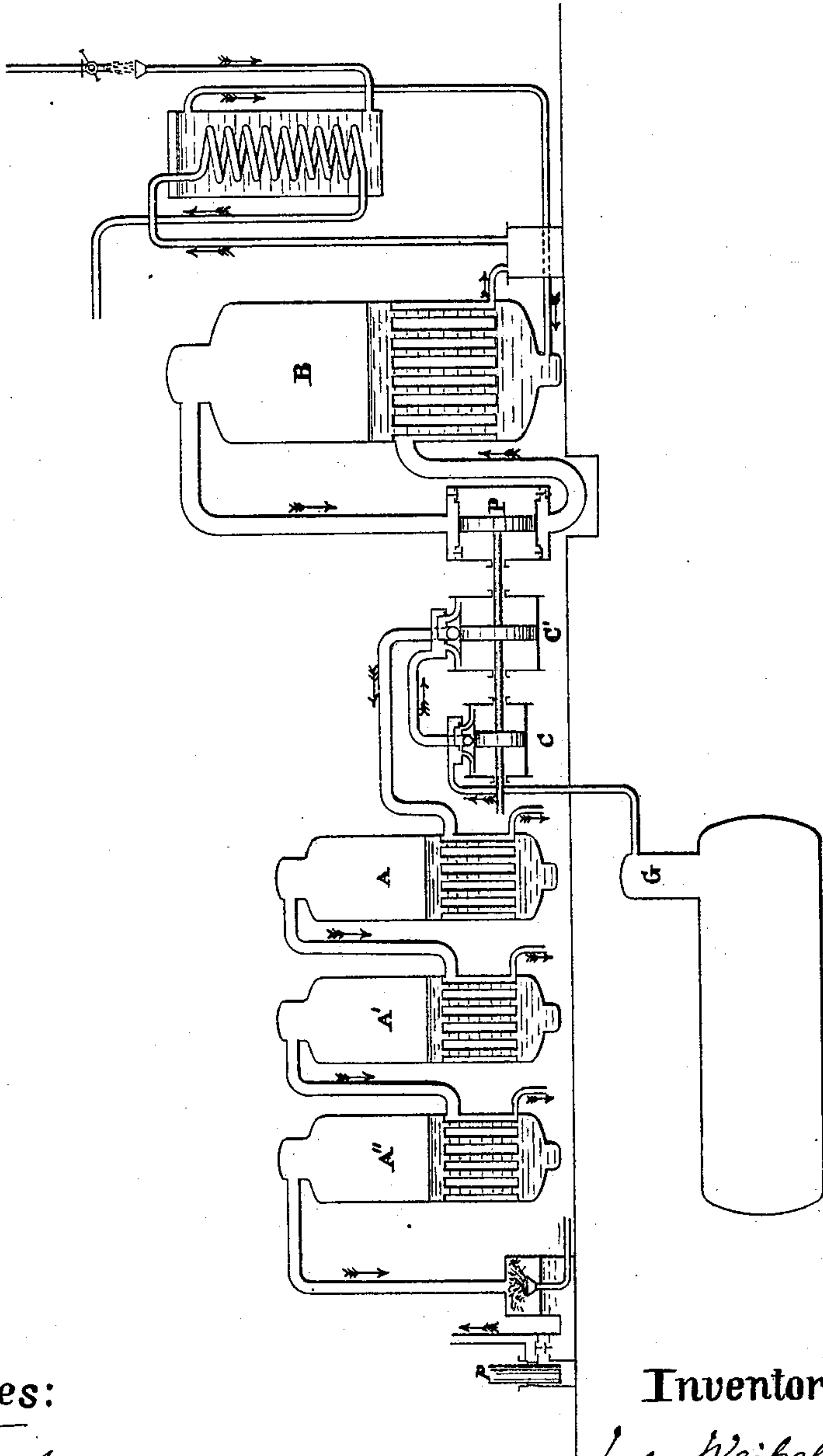


J. WEIBEL.

Concentrating Sirups and other Liquids.

No. 236,657.

Patented Jan. 11, 1881.



Witnesses:

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# UNITED STATES PATENT OFFICE.

JULES WEIBEL, OF GENEVA, SWITZERLAND.

## CONCENTRATING SIRUPS AND OTHER LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 236,657, dated January 11, 1881.

Application filed September 26, 1879. Patented in France July 31, 1878.

*To all whom it may concern:*

Be it known that I, JULES WEIBEL, of Geneva, Switzerland, have invented certain Improvements in Apparatus for Concentrating Sirups of Sugar, applicable also in other manufactures, of which the following is a specification.

My invention relates to the concentration of sirups and other liquids; and it consists in combining with the usual multiple evaporator or concentrator a supplemental evaporator provided with a pump or equivalent mechanical means for exhausting the vapor from said supplemental evaporator, compressing the same, and forcing it into the heating-chamber of said evaporator for the purpose of maintaining the required heat therein, and in operating said pump by the steam afterward used in the main evaporator, the steam passing to the evaporator as exhaust-steam from the pump or its operating-engine, whereby the full benefit of the steam is obtained and it is delivered to the evaporator at a proper temperature.

The invention further consists in employing the exhaust-steam of the evaporator to warm the liquid in the supply-chamber, and in other details hereinafter explained.

