AL-Ayen University
College of Health and Medical Technology
Department of Anesthesia

Vaporizer

Lecture (2) theoretical
Basics of Anesthetic Equipment (1)
2nd Stage
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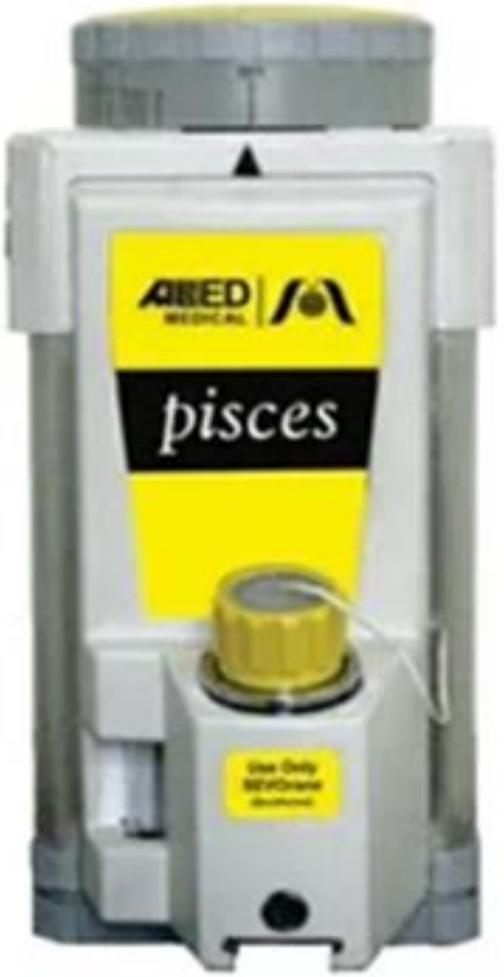
HALOTHANE

ISOFLURANE



SEVOFLURANE

Introduction:

- • Inhalational anaesthetic agents are usually liquid at room temperature and pressure; to use it must be converted to its gaseous state or vapour. This process of conversion is called Vaporization and the equipment use to achieve this is called a Vaporizer.
- • Vaporizers have been developed from a very simple device like face mask to present day hi-tech complex modern day vaporizers.
- • The Anaesthesiologist should understand the basic principles of designing of the vaporizer, the output and factors affecting the output.
- • Modern day vaporizers are agent specific, flow and temperature compensated, concentration calibrated, direct reading dial control, unaffected by positive pressure ventilation.

- • Vapour refers to a substance in the gas phase at a temperature lower than its critical temperature.
- • Boiling Point: Boiling point of a liquid is the temperature at which the vapour pressure of the liquid equals to the surrounding pressure, under this condition addition of heat results in the transformation liquid in to its vapour without raising the temperature of the liquid.

- • At sea level the water boils at 100 c, but at a height of 1905 meters water boils at 93.4 c • The boiling point changes as the pressure changes, at highier altitude the boiling point of water decreases because the barometric pressure decreases. Similarly the boiling point increases as atmospheric pressure increases.
- • Critical temperature: Every substance has its unique critical temperature above which it exists only as a gas, irrespective of how much pressure is applied to it.

Vaporizers:

- ❖ Anaesthesia vaporizer is device attached to an anaesthesia machine to deliver a given concentration of a volatile anaesthetic agent.
- ✓ • It works by controlling the vaporization of anaesthetic liquids and then also controlling the delivery these agents for mixing with the fresh gas flow to deliver a desired concentration.
- ✓ • The safe delivery of volatile anaesthesia today, is because of the development of increasingly advanced vaporizers.
- ✓ • Current vaporizers(tech vaporizers) have evolved from earlier examples of ether and trilene bottles attached to old Boyles machines which were uncalibrated, and whose output varied greatly with ambient temperature and gas flow rates.

