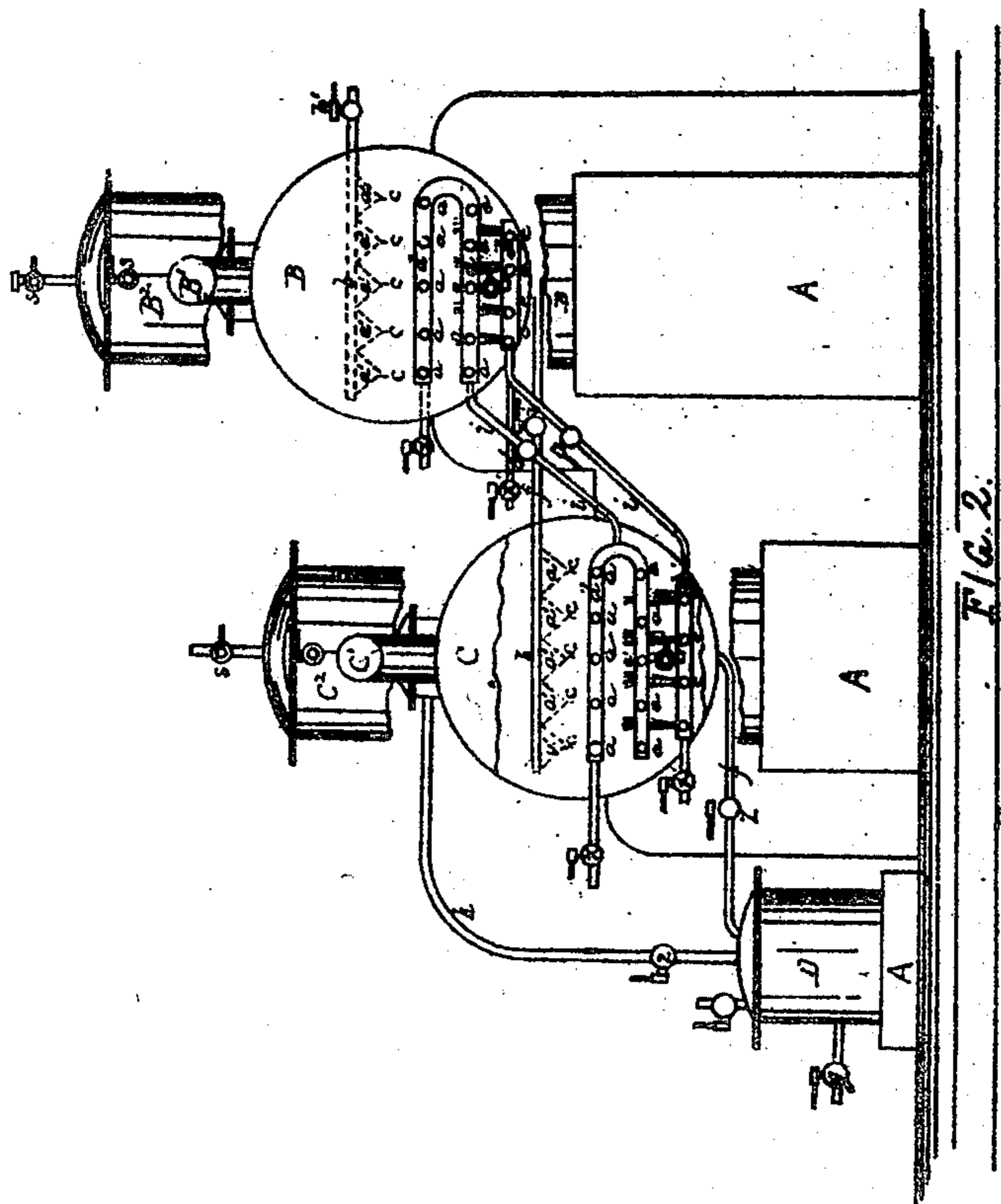


FIG. 2.

