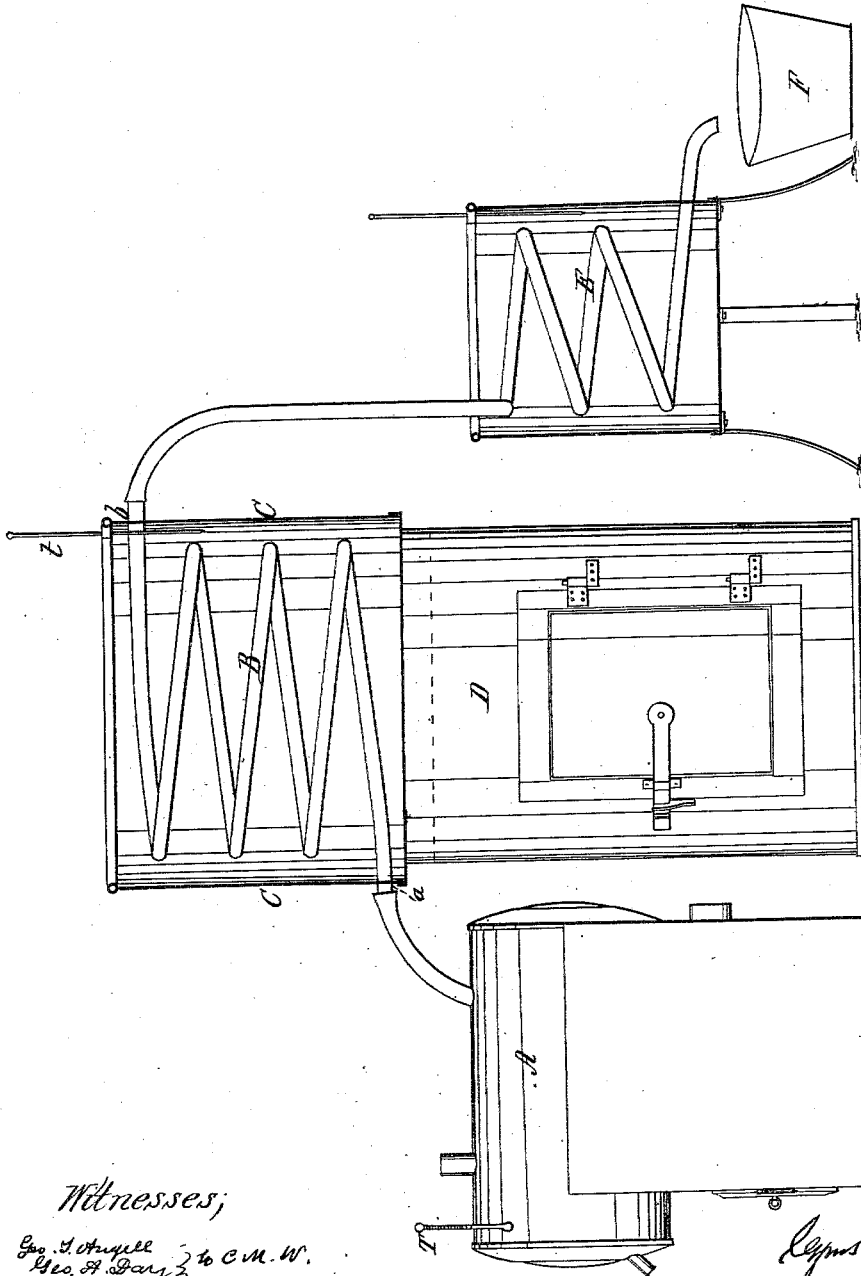


*C. M. Warren.*

*Oil Still.*

*N<sup>o</sup> 47,235.*

*Patented Apr. 11, 1866.*



*Witnesses;*

*Geo. J. Atwell  
Geo. H. Dwyer* } to C. M. W.

*Inventor,*

*Leopold M. Warren*

# UNITED STATES PATENT OFFICE.

CYRUS M. WARREN, OF BOSTON, MASSACHUSETTS.

## IMPROVED APPARATUS FOR DISTILLING PETROLEUM, &c.

Specification forming part of Letters Patent No. 47,235, dated April 11, 1865.

### *To all whom it may concern:*

Be it known that I, CYRUS M. WARREN, of Boston, in the county of Suffolk, in the State of Massachusetts, have invented a new and useful Improvement in Apparatus for Fractional Condensation or Distillation of Complex Mixtures of Liquids; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The nature of my invention consists in attaching to a still or retort an elevated condenser the temperature of which is regulated and controlled by the special application of heat, and which is so constructed and placed between the still and a common condenser that the less volatile portions of the mixture to be separated, being condensed in the elevated condenser, will flow back into the still, while the vapors of the more volatile portions will continue to go forward to the common condenser, which is kept cold, and thus become separated in a pure state.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

I construct my still A in any of the known forms; but instead of passing the vapors directly into a common condenser inclining downward from the top of the still, I conduct these vapors upward into the lower end, *a*, of a heated elevated condenser, B, constructed in any of the known forms, but inclining upward and discharging backward into the still. This elevated condenser, which is usually a coil of iron or copper pipe, is placed in an iron tank or bath, C C, above the level of the top of the still A, as shown in the drawings. The tank C C is provided with a furnace, D, underneath, by means of which the temperature of the condenser which it contains may be regulated. It is also furnished with a thermometer, *t*. The space within the tank surrounding the elevated condenser is filled with oil having a higher boiling-point than any liquid which is to be distilled through it; or it may be filled with any other heating medium that will answer the same purpose. The bulb of the thermometer should extend down into the oil or other heating medium surrounding the condenser. The upper end, *b*, of the elevated condenser connects with the upper end of the

cold common condenser C, which inclines in the opposite direction, and from which the purified product, as it is condensed, falls into the receiver F.

