University of Mechanical Engineering

The Cryogenic systems

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Methodology

- liquefied gas
- coolant (liquid nitrogen or helium).
- Dewar`s vessel

The methods for producing cryogenic liquid

1. Throttling
2. The extension with performing external work

Throttling

- Key point: when gas flows through the narrowing channel of the pipe or through a porous membrane, its pressure is lowering together with decrease in its temperature.

Joule-Thomson`s coefficient.

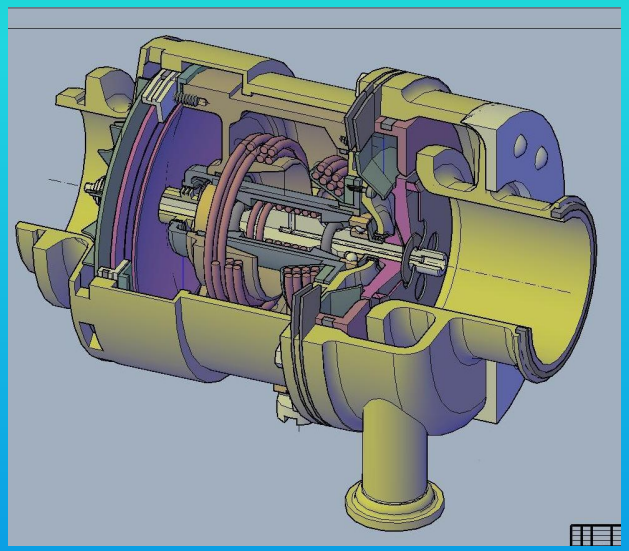
$$\mu_{JT} = \left(\frac{\partial T}{\partial P}\right)_H$$

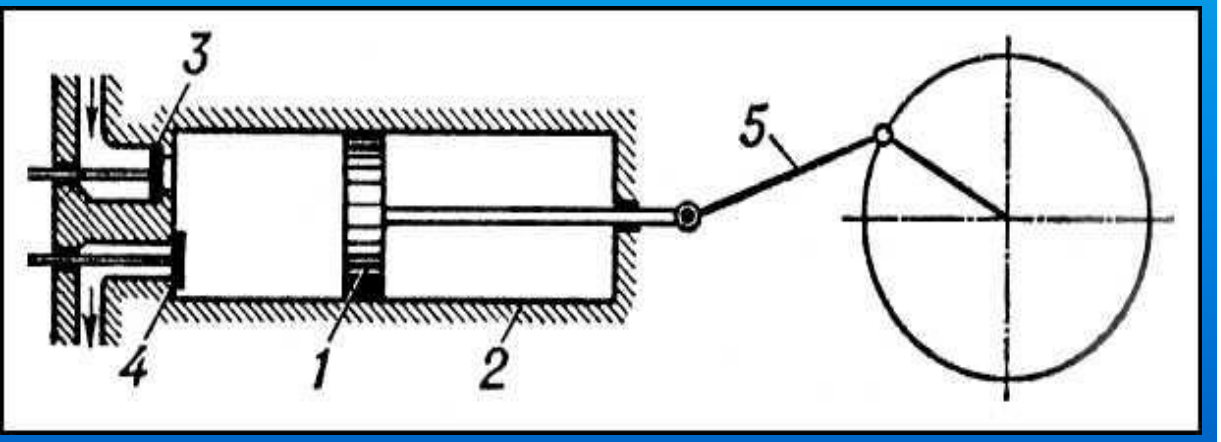
- Prescription: deep cooling and liquefaction of gases.

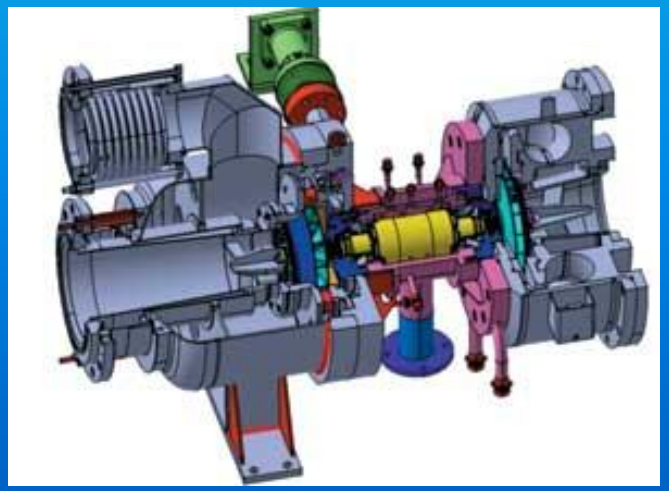
The extension with performing external work

Devices:

