

AL-Ayen University
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Department of Anesthesia



Flowmeter

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

Flowmeters measure the flow Rate of a gas passing Through them. They consist Of:

- 1- valve control flow.
- 2- tapered transparent Tube. (wider at the top)
- 3- Bobbin rotating lightweight.

Overview:

Constant pressure, variable orifice flowmeters are found on the front of the anaesthetic machine, and also on adaptors that plug into Schrader valves on walls or gas cylinders.

Although they appear cylindrical, they are actually conical with their base directed upward.

At the apex of the cone there is a needle valve that regulates the flow of gas into the flowmeter. Inside the cone there is a bobbin that moves in the gas flow allowing the flow to be read from a calibrated scale.

The cone of the flowmeter is made of plastic or glass and is coated with a transparent anti-static material; there is also sometimes a conductive strip to prevent the bobbin sticking due to static. The shape of the bobbin varies, but there is often a groove to make them spin in the gas flow and a visual indicator to make it easy to see that they are spinning and have not become stuck. The scale is read parallel with the equator of a spherical bobbin and from the top of a cylindrical one.

Uses:

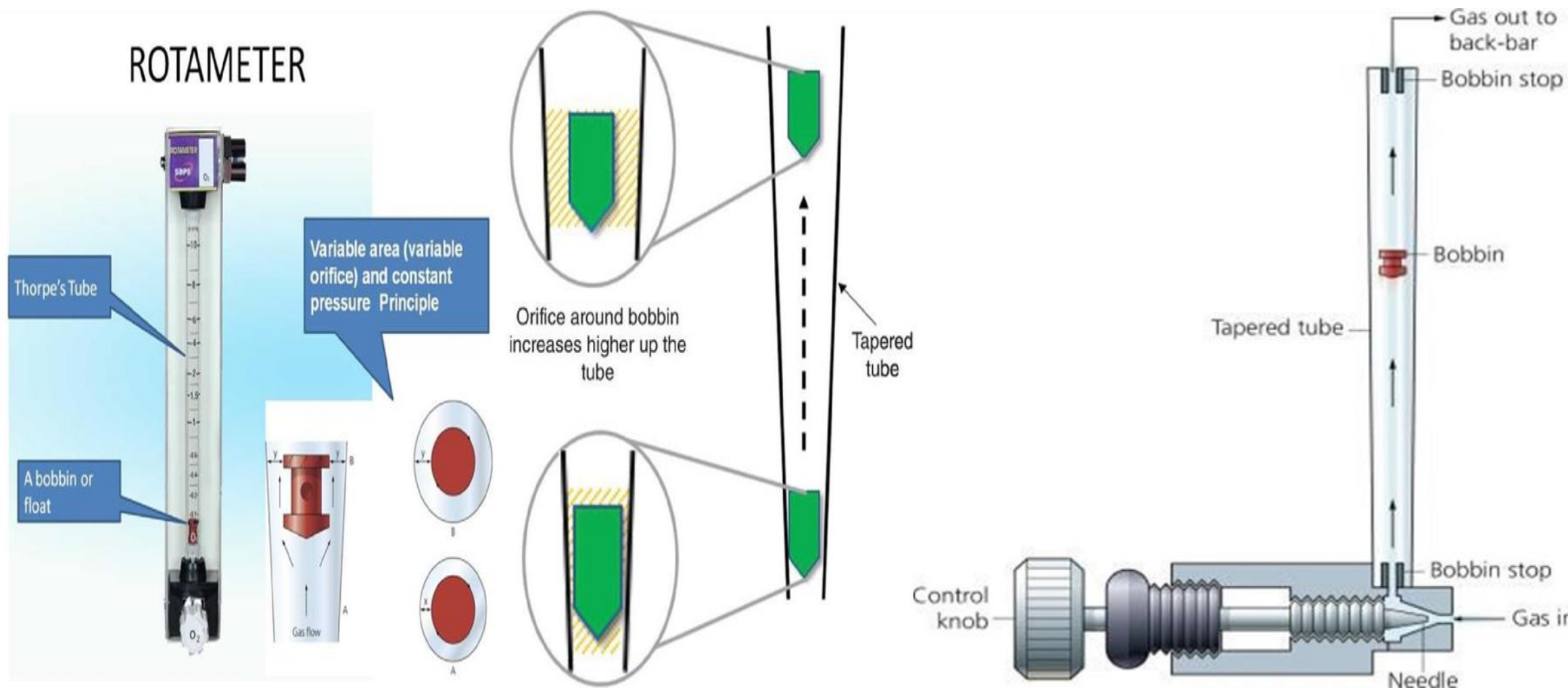
Flowmeters provide a simple visual measurement of each gas as it flows through the anesthetic machine or out of a gas cylinder or pipeline.



How it works:

As the needle valve is opened, gas enters the flow meter and exerts a force on the bobbin, pushing it upward. The gas flows around the bobbin and on into the back bar, however, the bobbin acts as an obstruction to flow and so there is a pressure drop across it. At equilibrium, the pressure drop is equal to the bobbin's weight (mass multiplied by gravity) divided by its cross-sectional area, and is therefore constant, hence 'constant pressure'. The flow meter is designed so that at any given flow, the bobbin will reach an equilibrium position where the force of the gas moving in the upward direction is exactly balanced by the force of gravity acting on the bobbin in the downward direction. If the flow is increased, the bobbin rises up the cone due to an increase in pressure between the needle valve and the bobbin.