To separate the constituents of a mixture of liquids—such as petroleum for example—I proceed as follows: The still A, which is furnished with a thermometer, is first charged with the mixture to be operated upon. The heating of the still is then commenced, and at the same time a moderate fire may be placed under the tank or oil-bath C C. When the liquid in the still is observed to boil, as shown by the thermometer *t*, the fire under the oil-bath is increased, and the temperature of the bath thus carefully raised until it reaches the point which will allow the vapors of the most volatile portion to pass through the elevated condenser contained in the bath, which will be indicated by a flow of liquid from the cold condenser E into the receiver F. This flow, which should not be too rapid, is controlled by regulating the fire under the oil-bath C C, the temperature of which will require to be gradually raised as the distillation progresses. When the separation of the first and most volatile product has been completed, the receiver E is charged, and the temperature of the oil-bath C C gradually raised, as before, until the next product shall have been obtained, and so on until all the desired separations shall have been made.

In the manufacture of illuminating-oil from petroleum, however, it will be found about as well and more economical in practice to make use of this apparatus only in taking off and separating the two more volatile products—viz., the extremely volatile liquid employed to carbonize air for gas-light, and the naphtha employed as a substitute for spirits of turpentine. When these two products shall have been separated, the hot residual oil may then be transferred from the still A to another still provided only with a common condenser, from which the illuminating-oil may be distilled in the ordinary manner. This transfer of the hot oil may be readily accomplished by introducing steam into the top of the still A, and thus produce a slight pressure on the surface of the oil, sufficient to force it over through a connecting-pipe.

That the nature of my invention may be more clearly defined, I would state that when a

mixture of liquids of different boiling-points is subjected to distillation in the ordinary manner, the thermometer in the still will indicate a constant and frequently, as is the case with petroleum, a nearly uniform rise of temperature—that is to say, with a constant application of the same quantity of heat to the still the temperature of the latter will rise about the same number of degrees during the lapse of an equal space of time at any stage of the operation, there being no point at which there will be a perceptible approach to constancy of boiling-point. On this account neither all nor even the principal part of any one of the constituents of the mixture can be obtained by keeping the temperature of the heated condenser at any fixed point. On the contrary, the temperature of the heated condenser must be gradually raised in proportion as the more volatile portions of the mixture are taken off; hence, also, in proportion as the boiling-point of the mixture remaining in the still is raised in consequence of such removal of its more volatile constituents. Therefore it becomes necessary to preserve throughout the operation about the same difference between the temperature of the heated condenser and that of the still in order to obtain in a separate state all or even the larger part of each of the constituents of the mixture; and, as the boiling-point of the mixture in the still is constantly increasing, and inevitably must increase in proportion as the more volatile constituents are taken off, it follows that this constant difference between the temperature of the still and that of the heated condenser can only be maintained by gradually increasing the temperature of the latter, which is provided for by my invention. This seems to have been overlooked in previous inventions, and provision only made for preserving a tolerably constant temperature of the heated condenser or condensers, and therefore they fail to accomplish anything like a complete separation of the different constituents.

The chief advantage gained by my invention consists, therefore, in this: that it secures to the operator at every stage of the operation complete and easy control of the temperature of the mixed vapors given off in distillation, by means of which he can readily cool these vapors to the lowest limit of temperature which the most volatile portion of the mixture is able to bear and not lose its vaporous condition; hence, that the operator has it in his power to secure in any case the very largest possible amount of condensation of the heavier from the lighter vapors, and in this manner to obtain a series of products which shall contain the minimum quantity of the less volatile constituents. By the use of this apparatus the inventor has been able to obtain from petroleum—the most complex mixture of liquids known—a series of bodies having absolutely constant boiling-points, not surpassed in this respect by distilled water—a result which he believes was never before accomplished with such a mixture.

I do not claim the regulating of the temperature of a condenser placed in a tank of water or other liquid by means of the addition from time to time of cold water or other liquid, by which only a very limited control of the temperature of the vapors can be secured; but

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

The special application of heat by means of a separate fire or its equivalent to a condenser attached to a still, for the purpose of controlling and regulating the temperatures of the vapors given off in distillation, in order to produce a more complete separation of the constituents of complex mixtures of liquids.

CYRUS M. WARREN.

Witnesses:

GEO. T. ANGELL,  
GEO. A. DARY.