

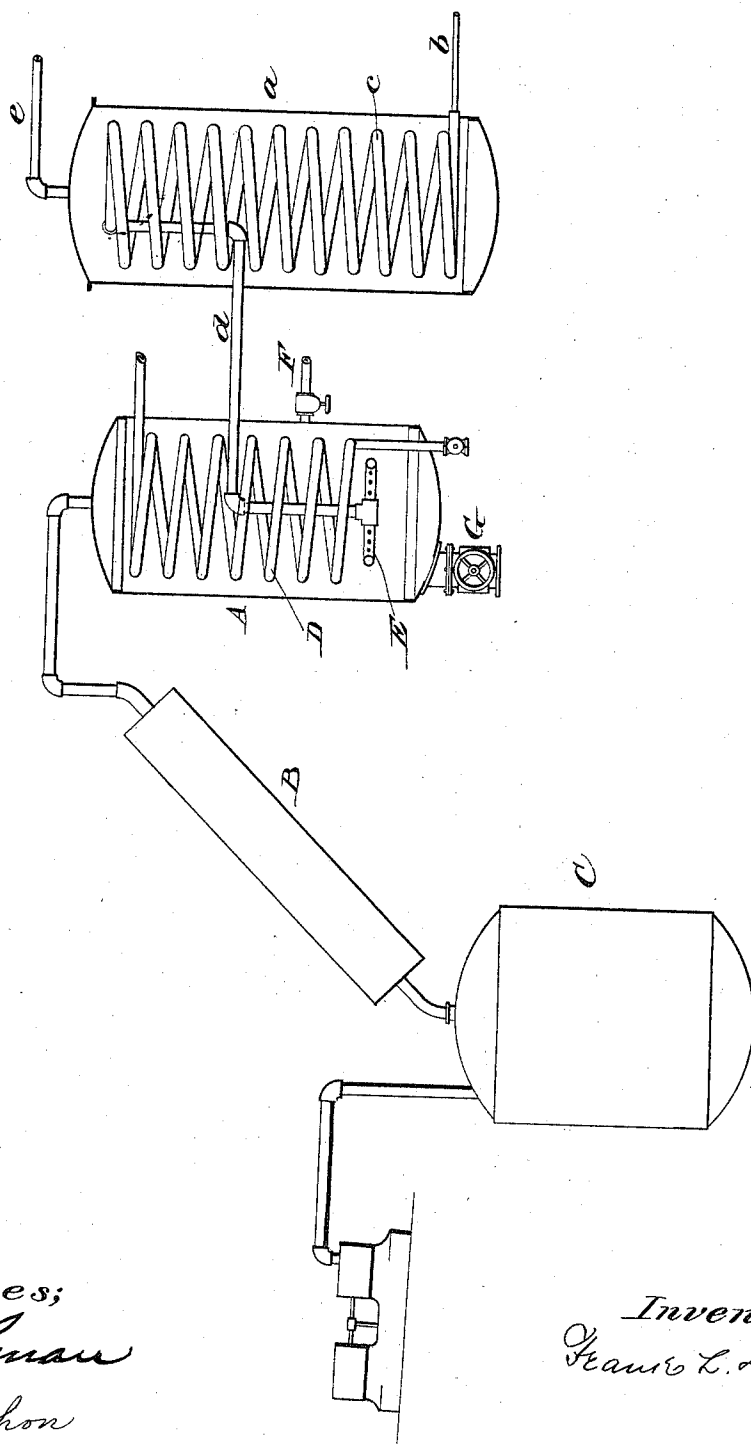
(No Model.)

F. L. DYER.

PROCESS OF DISTILLING VOLATILE LIQUIDS.

No. 579,360.

Patented Mar. 23, 1897.



Witnesses;

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PROCESS OF DISTILLING VOLATILE LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 579,360, dated March 23, 1897.

Application filed March 7, 1894. Serial No. 502,693. (No specimens.)

To all whom it may concern:

Be it known that I, FRANK L. DYER, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in the Process of Distillation of Volatile Liquids; and I do hereby declare the following to be a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a process of rapid distillation of volatile liquids, such as petroleum, coal-tar, ammonia, gas liquors, alcohol, oil of turpentine, oil of peppermint, and other essential oils and rosin-oil; and it consists in the injection of expanded and reheated steam into the liquid treated with or without a vacuum.