Because the flowmeter is conical, there comes a point where the orifice between the bobbin and the side of the cone has enlarged sufficiently to accommodate the increased flow. This drop in resistance to gas flow reduces the pressure on the bobbin and the force in the upward direction is once again balanced by the force in the downward direction due to gravity. If the flowmeter was cylindrical instead of conical, opening up the needle valve to deliver even a small flow of gas would lead to the bobbin shooting out of the top of the flowmeter, akin to a pea-shooter.



Advantages:

- Cheap and simple.
- No electrical power required for use.
- Quick and easy to obtain desired flow and to read the current flow.
- Accurate for flows used clinically ($\pm 2.5\%$). Some machines have a smaller sized flowmeter for lower flows (e.g. 0 to 1 l.min⁻¹) to increase accuracy.

Disadvantages:

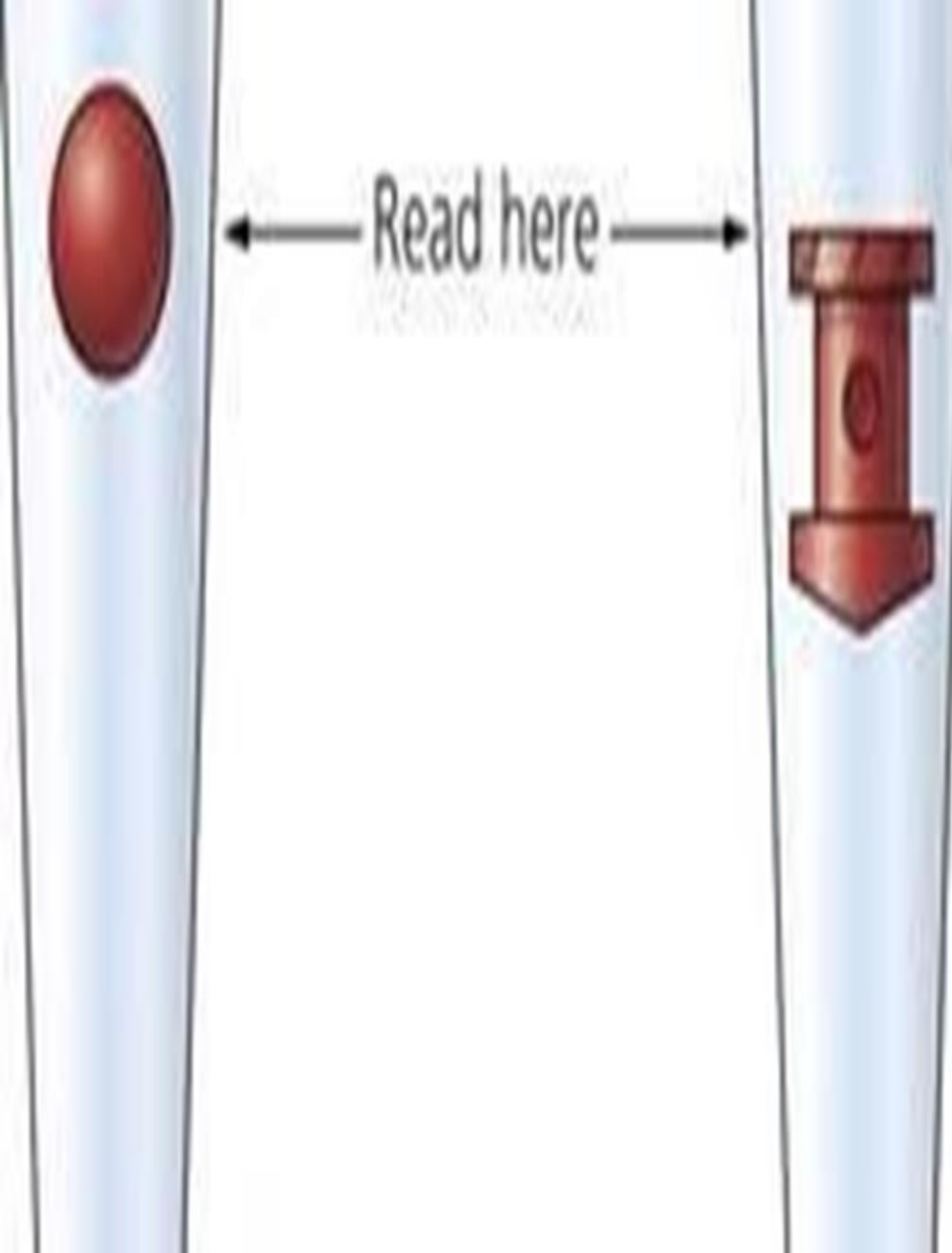
- Bobbin can get stuck due to static or dirt, leading to inaccurate readings.

Safety:

- 1-The flow control knobs are color coded for their respective gases
- 2-The oxygen control knob is Situated to the left and, in some Designs, is larger with larger Ridges and has a longer stem from The other control knobs, making it Easily recognizable
- 3-A crack in a flowmeter may Result in a hypoxic mixture. To Avoid this, oxygen is the last gas To be added to the mixture Delivered to the back bar
- 4-Flow measurements can become Inaccurate if the bobbin sticks to The inside wall of the flowmeter.

Problems of flowmeter:

- 1- A crack in a flowmeter leads to a hypoxic mixture
- 2- the bobbin sticks due to dirt and static electricity
- 3- change in the position of the machine



A top-down view of a desk setup. In the center is a white notepad with a brown border, containing the handwritten text "thank you" in a cursive script. Above the notepad are two silver paper clips. Below it is a gold pen with a clear gemstone on the cap. The scene is decorated with green eucalyptus leaves around the edges. A solid blue bar is at the bottom of the image.

thank
you