- It is designed to add a controlled amount of an inhalational agent, after changing it from liquid to vapour, to the FGF.
- It is expressed as a **percentage of saturated vapour** added to the gas flow.
- The **Calibration** of each vaporizer is agent-specific.
- The Interlocking Extension Rods prevent more than one vaporizer being used at any one time
- The FGF only enters the vaporizer when it is switched on.

❖ The purpose of a vaporizer is to reliably deliver an accurate, adjustable concentration of anaesthetic vapour.

Types of Anaesthesia Vaporizers. The vaporizers are basically of two types.

1. Draw-over
2. Plenum vaporizers

1-Draw-over vaporizer: it is a type of vaporizer where the patients negative inspiratory effort allows the inhaled gas to pass over a liquid anaesthetic in a container and the inhaled gas carries the vapour of that liquid along with it.

• It is a low-resistance system and much simpler in design. Ether bottle is an example of this vaporizer

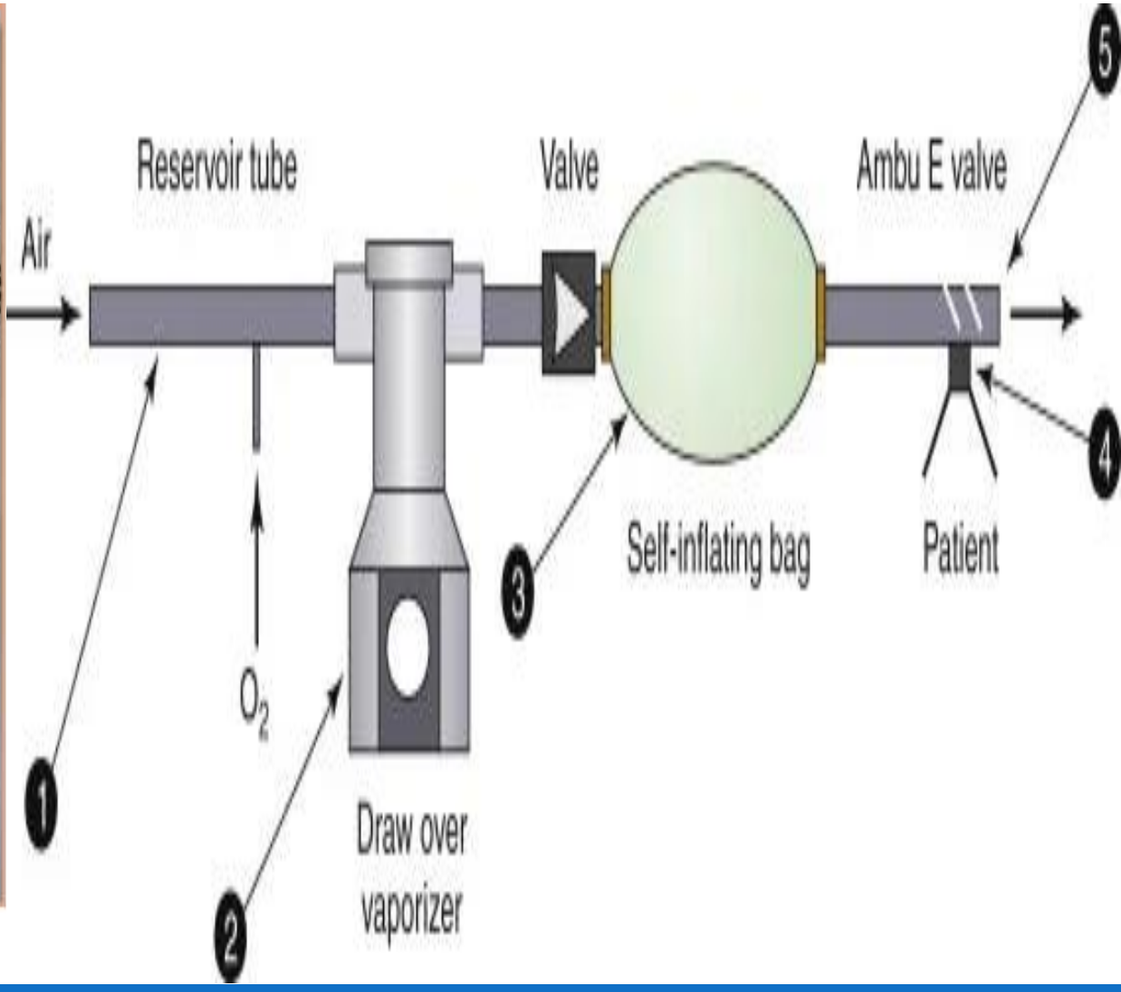


Figure 1. Standard U-PAC Draw-over Setup Ready for

2- Plenum vaporizers: in contrast rely on pressurized gas flow rather than the patients inspiratory effort. They have a high internal resistance and are used with continuous flow anesthetic machine. The Plenum vaporizers should saturate all gas that passes through the vaporization chamber in order to achieve a consistent output even at high FGF .

Fig. 5.5.1: A Sevoflurane Tec 7 vaporizer. Image reproduced with permission from GE Healthcare.

