

Spotlight: Multiple Effect Evaporator

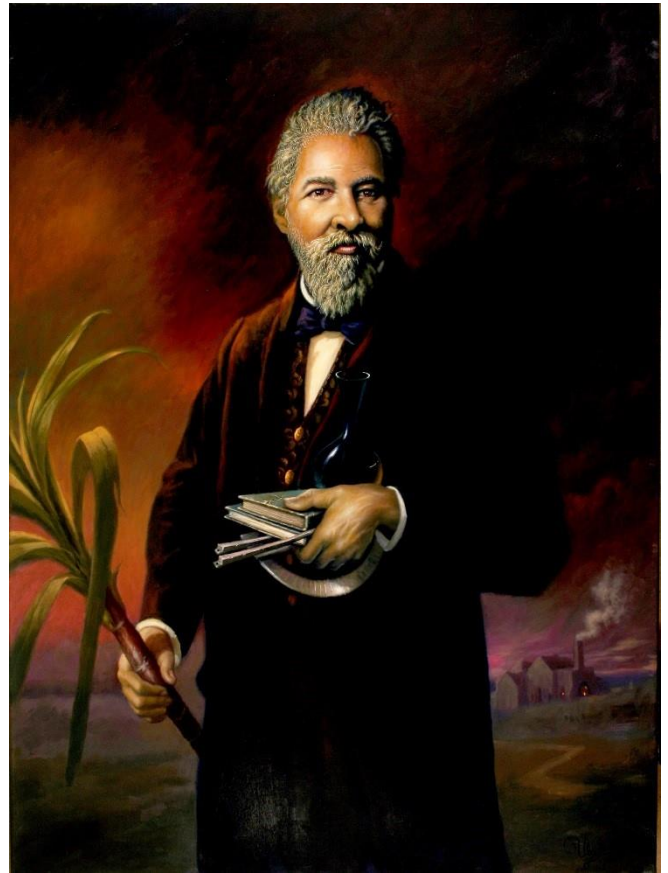
As a boy Norbert Rillieux showed a keen interest in engineering. A child of a bi-racial union in the antebellum South, whose mother was a free woman of color and whose father was a wealthy plantation owner, Rillieux was sent to France for his education.

By the age of 24, Rillieux was an instructor in applied mechanics at the *Ecole Centrale* in Paris. Around 1830, Rillieux published a series of papers on steam engines and steam power.

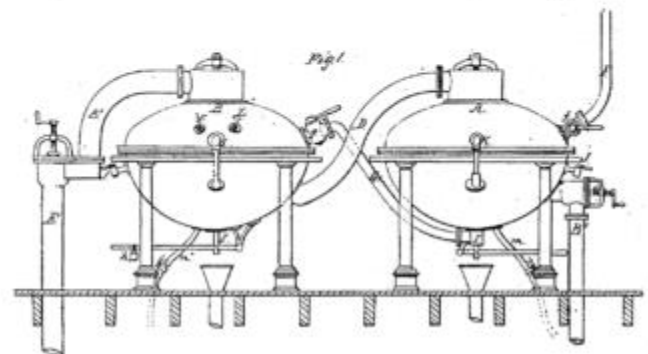
While in France, Rillieux began working on the multiple effect evaporator. Rillieux recognized the potential of reusing latent heat from the steam and vapors created during the processing of sugar cane. What Rillieux did, and what became the basis for all modern industrial evaporation, was to harness the energy of vapors rising from the boiling sugar cane syrup and pass those vapors through several chambers. In so doing, he created a partial vacuum in the boiling chambers. This reduced the temperature at which the syrup reached a boil, requiring only the first chamber to be heated by an external heat source while the subsequent chambers took advantage of the latent heat present in the captured steam.

Rillieux's evaporator was a safer, cheaper, and more efficient way of evaporating sugar cane juice than the method then in use, the Jamaica train. In this system, teams of enslaved workers ladled boiling sugar juice from one open kettle to another. The resulting sugar tended to be of low quality since the heat in the kettles could not be regulated, and much sugar was lost in the process of transferring juice from kettle to kettle.

The multiple effect evaporator has been described as "revolutionizing the sugar industry as much as Eli Whitney's gin revolutionized the processing of cotton." It is still used today in a variety of industries.



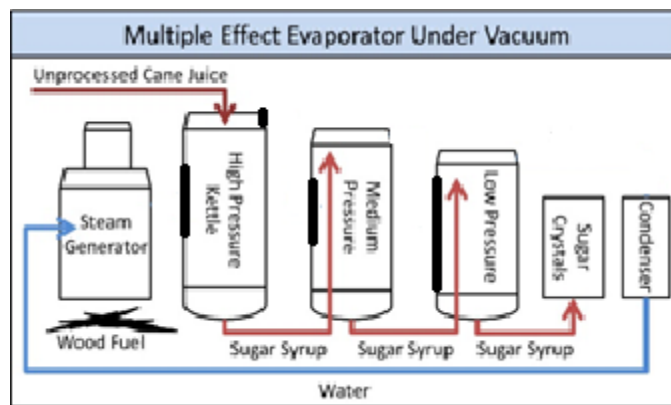
N. Rillieux,
Vacuum Pan,
N^o 3257. Patented Aug. 26, 1843



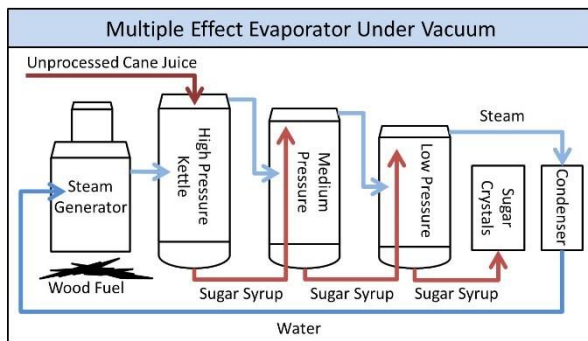
Activity:

Look at the following illustration of Norbert Rillieux's design. Insert arrows with a blue marker showing how you think the steam from the heated vat was reused to heat subsequent vats.

- A. Explain how heating the cane syrup in a vacuum made the process more efficient.
- B. Does this technology, in your opinion, have applications to other industries? If yes, conduct some research to discover which and tell why.



Answer Key:



- A. In creating a vacuum in the boiling chamber, Rillieux was able to lower air pressure. A lower air pressure allows for the liquid to boil at a lower temperature, thus reducing the amount of energy needed to boil the liquid.
- B. His invention is still used in sugar production as well as in the manufacture of condensed milk, soap, glue, and many other products. The multiple effect evaporator has found application in the petrochemical industry as well.