

Welcome to the Wonderful World of Cryogenics

HITT student response system

I am a:

- A. Physics Major
- B. Physics Graduate Student
- C. Engineering Student (Grad or Undergrad)
- D. Otherwise engaged

Milestones in Civilization from the Cryogenic point of View Class of 2007

Antoine Laurent Lavoisier

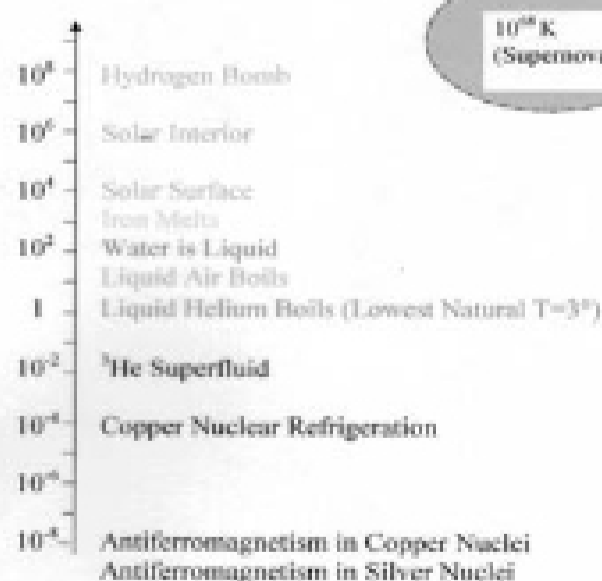


Antoine Laurent Lavoisier, 1743-1794, a portrait by David (Photo: Roger-Viollet)

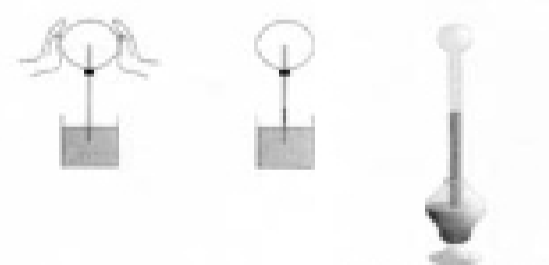
1743-1794
Father of Low Temperature Physics



Temperature (K)



Galileo's Air Thermoscope



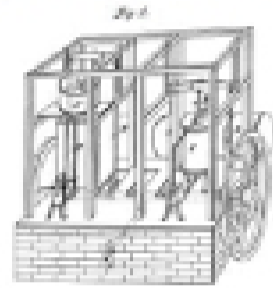
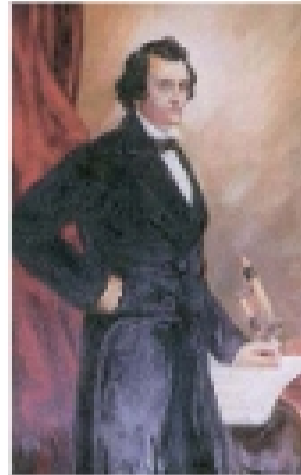
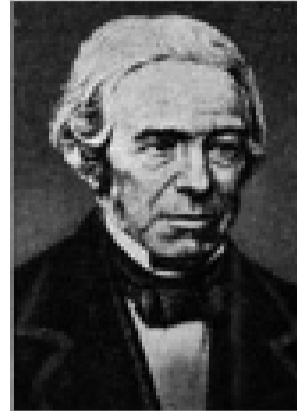
Push the tube into the stopper so that the tube extends about half way into the flask. The flask is then inverted into a beaker of colored water and heated by rubbing your hands together and then holding the flask. As the flask returns to room temperature, the liquid will rise in the tube.

What are the problems with this design?

Refrigeration

Christian Licona
Lynsey Breton
Matthew Spencer
Jennifer Storbeck

Gorrie-1850



Ferdinand Carre -developed successful Ice Business

Ice comes from....

From the Simpsons' featuring the cultivation of ice from the North Pole. When the ice deliveryman arrives at the Quik - E - Mart with his cargo, he says to Apu, "you've got to start charging more than a dollar a bag. We lost four more men on this expedition!" to which Apu replies, "If you can think of a better way to get ice I'd like to hear it."

"If the ice crop was poor, the price rose to the exorbitant rate of \$1.25 a pound." In today's dollar this price corresponds to over \$150 for a typical 3lb bag of ice (3).