In illustrating my invention I have represented the improvements as used in connection with a multiple evaporator, as being the form more commonly employed and capable of the most advantageous use; but it is apparent that they are applicable to other forms of apparatus as well. As represented, this apparatus consists of a series of boilers or evaporators, A A' A'', each having a heating and an evaporating chamber, the heating-chamber of the first being provided with a steam-supply pipe, and that of each succeeding boiler being connected with the evaporating-chamber of the last preceding, while the evaporating-chamber of the last boiler or evaporator connects with a cooling or condensing chamber and an exhaust-pump for the purpose of carrying the evaporating or concentrating process through as long a series of boilers as possible.

It is well known to those familiar with the art that in concentrating most if not all liquids by this process the product is impaired in quality, if, indeed, it be not ruined, by em-

ploying steam in the evaporators at too high a temperature; and it is likewise well understood that as the temperature is increased in a steam-generator the increase in the production of steam takes place in a much more rapid ratio than the increase in the consumption of fuel. It therefore follows that if the full effects or benefits of the steam at such high pressure can be utilized in the process of evaporation the process may not only be rendered more economical, but at the same time more rapid, or, in other words, a greater quantity of liquid may be concentrated in a given time and at less cost. To secure these results I generate steam at a pressure considerably greater than that at which it can be advantageously employed in the evaporators, and I utilize this excess of pressure to operate a pump which exhausts the vapor from a supplemental evaporator, compresses the same, thereby restoring to it its heat, and forces the same into the heating-chamber of said evaporator, by which means the necessary temperature is constantly maintained therein. The steam then passes to the evaporators, having, however, been allowed to expand in operating the pump, and having been thereby brought to the required temperature.

In the drawing, A A' A'' represent the multiple or main evaporator, as before mentioned; B, the supplemental evaporator; C C', a double-cylinder steam-engine, receiving steam from the generator G, and serving to operate the pump P, by which the heating of the evaporator B is effected.

The exhaust from the evaporator B (or it may be from the other) is conveyed through a coil of pipe located in the liquid-supply chamber, and thus serves to partially heat said liquid previous to its entering the evaporator B. While, as stated, the exhaust from the main evaporator may be thus employed, the arrangement represented is considered the best that can be employed.

With the apparatus constructed and arranged as above described a continuous and gradual process of evaporation or concentration may be carried on with great facility, the liquid being partially heated in the supply-chamber, raised to a higher temperature, and partially evaporated in the supplemental evap-



orator B, and finally concentrated in the evaporator A A' A'', or a separate concentration carried on in the evaporators A and B.

While the above arrangement of apparatus and method of operation are preferred, it is obvious that the pump may be employed to exhaust the vapor from the last of the series of evaporators, restore to it its heat, and introduce it to the first boiler or evaporator of a second series; and it is also apparent that similar modifications may be made in connection with the evaporator B.

I am aware that steam produced by the evaporation of brine in a boiler has been employed to operate a pump for feeding brine to the boiler, and the exhaust-steam from said pump employed to heat the previously-concentrated brine in a crystallizing-chamber. This process differs from mine in that it necessitates raising the heat in the boiler to at least 226°, at which excessive heat the liquid is concentrated, while by my process the temperature need not exceed 212° in the generator, and is lowered considerably below this point before acting upon the liquid, thus avoiding all danger of injury thereto.

I am also aware that it has been proposed to avoid wasting the entire heat of the vapor formed in the evaporator by passing it, in connection with a jet of steam, into the heating-chamber of said evaporator. In this case, however, the principal heat was due to the steam, which, moreover, was not thereby brought to the required temperature for use in the evaporator. I do not, therefore, claim the process described in said proposed plans.

It is apparent that the details of the apparatus may be varied, any well-known form of engine and pump and any usual form of evaporator acting upon the same general principle being used.

I claim—

1. The herein-described process of concentrating liquids, consisting in causing high-pressure steam to operate a pump, which ex-

hausts and compresses the vapor of an evaporator and returns the same to the heating-chamber of said evaporator, and conveying the exhaust-steam from the pump to another evaporator, whereby the full effect of the steam is utilized and it is brought to the proper temperature for use in an evaporator.

2. The herein-described method of tempering high-pressure steam for use in a concentrator and of utilizing its full expansive force, consisting in passing the steam directly from a steam-generator through a steam-engine cylinder previous to allowing it to act upon the liquid to be concentrated.

3. The herein-described method of maintaining a proper degree of heat in an evaporator, consisting in withdrawing the vapor from the evaporating-chamber, compressing the same, and forcing it, under pressure, into the heating-chamber of the evaporator, as described, the same constituting a step in the process of evaporation.

4. The combination, in one apparatus, of a concentrator, A, an evaporator, B, and an intermediate steam-pump arranged to exhaust the vapor from the evaporator and force the same into its heating-chamber, and to deliver the exhaust-steam from the steam-pump into the heating-chamber of the concentrator.

5. The combination of an evaporator having a steam-heating chamber, a concentrator having a steam-heating chamber, an intermediate steam-pump arranged to force the vapor produced in the evaporator into the heating-chamber thereof, a steam-generator arranged to supply the pump with high-pressure actuating-steam, and a conductor adapted and arranged to convey the low-pressure exhaust-steam from the pump to the heating-chamber of the concentrator.

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Witnesses:

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