1. expander
2. turboexpander





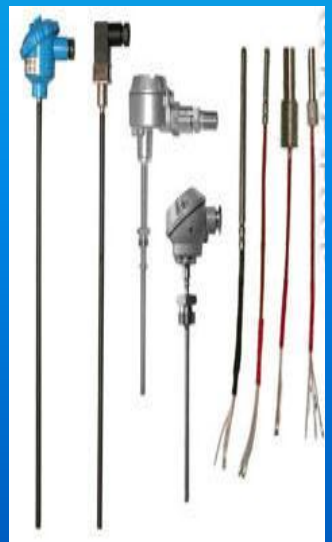


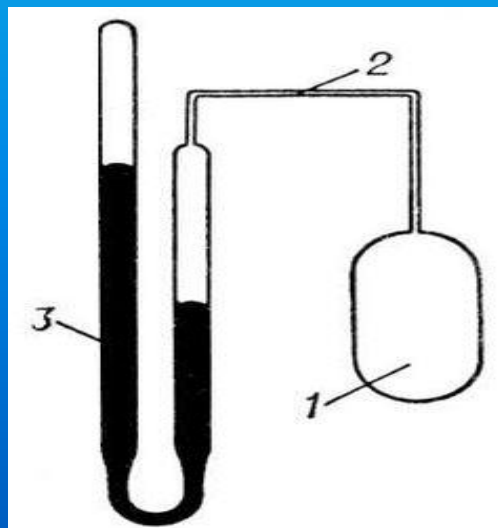
Storage

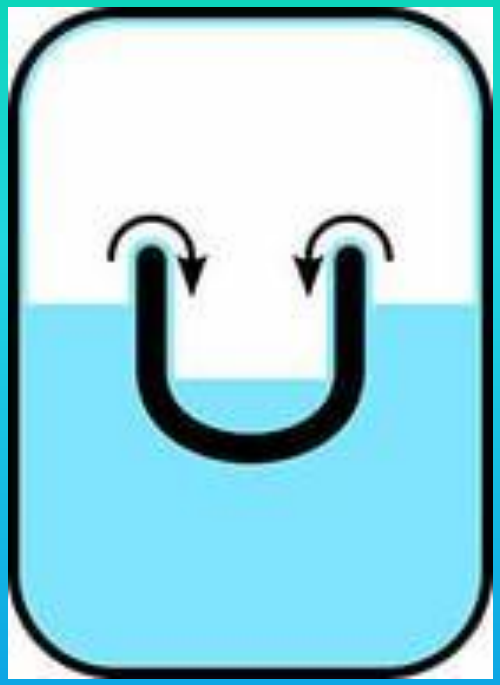
Low temperature measurement

- primary thermometric device - gas thermometer (≤1K)

- secondary thermometric device – thermocouple, semiconductor diode (30—100 K)

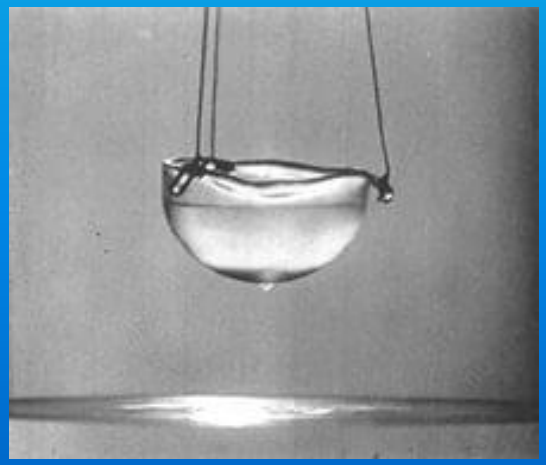




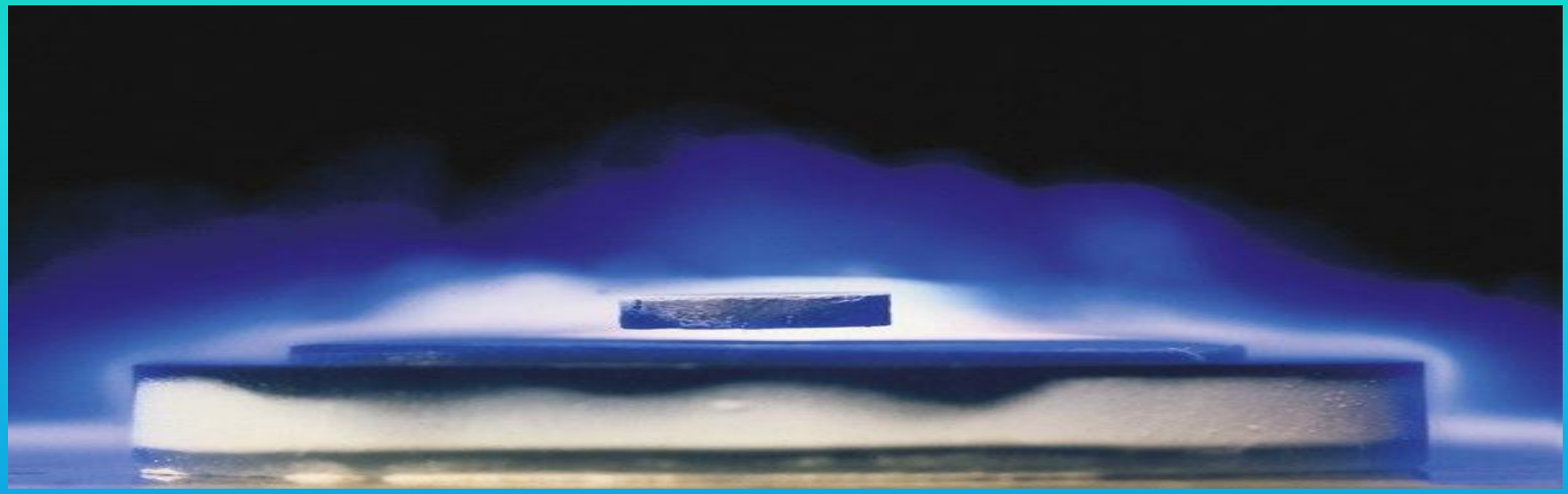


Superfluidity

the ability of a substance in a particular state that occurs when the temperature decreases to absolute zero, flowing through narrow slits and capillaries without friction



Superconductivity



- the property of some materials to have zero electrical resistance when they reach temperatures below a certain value (critical temperature).

Field of Application

- rocket and space technology;
- power industry;
- metallurgy;
- agriculture;
- science;
- chemistry;
- food industry, etc.

Problems:

- the improvement of habitat of large cities;
- improvement in fusion reactor;
- use in nanotechnology.

Conclusion

- The use of low temperature and especially cryogenic technology opens up new possibilities in science and technology, and has a decisive influence on the improvement of the human environment

Thanks for your attention!