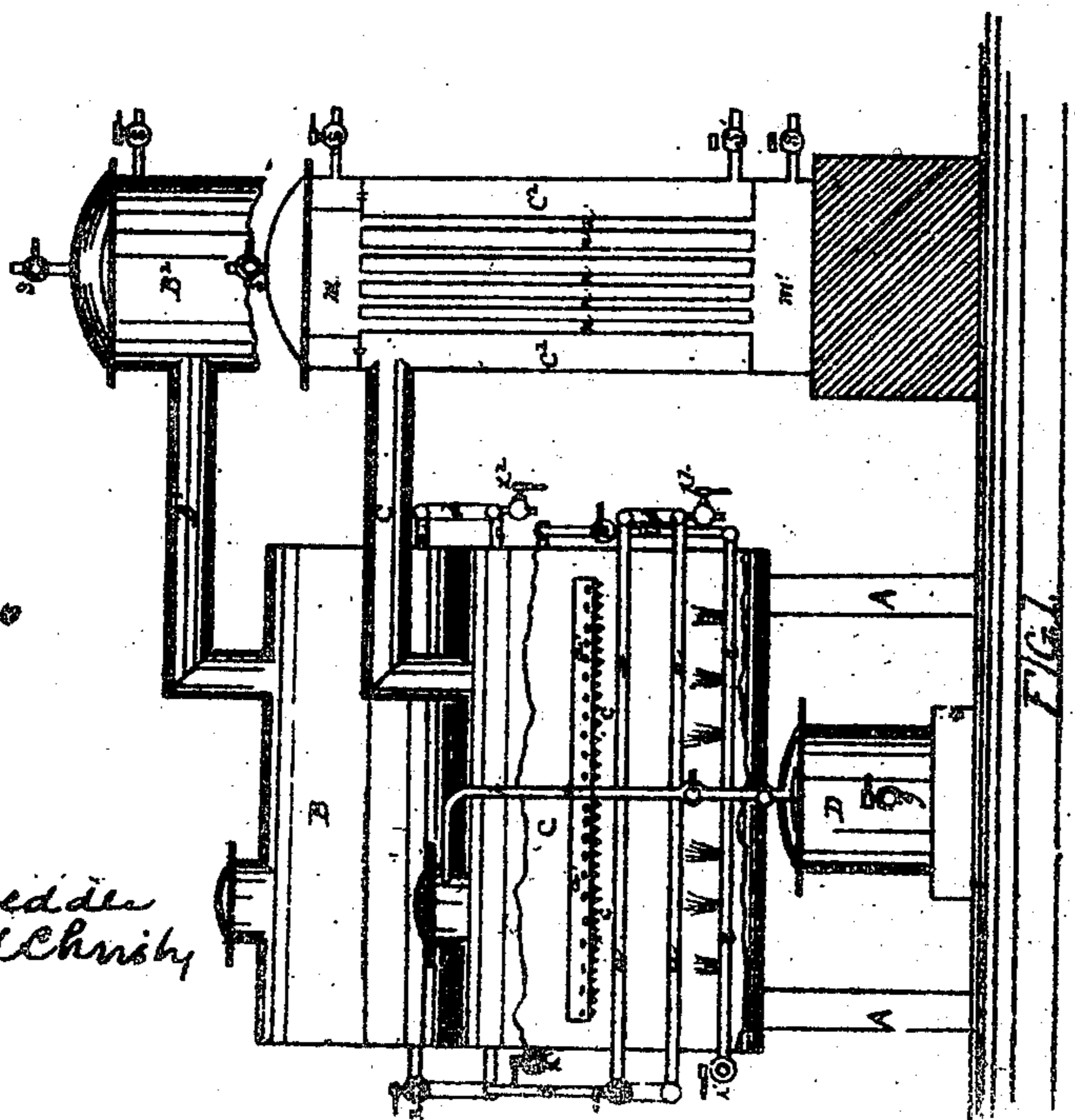


FIG. 1.

Witnesses.

W. D. Lewis
Witnessing
Inventor:

Herbert W. C. Tweddle
by Bakerwell & Christy
his Atty.

UNITED STATES PATENT OFFICE.

HERBERT W. C. TWEDDLE, OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN DISTILLING HYDROCARBON OILS.

Specification forming part of Letters Patent No. 72,126, dated December 10, 1867.

To all whom it may concern:

Be it known that I, HERBERT W. C. TWEDDLE, of the city of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Distillation of Hydrocarbon Oils; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is partly a side and partly a sectional elevation of the apparatus I employ in the process of distillation; and Fig. 2 is a rear end view of the same, partly in section.

