

# The Cryogenic systems

# 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



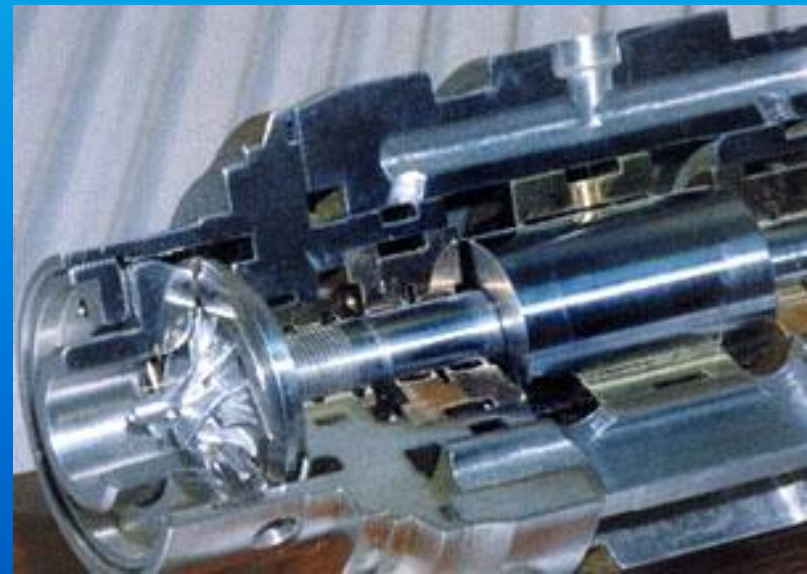
# Throttling

- 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.

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

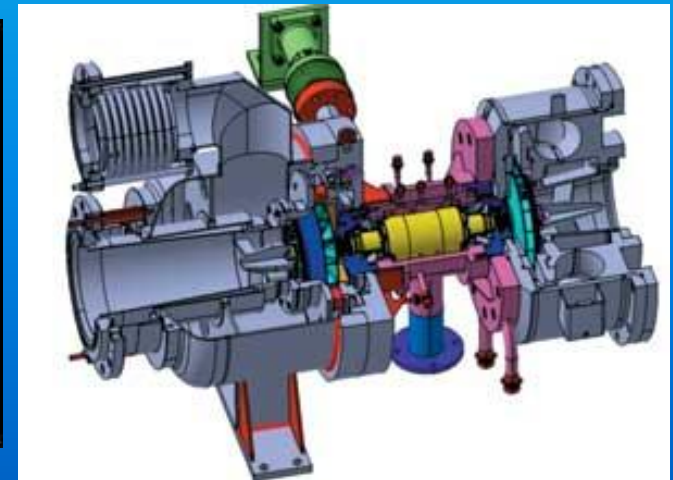
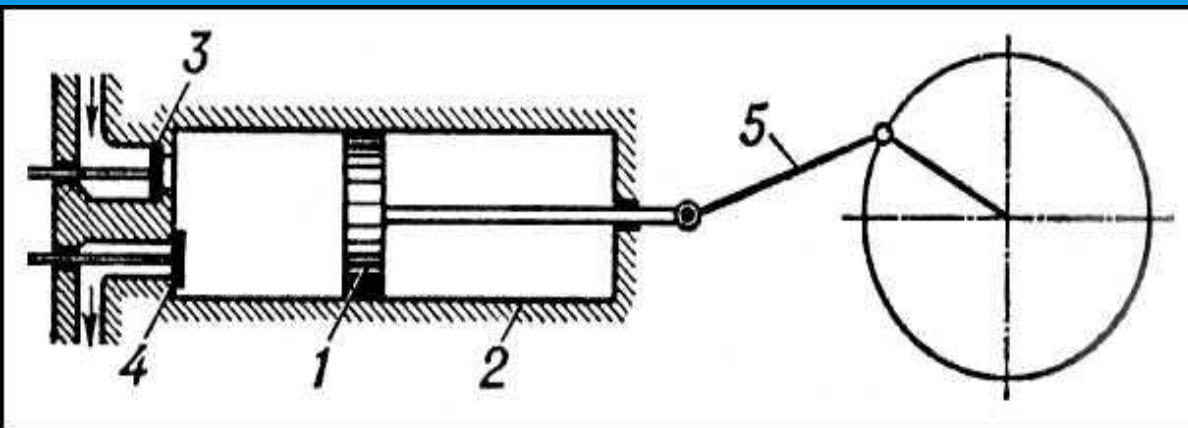
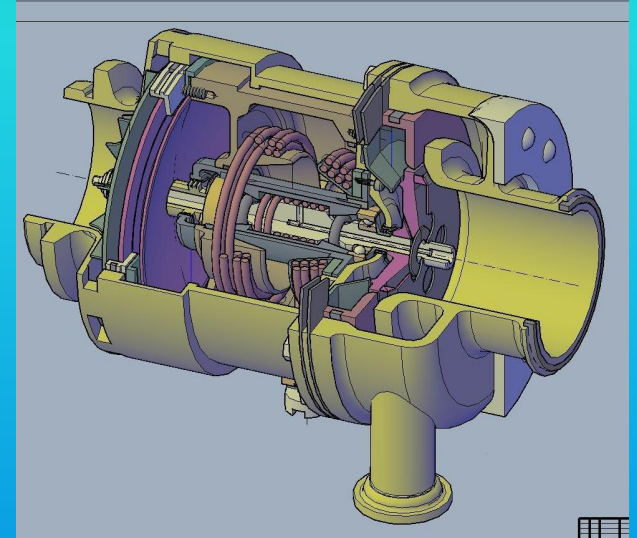
- Prescription: deep cooling and liquefaction of gases.