In order to prepare the steam used for distillation, I generate the same in an ordinary boiler and allow it to expand, so as to occupy a much greater space. The diminution of temperature caused by this expansion is wholly or partially compensated for by reheating the steam in any suitable way, whereby the steam in its expanded form will be of the proper temperature for rapid distillation. The objects of preparing the steam in this way will appear when my improved process is explained.

In the accompanying drawing I have shown diagrammatically in section and elevation a convenient form of apparatus for carrying out my process, in which *a* is a cylindrical drum made of sheet metal. *b* is a steam-pipe from the boiler. *c* is an expansion-coil within the drum *a*, connected with the steam-pipe *b* and of greater size than the same. *d* is a pipe leading from the expansion-coil *c* to the still. *e* is a steam-pipe conducting steam for heating the interior of the drum *a*. *A* is the still; *B*, the condenser; *C*, the receiver; *D*, the heating-coil in the still; *E*, the perforated delivery-pipe; *F*, the valved inlet-pipe for the introduction of the material into the still, and *G* the valved outlet-pipe for the residue in the still. I show this form of apparatus simply in order to illustrate my process, and therefore do not wish to be limited or restricted to the same. It is

necessary, however, in order to carry my process into effect that a still should be used supplied with independent means for heating the contents thereof and having a delivery-pipe for the injection of the steam therein, also that a condenser should be used to condense the distillate and that a receiver should be used to collect the condensed distillate.

In carrying out my process with an apparatus such as that illustrated for the distillation of oil of turpentine, for example, the still is filled to about two-thirds of its capacity with the material and heat is applied to the contents of the still, such as by steam in the heating-coil *D*, until the liquid is heated to a temperature approximating its boiling-point. To effect more rapid distillation, a high vacuum of about twenty-eight inches may be maintained within the still, so as to lower the boiling-point of the liquid treated. Steam is conveyed from any source of generation through the pipe *b* and in passing into the expansion-coil *c* will be rapidly expanded owing to the large size of the same, and the diminution of temperature caused by this expansion can be wholly or partially compensated for by the steam within the drum *a*, supplied thereto by the pipe *e*. Expanded and reheated steam prepared as I have just described at a temperature as low as possible and in sufficient quantity to maintain active distillation is now injected into the liquid and the distillation proceeds, the vacuum, if used, being maintained as uniform as possible. The distillate passes through the condenser *B* and is collected in the receiver *C*, and if the liquid is not miscible with water, such as oil of turpentine, it can be readily separated from the water of condensation by stratification and decantation in the usual way. In this way the distillation can be carried out very rapidly and at a low temperature, whereby an excellent quality of distillate is produced. From this description it will be obvious that the particular point of novelty in my process consists in heating the liquid to be treated at a temperature approximating its boiling-point and in injecting expanded and reheated steam into the liquid.

It is evident that the steam prepared as

above indicated with a vacuum, as described, will have a pressure less than that of atmospheric pressure, as otherwise it would expand in the still until it assumed the pressure prevailing therein under the influence of the vacuum.

The advantage of using expanded and reheated steam for the purpose of distilling volatile liquids resides in the fact that such steam carries more latent heat than saturated or superheated steam of the same temperature, and therefore acts as a more effective distilling agent, and such steam, being already expanded and of comparatively low pressure, will expand but slightly in the still and consequently absorb but little heat from the contents thereof. It therefore results that by using this process with old stills the rate of distillation will be much increased, and therefore the capacity of an old plant will be correspondingly augmented. The heat of the steam is also more thoroughly utilized, because with the same volume of steam passing through a condenser a larger amount of distillate is carried than by any of the old processes. This process therefore has the double advantage of a saving in fuel, as well as requiring a smaller plant.

In the distillation of other volatile liquids the same process may be used, it being understood that the temperature of distillation will have to be adjusted with respect to the liquids treated.