Then

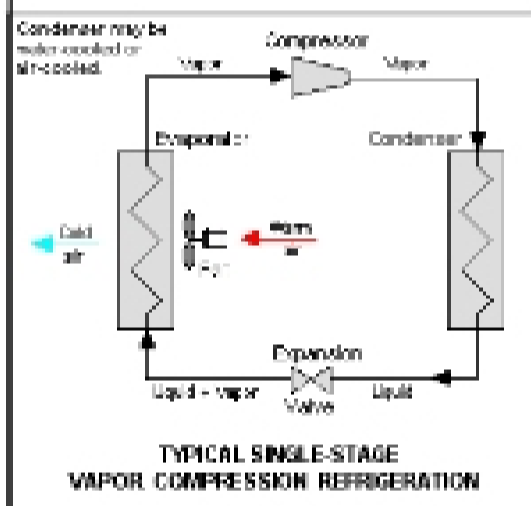


Now

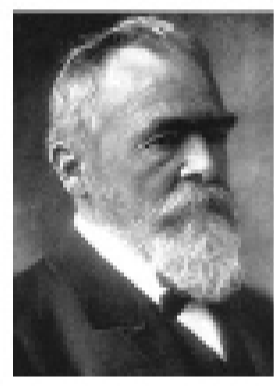


Cold Beer

Daniel M. Pajerowski



1873



Carl von Linde

dimethyl ether refrigerant--made Spatenbrau beer

LOX-1877

Arthur Ianuzzi

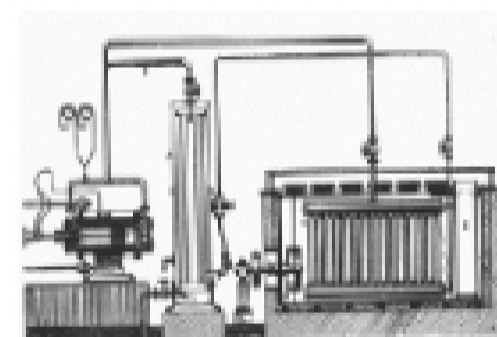


Louis Paul Cailletet (3)



Raoul Pictet (1)

French



Cailletet & Pictet's oxygen liquefaction process (5)



Space Shuttle Main Engine (1)



Fig. 21. Apparatus for Wroblewski and Ostroffski (1876)



Fig. 22. Apparatus for Pawlowski (1876)

Polish

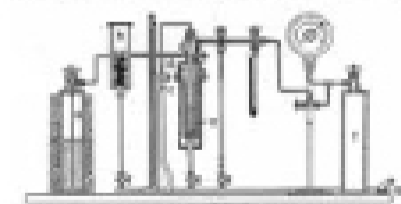


Fig. 23. Apparatus for Wroblewski and Ostroffski (1876)

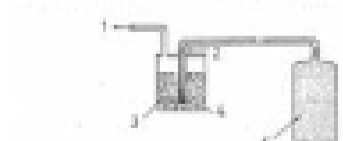
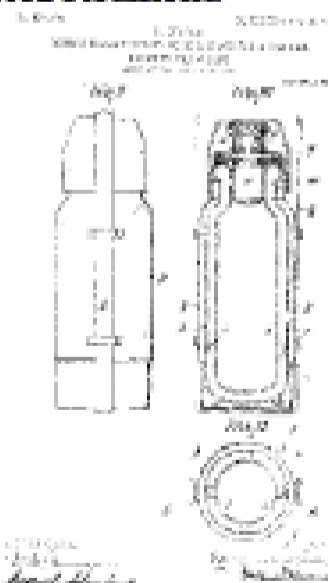


Fig. 24. Apparatus for Pawlowski (1876)

Bret Adams
Vivek Gowda
Christopher Conlan
Erica Redmond

Dewar Flask

Jules Violle in 1882

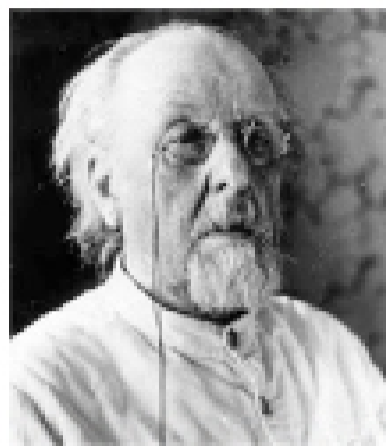


Dewar's improvement in 1892?

Vacuum insulation and silvering



Father of Rocketry



Konstantin Tsiolkovsky 1903

Identified LH_2 and LO_x as the respective fuel and oxidizer of choice, and also suggested use of multi-stage rockets

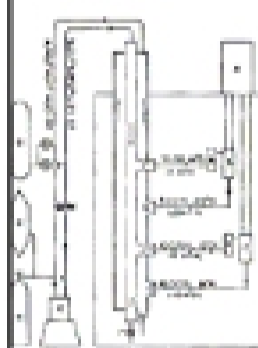
Liquefaction of helium - 1908

Shu-chen Liu
Michael Zglinicki

Kamerlingh Onne in Leiden

Joule-Thomson Effect

Samuel C. Collins - 1947



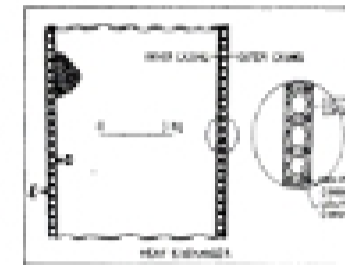
Gas Flow



Cryostat



cross-section



Heat exchanger

Blood Storage and Handling

Evan Kim

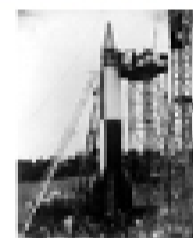
In 1915, Dr. Richard Weil discovered that refrigeration in conjunction with citration (to prevent blood clotting) allowed for the storage of blood for several days. Until then, blood transfusions needed to be made directly from donor to recipient. Refrigerated "Percipitation" of blood also developed.

Cryogenics and Rocketry

Brook Baker
Ella Kinberg
Nika Merta
Renji Thomas



Robert H. Goddard - 1926-41 feet



V2 Rocket Herman Oberth



Wernher von Braun

Freon Refrigerants

Jacob Papp

halogenated hydrocarbon

Formerly used toxic refrigerants included ammonia, butane, methyl chloride (or bromide), and sulfur dioxide

Charles Kettering and Thomas Midgley invented the non-toxic freons in about 1935

Cryo-coolers

K. J. Thompson

Based on Sterling engine, first introduced to cryogenics at 1956 Cryogenic Engineering Conference by J.W.L. Kohler