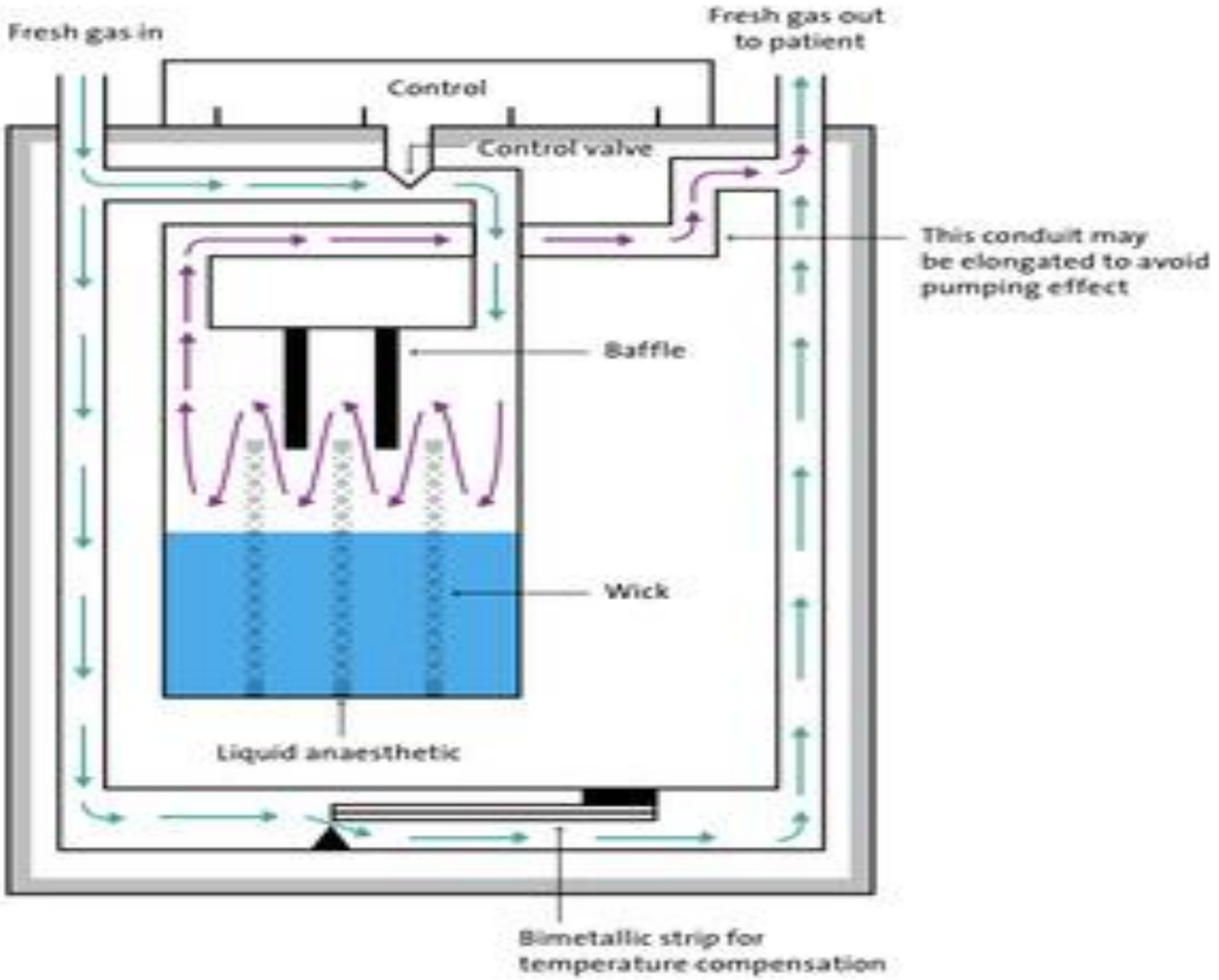
