

E. A. BARBET.
COOLING PLATE FOR CONTINUOUS RECTIFICATION APPARATUS.
APPLICATION FILED MAR. 26, 1917.

1,328,259.

Patented Jan. 20, 1920.
2 SHEETS—SHEET 1.

Fig. 1.

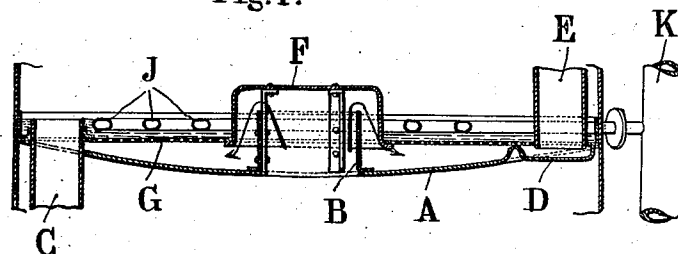
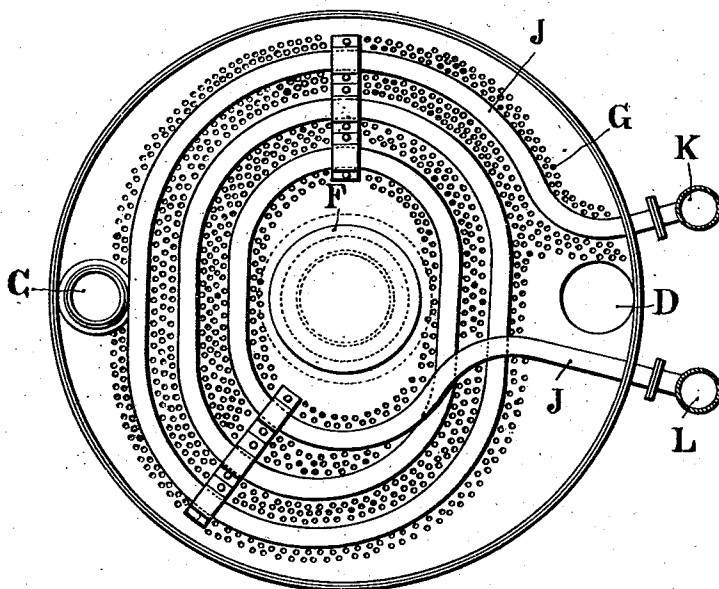


Fig. 2.



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Fig. 3.

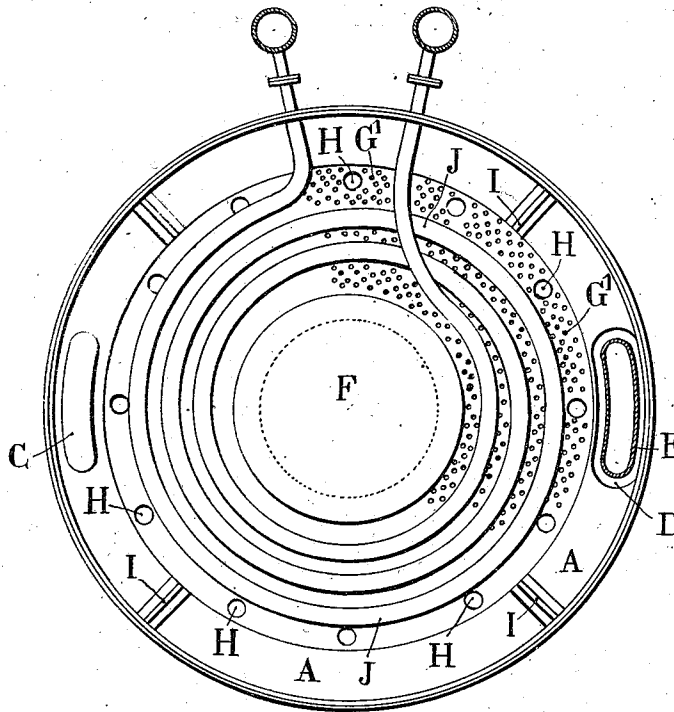


Fig. 4.

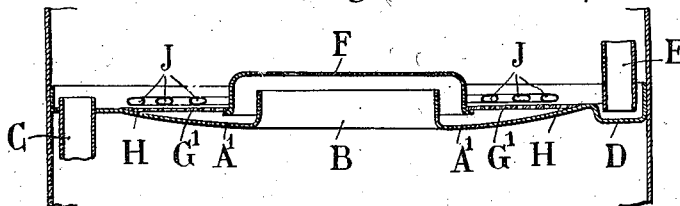
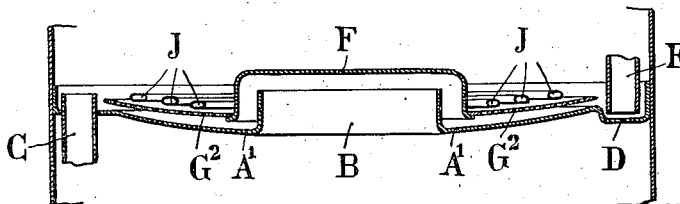


Fig. 5.