Like letters of reference indicate like parts in each.

The nature of my invention consists in distilling hydrocarbon oils, by causing the oil to flow in a thin film or layer over the surfaces of a series of heated pipes in a vacuum-still, with or without the application of superheated steam; and in securing a continuous and complete distillation of such oils, by causing them to flow over the surfaces of a succession of such pipes in different stills, the temperature of the pipes increasing in each successive still, so as to drive off first the more volatile ingredients, and then those less so, and so on until only the residuum remains; also, in the application of such process to the redistillation of fire-distilled, residual, and lubricating oils.

This process of distillation may be carried on in various ways; but the devices which I find most convenient therefor I will proceed to describe, to enable others skilled in the art to make use of it.

On any suitable bed or foundation, A, I place two or more stills, B C, or a battery of stills, one, B, somewhat higher than the other, C, usually, so that the oil may flow readily from at or near the bottom of one into the other, as yet to be described. In these stills I preserve a partial or complete vacuum by the use of an air-pump, or in other known way, and connect them to the condensers B² C² by the goose-necks B¹ C¹, respectively. In each of the stills B C is a series or coil of pipe, a, each pipe of the series or coil passing through the still horizontally, but one being arranged over another in any desirable num-

ber of vertical rows, and all connected together by a connection-pipe, d, or other equivalent device. Above each vertical row of such pipes a is placed a trough, a', which has small perforations in the sides or bottom, as seen in Fig. 1, and a serrated edge, c, underneath. Below the series or coil a is placed a series of perforated pipes, e, for admitting superheated steam, such pipes being joined together by a connecting-pipe, d'.

The petroleum to be distilled, either crude or deprived of the gasoline or other more volatile ingredients, and either cold or in a heated state, as may be deemed advisable, is admitted through a cock, b', at the side of the still B into a pipe, b, which, running transversely across over the troughs a', discharges through a perforation over each such trough, as shown in Fig. 2, the oil into such perforated and serrated troughs a'. Through the perforations in each trough a' the oil runs down, gathers on the points of the serrated edges c, whence it falls onto the steam-pipes a, dropping or running from pipe to pipe, and passing in a thin film over the surfaces of such pipes. A current of dry or superheated steam passing in at the valves x x keeps such pipes a heated to a high temperature; consequently the drops or streams of oil coming in contact with and passing over them are subjected to the action of a heated surface relatively large, which causes it to volatilize with great rapidity, the more so as the pressure of the atmosphere is already removed from the inside of the still by the air-pump, as hereinbefore stated. Fluids in motion, also, it is well known, vaporize more rapidly than fluids at rest, so that by causing the oil to flow over heated surfaces in a vacuum I secure an exceedingly rapid evaporation. I also facilitate this process by bringing jets of superheated steam from the pipes e in contact with the oil while flowing over the surfaces of the pipes a. A serrated edge may be placed under each such pipe a to secure a more even distribution of the oil in its flow from pipe to pipe. Steam is admitted to the pipes e through the valves x¹ x¹, and the water of condensation drawn off from the pipes a and e by the cocks x² x².

By the use of these devices the lighter or more volatile oils are driven off in the first

still B in the form of vapor, which, being carried over by the goose-neck B¹ to the condenser B², is there condensed, as presently to be described.

Such of the heavier oils as are not thus vaporized in the first still, B, fall to the bottom of the still, whence, by a pipe, *f*, they are conducted into the next still, C. There they are discharged into perforated and serrated troughs *a'*, flow onto and over pipes *a*, and other volatile ingredients are driven off in vaporous form by an increased degree of heat received therefrom and from the superheated steam, which escapes from the jet-holes in the pipes *e*, in the manner already described. The residuum, with the oils not yet volatilized, if any, falls to the bottom of the still C, whence it is conducted to another still and similarly treated, or, by a pipe, *f'*, is discharged into a receiver, D, in which a vacuum is also preserved. From this it is drawn off by a cock, *g*, at pleasure. A pipe, *h*, connects the receiver D with the still C for convenience in securing a vacuum in the former, and for the purpose of conducting over any vapors which may arise from the residual matter in such receiver.