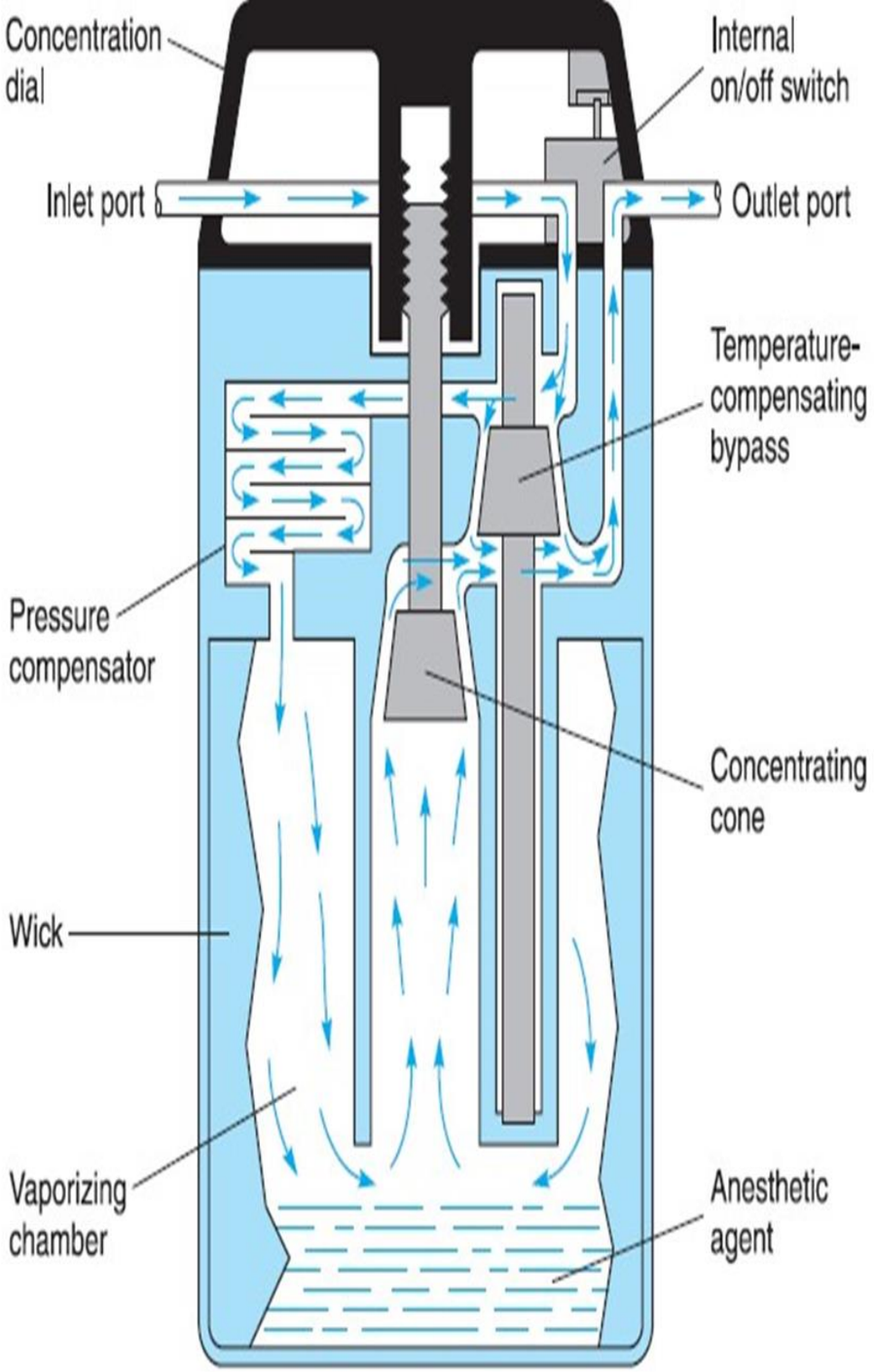
