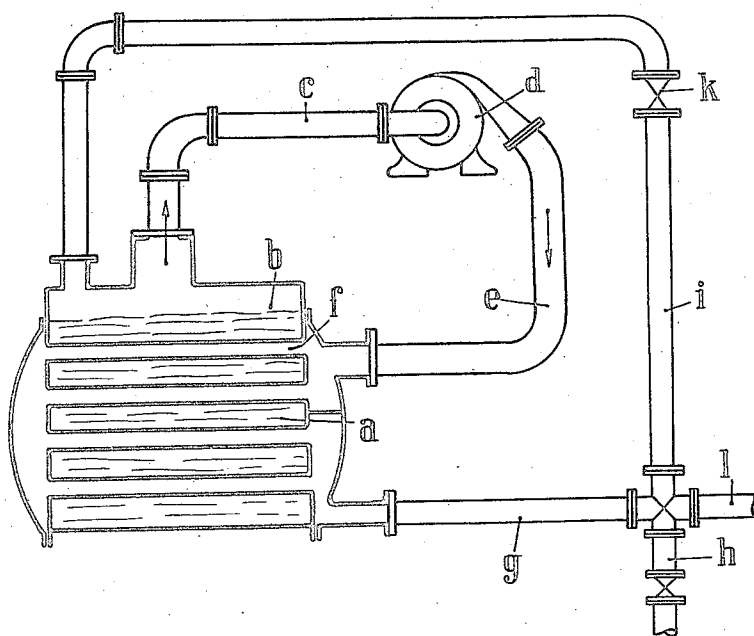


1,425,005.

Patented Aug. 8, 1922.



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UNITED STATES PATENT OFFICE.

WILHELM GENSECKE, OF BAD HOMBURG, GERMANY.

METHOD OF EVAPORATING LIQUORS AND APPARATUS THEREFOR.

1,425,005.

Specification of Letters Patent.

Patented Aug. 8, 1922.

Application filed April 27, 1920. Serial No. 377,142.

To all whom it may concern:

Be it known that I, WILHELM GENSECKE, citizen of the German Republic, residing at Bad Homburg on the Höhe, Homburger-
5 strasse 87 Germany, have invented certain new and useful Improvements in Methods of Evaporating Liquors and Apparatus Therefor, (for which I have filed applications in Germany, Ser. No. M. 65107 IV/12a, filed
10 March 13, 1919, Austria, Ser. No. A 4048-19, filed Nov. 3, 1919, Switzerland, Ser. No. 2423, filed Nov. 4, 1919, Sweden Ser. No. 5074-1919, filed Nov. 11, 1919, Norway Ser. No. 18417, filed Nov. 21, 1919, Czechia Ser.
15 No. P. 4589-19, filed Dec. 3, 1919, Hungary Ser. No. 16359-M, 6652, filed Dec. 6, 1919, Holland Ser. No. 17465, filed Dec. 18, 1920, Spain Ser. No. 12277-2583, filed Jan. 13, 21, France Ser. No. 122642, filed Jan. 28, 1920,
20 England Ser. No. 3896-20, filed Febr. 9, 1920 Final No. 140059, Italy Ser. No. 40629, filed Jan. 15, 1921), of which the following is a specification.

This invention relates to improvements in
25 the method of evaporating liquors and apparatus therefor.

In methods of evaporating or concentrating in which the hot vapors after having been compressed are used as heating agent
30 for the evaporators, the thermic efficiency is the greater in proportion as the difference of temperature is smaller, that is to say the lower the ratio of compression employed. However, in this case the disadvantage occurs that a considerable portion of the compressed hot vapor which is used as heating
35 vapor is not condensed so that the number of heat units given off by the heating vapor is considerably less than the heat required for evaporation. In consequence the deficiency of heat from the heating vapor is covered by the heat of the liquid to be evaporated the result being that the temperature of the latter falls continuously. The evaporating plant ceases to function regularly, the efficiency diminishing and the temperature
40 falling continuously. In order to maintain a regular working of the evaporating plant according to the present invention the deficiency of heat from the heating vapor is compensated by the introduction of extraneous heat for example by means of live steam. However, also the introduction of live steam can be completely or to a large
55 extent dispensed with by a further measure,

even when the temperature difference in the evaporator is small, that is to say with a small compression ratio in the compressor. This further inventive measure is based on the recognition that the cause of the incom-
60 plete condensation of the compressed hot vapor is less attributable to the heating surface of the evaporator, which for technical reasons is more or less restricted, than to the presence of an admixture of air which in
65 practice can never be completely avoided.