In distilling water-soluble liquids the distillate will be diluted with water, but will otherwise be pure, in which case the removal of the water will have to be effected by a subsequent distillation in the ordinary way. In the treatment of liquors of this kind the first distillation will have the advantage of furnishing a very pure liquid, from which subsequently an anhydrous or concentrated product may be obtained. It is obvious that when liquids which are commonly used diluted with water, such as the various alcoholic distilled liquors used as beverages, such as whisky, brandy, rum, and arrack, and aqua-ammonia or household ammonia, no subsequent distillation is necessary.

While the independent heating of the liquid treated is advantageous, as it will increase the rapidity of the distillation, yet it is not necessary to obtain operative results when treating liquids non-miscible with water. The expanded and reheated steam will soon bring the contents of the still up to the boiling-point, after which the distillation will proceed in the same way as when independent heat is applied, with the only difference that the rate of distillation is diminished.

By reheating the steam after expansion by live steam, as explained, the temperature of the expanded and reheated steam injected into the still can be so regulated as to be practically constant, the pressure within the boiler being of course kept at the proper figure. If the live steam for reheating the expanded

steam is supplied by the same boiler which supplies the expanded steam, a material saving in the plant will be effected, and the apparatus will be much simplified. This, however, is not necessary, nor is it necessary to reheat the expanded steam by means of live steam, as other means may be employed for doing this, such as a bath of molten metal having a low melting-point or by a heated liquid under pressure or by hot air. It is desirable, however, that the means employed for reheating the expanded steam should be such as will prevent material variations in the temperature of the injected, expanded, and reheated steam either to raise the temperature of the steam so high as to result in destructive distillation or to lower the temperature of the steam below the boiling-point of the liquid.

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

1. In the art of distilling volatile liquids, the improvement which consists in maintaining the liquid to be distilled at a high vacuum, in injecting expanded and reheated steam into the liquid, whereby active distillation is effected and in maintaining the vacuum by the removal of the vaporized distillates as fast as formed, substantially as described.

2. In the art of distilling volatile liquids, the improvement which consists in maintaining the liquid to be distilled at a high vacuum and in a heated state, in injecting expanded and reheated steam into the independently-heated liquid, whereby active distillation is effected, and in maintaining the vacuum by the removal of the vaporized distillate as fast as formed, substantially as described.

3. In the art of distilling volatile and water-miscible liquids, the improvement which consists in maintaining the liquid to be distilled at a high vacuum in a heated state, in injecting expanded and reheated steam in the independently-heated liquid whereby distillation is effected, in maintaining the vacuum by the removal of the vaporized distillate, as fast as formed and subsequently subjecting the distillate obtained to distillation to obtain a concentrated or anhydrous distillate, as and for the purpose described.

4. In the art of distilling volatile liquids, the improvement which consists in injecting into the liquid to be distilled, expanded and reheated steam of a pressure less than that of atmospheric pressure and of a temperature sufficient to effect distillation, and in condensing the distillate.

5. In the art of distilling volatile liquids, the improvement which consists in maintaining the liquid to be distilled at a high vacuum and in a heated state, in generating steam in a boiler, allowing the steam to expand and reheating the expanded steam by live steam, in injecting the expanded and reheated steam thus prepared into the independently-heated liquid, whereby active distillation is effected, and in maintaining the vacuum by the re-

moval of the vaporized distillate as fast as formed, substantially as described.

6. In the art of distilling volatile and water-miscible liquids, the improvement which consists in maintaining the liquid to be distilled at a high vacuum and in a heated state, in generating steam in a boiler, allowing the steam to expand and reheating the expanded steam by live steam, in injecting the expanded and reheated steam thus prepared into the independently-heated liquid whereby active distillation is effected, in maintaining the vacuum by the removal of the vaporized distillate as fast as formed, and in subsequently

subjecting the distillate obtained in distillation to obtain a concentrated or anhydrous distillate, as and for the purposes described. 15

7. In the art of distilling volatile liquids, the improvement which consists in injecting into the liquid to be distilled, expanded and reheated steam of a substantially uniform temperature. 20

In testimony whereof I affix my signature in presence of two witnesses.

FRANK L. DYER.

Witnesses:

A. L. SOHON,
A. G. REESE.