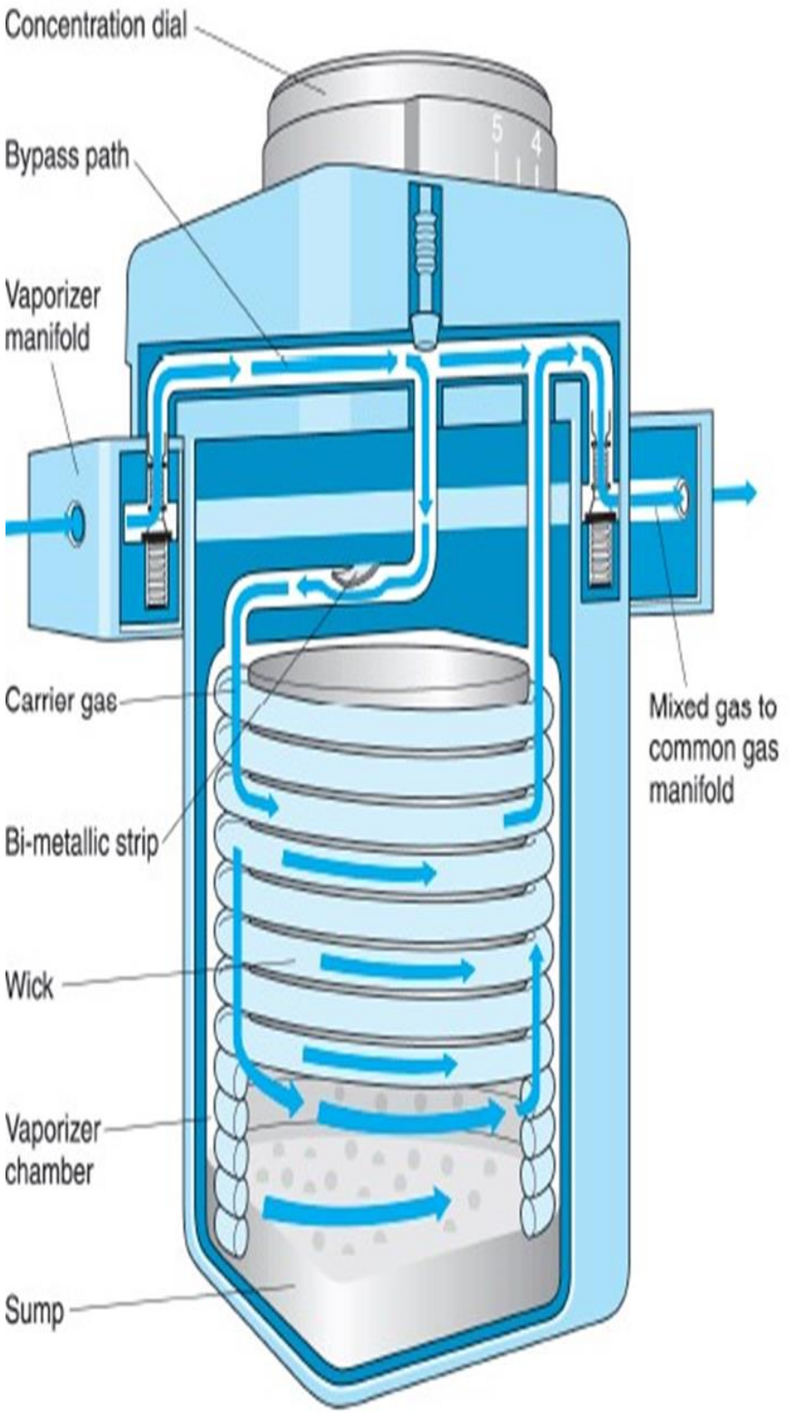