This process can be explained physically on the base of Dalton's law of partial pressures. The pressure of the compressed vapor is the sum of the partial pressures of
70 vapor and air. In proportion as condensation is effected and progresses, the weight of vapor decreases, that is to say, the partial pressure of the vapor continuously falls, whereas that of the air continuously in-
75 creases so that the sum of the two remains the same. The temperature of such admixture, however, is determined by the partial pressure of the vapor and when this has fallen to such an extent that its value is
80 equal to that of the vapor pressure of the evaporating medium equilibrium of temperature is attained and thus any further heating effect ceases, so that the amount of water vapor which is now still contained in the
85 compressed medium can no longer be utilized for heating the evaporator.

The essential feature of the invention consists in that an amount of heat sufficient for evaporation is made available by the vapor
90 compressor circulating an amount of vapor which is greater than the amount of vapor generated in the evaporator. This can be effected by connecting the outlet chamber of the heating-tube system of the evaporator
95 with the evaporating chamber of the evaporator or with the suction pipe of the compressor by means of a pipe suitably provided with a closing means adapted to modify its sectional area. The result thus
100 obtained is that the volume of vapor passed through the heating tube system need not be completely condensed and that the required heating effect is attained in spite of
105 the presence of air.

The drawing represents the embodiment of the object of the invention by way of example. *a* is the evaporator in which the liquid to be evaporated reaches to the level
110 *b*. The vapors generated in the evapo-

rator pass through the tube *c* into the compressor *d*, are compressed therein and forced through *e* into the heating system *f*. The condensate and the uncondensed vapors leave at *g*; the condensate runs off through *h*, whilst the whole or part of the uncondensed vapors are returned to the evaporator *a*, through the pipe *i* provided with the valve *k* which pipe is essential for carrying out the object of the invention. The pipe *l* leads into the open air, or in case the plant is working with a vacuum into a condenser provided with an air pump.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. In a plant for evaporating liquids comprising a container for the liquid to be evaporated and a chamber for the heating medium in heat exchanging proximity to said liquid, means for withdrawing the vapor from said container, means for withdrawing mixed vapor and condensate from said chamber, separating the vapor from the condensate, and joining said vapor with the vapor generated in said container, and means for compressing these joined vapors and conveying them into said heating chamber.

2. In a plant for evaporating liquids comprising a container for the liquid to be evaporated, and a chamber for the heating medium in heat exchanging proximity to said liquid, a compressor pump having its low pressure side in communication with said container and the outlet of said heating chamber, and its high pressure side discharging into said chamber.

3. In a plant for evaporating liquids comprising a container for the liquid to be evaporated and a chamber for the heating medium in heat exchanging proximity to said liquid, a line for conveying the vapor away from said container, means for withdrawing mixed vapor and condensate from said chamber, a trap for separating the vapor from the condensate, a passage of adjustable section connecting said trap and said vapor line for joining the uncondensed vapor with the vapor generated in said con-

tainer, and means for compressing these joined vapors and conveying them into said heating chamber.

4. A plant for evaporating liquids, comprising a container for the liquid, a heating chamber in heat transferring relation to said liquid, a fluid passage connecting said heating chamber with said container for conveying uncondensed vapors from the former to the latter, a second fluid passage connecting said container with said heating chamber, and a pump in said second passage for compressing the vapors from the container and delivering them to said heating chamber at a rate higher than that at which liquid in the said container is being evaporated.

5. In a plant for evaporating liquids the combination of a container for the liquid to be evaporated, a heat exchanger in said container, means for compressing the hot vapors issuing from said container and passing them through said heat exchanger, outlet means for the uncondensed portion of the vapor from said heat exchanger, and means for joining said uncondensed vapor with the vapor generated in the container prior to compression.

6. The method of evaporating liquids in which the vapor arising from said liquid together with the uncondensed portion of the heating vapor are compressed and used as the heating medium, thus returning to the liquid all or a part of the heat resident in said uncondensed vapor.

7. The method of evaporating liquids in which the liquid is vaporized, the resulting vapor compressed and passed in heat exchanging proximity to said liquid, and the heat of the uncondensed portion of said heating vapor utilized by uniting said portion directly with the evaporated hot vapor prior to compression.

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

WILHELM GENSECKE.

Witnesses:

H. KÖCK,

A. SCHÖN.