The steam used in this process may be admitted into the pipes *a* and *e* of each still separately; or it may be first admitted into the pipes *a* and *e* of the last and lowest of such stills, and conducted thence by pipes *i i'* into the pipes *a e* of the next still, and so on till the last or highest still is reached. In this way I apply the steam when hottest to volatilizing the heavier oils, which, of course, require for that purpose the greater degree of heat; and, as the temperature of the steam is reduced in its passage from still to still, I apply it at a lower temperature to driving off the lighter oils in each higher still; or, in other words, I secure a continuous and complete distillation of hydrocarbon oils by vaporizing the lighter ingredients with a comparatively low degree of heat, the next heavier ingredients by a higher degree of heat, passing the residual oil for that purpose from still to still, so as to subject it to a constantly-increasing temperature in the successive stills till only the residuum remains. Superheated steam may, if preferred or found necessary, be used in the pipes *a* as well as in the pipes *e*.

By the use of this process I render unnecessary the application of fire or fire-heat directly to the oil at any stage of the distillation, whereby I avoid all possibility of a fire or an explosion, which are the chief sources of danger in the distillation of hydrocarbon oils.

As already stated, the vapors of volatilization in the still B pass, by the goose-neck B¹, to the condenser B², which is a combination of a surface and shower condenser. The condensing apparatus is the same for all the stills, and consists of a condensing-chamber, C², with cold-water chambers *m m'* at either end, connected together by pipes *n*. The upper chamber is perforated, as at *o*, so as to discharge

jets of cold water into the condensing-chamber C² to condense the oily vapors. Cold water is passed through the pipes *n* for the same purpose. Water is admitted and drawn off by the cocks *s s*. The condensed oil is drawn off at the cock *s'* with the condensed water, if there be any, and discharged into a tank or other receptacle through an air-pump or otherwise. The condensers may be so constructed that the pipes *n* shall run horizontally through the condensing-chamber, if so preferred.

It is not absolutely necessary that one still should be higher than another, since, by creating a more complete vacuum in the second still than in the first, and so on in each successive still, the residual or unvaporized oil in the bottom of each still may be forced into the next at the same or a higher level.

The advantages of this process of distillation are, among others, first, dispensing entirely with the application to the oil of fire or a fire-heat, as already stated; second, a more rapid vaporization of the oil; third, collecting the vapors of the lighter and heavier oils and condensing them in separate receivers, whereby a quality of oil can be produced for illuminating purposes perfectly free from the volatile ingredients which render them dangerous in use at the temperatures to which in such use they are necessarily raised; fourth, a continuous and more complete distillation of the oil than can be secured by the ordinary process; fifth, a cheaper process of distillation; and, sixth, the production of a better article.

As a further part of my improved process, I take oil produced by distilling by fire (the process ordinarily in use) and redistill it *in vacuo*, substantially as above described. Unrefined fire-distilled oil has a disagreeable odor and a bad color, to remove which the oil is generally treated with acids, alkalies, &c. My process of distillation obviates the necessity of refining the oil, with a consequent saving of time, trouble, and expense, and also produces an article superior in quality to the common fire-distilled refined oils. I also apply my improved process to the distillation of the residual and lubricating oils produced by fire-distillation, with the same benefits as are above set forth.

In carrying on the process of distillation above set forth, I do not limit myself to the particular devices described; but

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

1. In distilling hydrocarbon oils, vaporizing the oil by causing it to flow in a thin film or layer over the surfaces of a series of heated pipes in a vacuum-still, with or without the application of superheated steam, substantially as above described.

2. The application of the process of distillation hereinbefore described to the redistillation of fire-distilled oils, for the purpose of producing an oil similar to the refined oil of commerce, substantially as above set forth.

3. Securing a continuous and complete distillation of hydrocarbon oils by causing the oil to flow over the surfaces of a succession of heated pipes in different vacuum-stills, the temperature of such pipes increasing in each successive still, so as to drive off at first the more volatile ingredients and then those less so, and so on till only the residuum remains, substantially as hereinbefore described.

In testimony whereof I, the said HERBERT W. C. TWEDDLE, have hereunto set my hand.

HERBERT W. C. TWEDDLE.

Witnesses:

A. S. NICHOLSON,
G. H. CHRISTY.