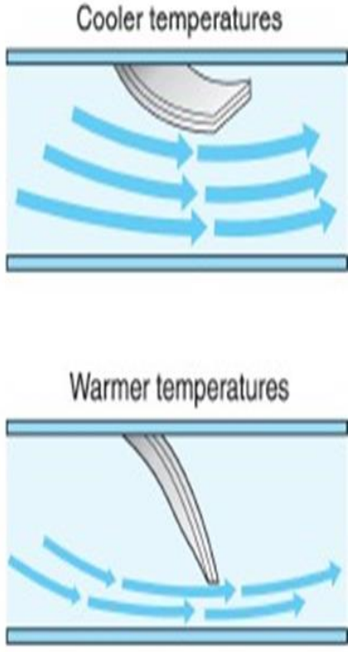
Fig. 5.5.2: A temperature compensated plenum vaporizer.


Concentration dial
Internal on/off switch
Inlet port
Outlet port
Temperature-compensating bypass
Pressure compensator
Concentrating cone
Wick
Vaporizing chamber
Anesthetic agent

A


Concentration dial
Bypass path
Vaporizer manifold
Carrier gas
Mixed gas to common gas manifold
Bi-metallic strip
Wick
Vaporizer chamber
Sump

B


Cooler temperatures
Warmer temperatures

• Components of the Vaporizer:

1.The Case with the Filling Level Indicator and a Port for the Filling Device.

2. Percentage Control Dial on top of the case.

3. Bypass Channel and Vaporization Chamber. The later has wicks or baffles to increase the surface area available for vaporization.

4. The Splitting Ratio is controlled by a Temperature-Sensitive Valve with a Bimetallic Strip. It is positioned inside the vaporization chamber.

5. The vaporizers are mounted on the back bar using the Interlocking System

the percentage control dial cannot be moved unless the locking lever of the system is engaged the interlocking extension rods prevent more than one vaporizer being used at any one time, preventing contamination of the one downstream.

• The Vaporizer is made of Copper , because it has :