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UNITED STATES PATENT OFFICE.

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COOLING-PLATE FOR CONTINUOUS-RECTIFICATION APPARATUS.

1,328,259.

Specification of Letters Patent.

Patented Jan. 20, 1920.

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To all whom it may concern:

Be it known that I, EMILE AUGUSTIN BARBET, a citizen of the French Republic, residing at No. 5 Rue de l'Echelle, Paris, France, have invented certain new and useful Improvements in Cooling-Plates for Continuous-Rectification Apparatus, of which the following is a specification.

This invention relates to cooling plates for rectifying columns:

The construction of metal cooling plates employed in the continuous rectification of alcohols and other industrial products presents certain difficulties. For instance, the metallic plates on which the liquid rests, are naturally good conductors of heat, and therefore the liquid which is being cooled is being reheated at the same rate, not by the bubbling up of the vapors as desired, but simply owing to the conductivity of the plates which absorb heat from the vapor existing under the plate.

The result is a partial condensation of these vapors, just as if a cooling pipe coil were located in the vapor chamber on the Coffey system. The object in view is not attained:—there is a partial condensation of vapor on the under side of each plate, and the desired effect, namely, the bubbling of a vapor at a certain temperature through a liquid, that is at a slightly lower temperature, is not realized.

On the other hand there are constructional difficulties in the way of arranging the cooling pipe coil through the narrow passages of the hoods of which so many are located on each plate.

This last difficulty would be solved if recourse were had to the old perforated plate, but although this last kind of plate is very suitable for use in discontinuous rectifying apparatus, where it is a necessity to discharge the impure liquid of the plates after each operation, yet on the contrary, the perforated plate is contra-indicated in the case of continuous rectification. It has been found in practical work that in the latter case it is absolutely necessary to use only "unemptiable" plates which hold permanently a constant quantity of liquid and which allow the operator to stop the rectify-

ing process for a short time now and then without causing, for instance, the "good" alcohol of the upper regions to flow down suddenly or in bulk into the lower part of the apparatus which should always remain increase the pressure in the column.

The object of the present invention is to provide an improved cooling plate for rectifying columns of the kind in which a perforated plate is provided for causing the vapors passing through the liquid supported on the plate to be broken up into small bubbles.

According to the invention a cooling coil is associated with the plate in such manner that the coil is immersed in the reflux liquid on the plate.

The invention includes the provision of plates of the "emptiable" and "unemptiable" types, and particularly plates of the latter type which comprise a basin, a perforated diaphragm, a central chimney, a hood over the chimney and an overflow.

Several embodiments of this invention are illustrated in the accompanying drawings in which:—

Figure 1 is a vertical section of the plate, Fig. 2 is a plan thereof,

Figs. 3 and 4 are respectively a plan and a vertical section of a modification, and

Fig. 5 is a vertical section of a further modification.

As shown, the plate A is concave and comprises a central chimney B, with an overflow C and a basin D for receiving the liquid from the overflow E. The chimney B is surmounted by a single central hood F the annular edge of which is extended in the form of a horizontal perforated diaphragm G extending up to the circumference of the plate. By this means the alcohol vapor instead of emerging immediately from the hood in the form of very coarse bubbles, is now on the contrary subdivided into thousands of very fine bubbles issuing from each of the holes of the diaphragm, exactly as in the old perforated plates. The space comprised between A and G is full of vapor, and the pressure of this vapor maintains the liquid above the diaphragm G up to a level that is regulated by the level of the overflow C.

If the heating of the apparatus should be stopped, the whole of the liquid passing through the diaphragm G will be accommodated on the plate A, and since the top of the chimney B of the central hood is higher than the overflow C, no part of the liquid can fall back on to the lower plate. The plate is therefore unemptiable.

As soon as the lower part of the rectifier is again heated, the pressure of the vapor issuing from underneath the hood F, will force the liquid back toward the periphery, and will empty the space between A and G of liquid, and it will compel the liquid to remain entirely on top of the horizontal diaphragm as it was at the beginning of the stoppage.

By the combination of this unemptiable perforated plate having a smooth surface, there is no longer any difficulty in locating a cooling pipe coil, and in increasing the number of the convolutions of said coil to any desired extent. Since the thickness of the layer of liquid is small, it is advisable to flatten the pipe J to an elliptical shape in order that it may be immersed. The said pipe is held at a suitable fixed height by means of supports S. The pipe J is connected at one end to the collector K which supplies cold water; the warmed water flows off through the collector L.