# The extension with performing external work

Devices:

1. expander
2. turboexpander

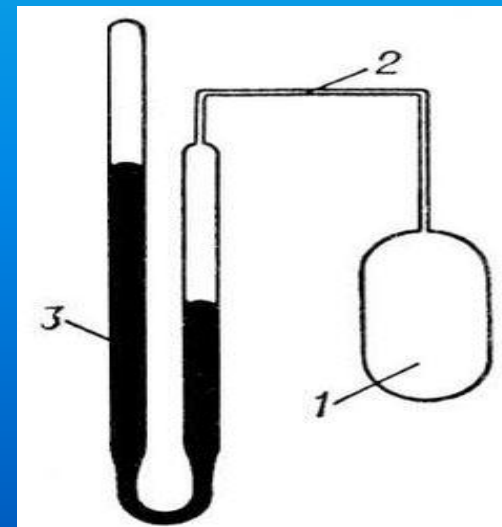
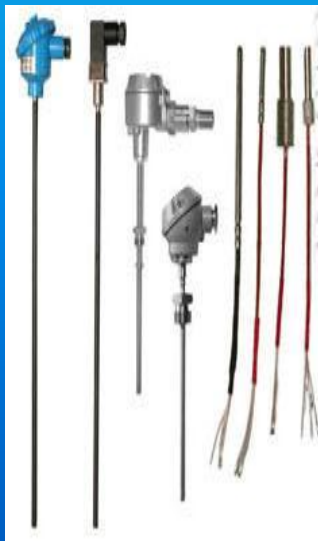