1. High Density

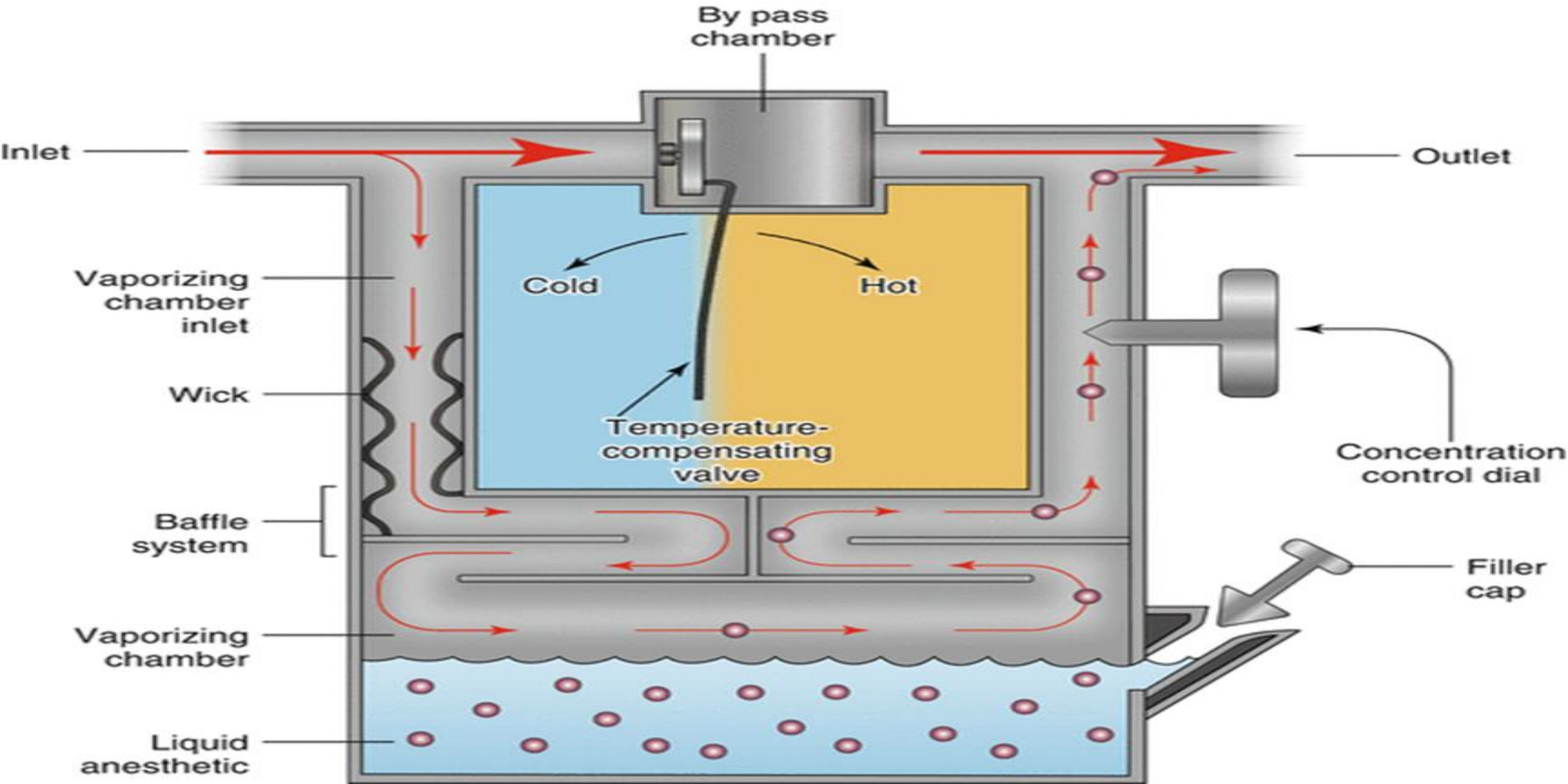
2. High Specific Heat Capacity

3. Very High Thermal Conductivity

Mechanism of action

1- the calibration of each vaporizer is agent–specific.

2-fresh gas flow is split into two streams on entering the vaporizer. One stream flows through the bypass channel and the other, smaller stream flows through the vaporizing chamber. two gas streams reunite as the gas leaves the vaporizer.



Characteristics feature of the ideal vaporizer:

1-its performance is not affected by changes in

- ✓ FGF
- ✓ The volume of the liquid agent in avaporizer
- ✓ Ambient temperature and pressure

2- low resistance to flow

3-light weight with asmall liquid requirement

4-economy And safety in use with minimal servicing requirements

5-corrosion and solvent resistant construction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Thank you