In operation, the liquid is far from presenting a smooth surface. On the contrary it is in a state of very intense ebullition, so that the liquid is renewed very rapidly at the contact with the pipe coil, and it loses by that contact some fractions of a degree of temperature.

Traveling thence to the right and to the left, the liquid is traversed by the small bubbles of vapor issuing from the diaphragm G, the result being the bubbling of the vapor, in a liquid which has been slightly cooled at that very moment; this is the realization of the object in view.

In certain cases it may be very difficult to arrange pipe coils covering the entire surface of the plate in order to effect a good cooling of the liquid. In this case it is sufficient to perforate the diaphragm D only in those parts thereof which are adjacent to the cooling coil. By setting the holes closer together it would be possible to provide the number of holes which has been found necessary by calculation.

Further, and especially in apparatus of large sizes, it has been found that these plates do not work uniformly throughout the entire surface of the perforated part. The perforations at the periphery allow only a small quantity of vapor to pass through, whereas a much greater quantity passes through the perforations situated near the center, that is to say, around and close to

the hood. The result of this is that the usefulness of a part of the perforations in the operation is greatly reduced, and in order to obtain a complete utilization of the holes for the passage of the vapor it is necessary to increase the pressure in the column.

Consequently recourse is had to the following construction shown in Figs. 3 and 4, which is employed more particularly in the case of large plates.

As shown in these figures, the bottom A has a cavity A¹ beginning at a certain distance from the edge of the plate and increasing toward the center where the central chimney B is located. As in the preceding construction, there are provided an overflow C and a basin D preferably of elongated form.

The chimney is covered as usual by a hood F.

A flat horizontal diaphragm G¹ of annular shape is located above the bottom A, A¹.

Its outer diameter is equal to the diameter of the concavity of the bottom A¹, and its inner diameter is equal to that of the hood.

This diaphragm is fixed in any suitable manner to the body A and to the hood F.

It is provided throughout its surface with perforations, the number and diameter of which are determined by calculation so that the total section of the perforations shall be sufficient for the work required to be done by the column.

This perforated diaphragm G¹ is moreover provided at its periphery with a certain number of holes H of much larger diameter than the other holes; the use of these holes is hereinafter described.

I are upstanding baffles located on the flat part of the bottom A, for the purpose of compelling the liquid to flow over the perforated plate.

The cooling pipes J are arranged and operated as in the preceding construction, but it is no longer necessary for them to have a complicated curvature. As the perforated diaphragm is circular, the pipes are arranged in a spiral, and the whole of the perforated diaphragm thus receives the cooling effect in the uniform manner. They may be also arranged in any other suitable manner.

The operation of this modification is the same as in the preceding example, but at the start, the liquid driven by the vapor coming from B flows on top of the diaphragm G¹ through the orifices H, and the liquid which has some difficulty in passing through the ordinary perforations of G¹, will on the contrary pass very readily through the orifices H; this facilitates the starting of the apparatus. These orifices which allow of a rapid flow of the liquid

from the basin above the diaphragm, thus regulate the working of the apparatus by avoiding over-pressures, and as a matter of fact as the pressure of the vapor increases, the liquid is more and more driven from the basin and thereby uncovers fresh perforations in the diaphragm G¹ through which the vapor can escape.

It is to be understood that since the annular diaphragm is entirely perforated without any residual solid portion, the work of perforation can be effected economically by machinery.

In the modification shown in Fig. 5, the perforated diaphragm instead of being flat, is made slightly dish-shaped as shown at G². This construction facilitates the arrival of the vapors up to the periphery of the perforated diaphragm.

Further, the large orifices H are omitted; but in order to provide an equivalent and thereby obtain the same facility of starting, instead of the diaphragm G² being located directly upon the bottom A, small wedges are interposed between those two parts, and the annular slit thus provided performs the same function as the orifices H.

The hereinbefore described constructions of plates may be employed in all apparatus

for distilling or refining, with or without the addition of cooling pipes according to requirements.

What I claim is:—

1. A cooling plate structure for rectifying columns comprising a dished bottom plate, an upstanding chimney arranged therein, a hood surrounding the said chimney, a substantially horizontal perforated diaphragm surmounting the said dished plate for causing the vapors passing through the liquid on the diaphragm to be broken up into small bubbles and a cooling coil associated with the said device, such cooling coil being located below the normal liquid level of the reflux liquid supported on said perforated diaphragm, the perforations in said diaphragm being located only close to the said cooling coil.

2. A cooling device for rectifying columns as specified in claim 1, in which the bottom plate comprises a concave basin, the chimney therein in central position and an overflow.

In testimony whereof I have signed my name to this specification.

EMILE AUGUSTIN BARBET.

Witnesses:

LUCIEN PAILLARD,
CHAS. P. PRESSLY.