# Storage

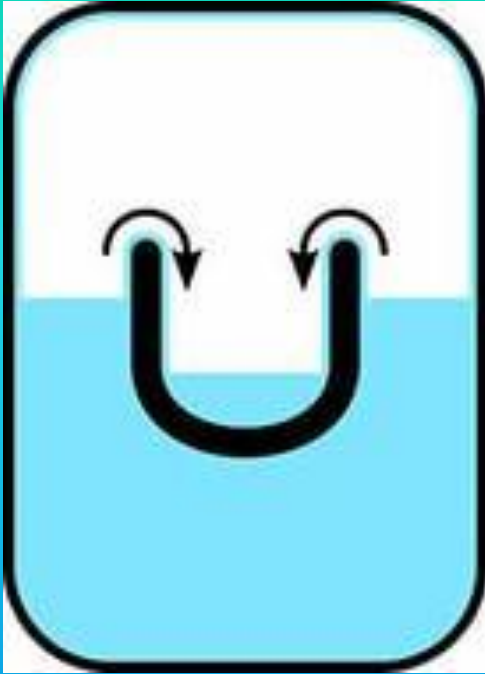


# Low temperature measurement

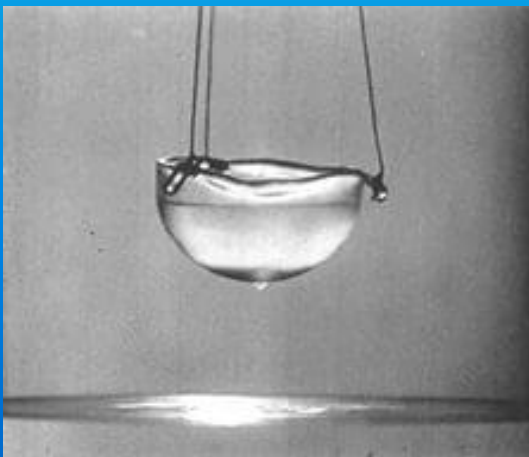
- primary thermometric device - gas thermometer ( $\leq 1\text{K}$ )
- secondary thermometric device – thermocouple, semiconductor diode (30—100 K)



# Superfluidity

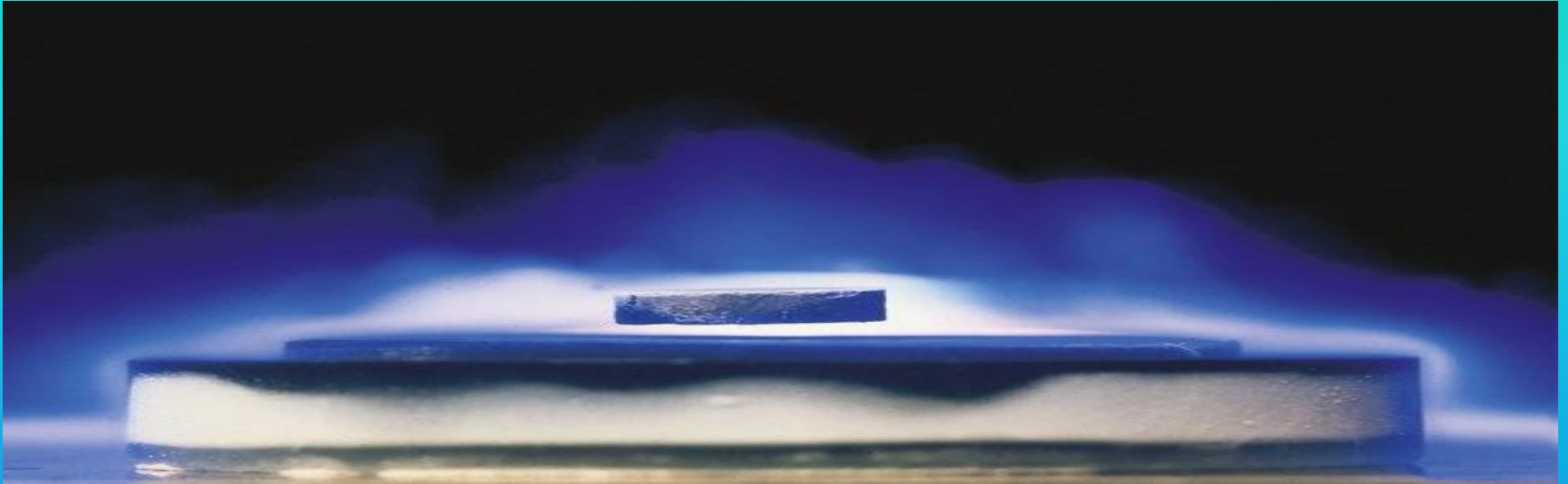


the ability of a substance in a particular state that occurs when the temperature decreases to absolute zero, flowing through narrow slits and capillaries without friction





# 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!