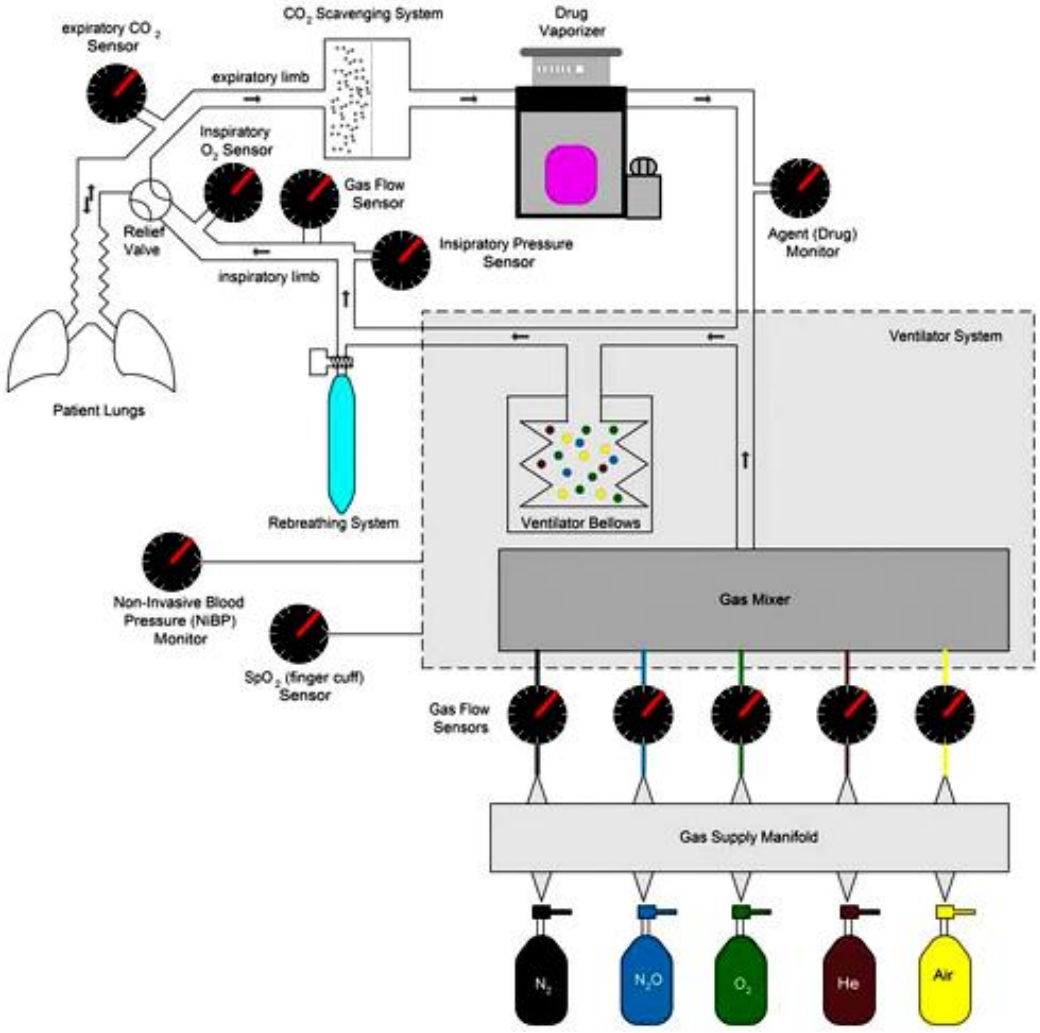
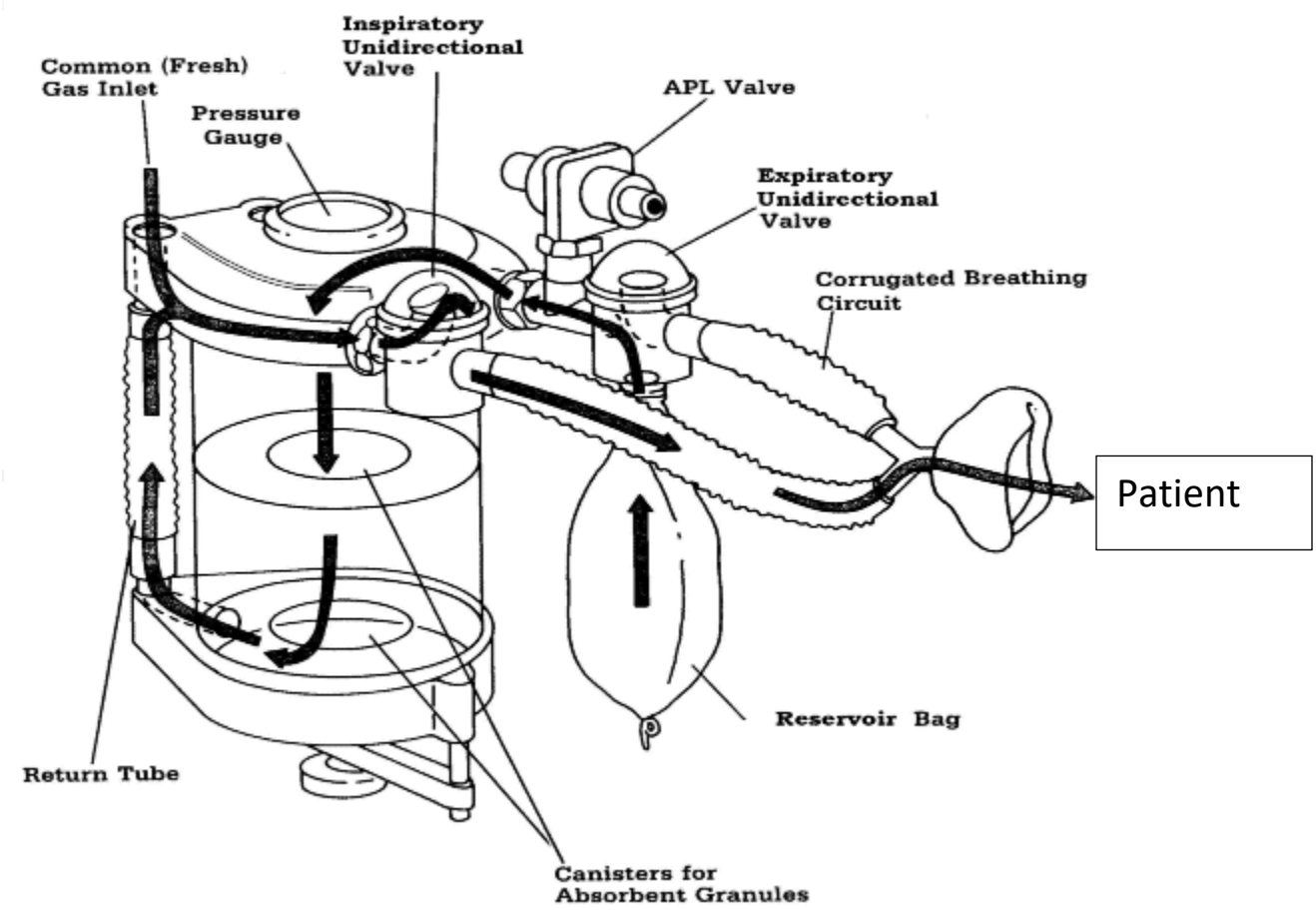
PROBLEM STATEMENT BY GE HEALTHCARE

BACKGROUND

Anesthesia machines are used to help patients ventilate while providing the anesthetic agents necessary to sedate them during surgeries. During a normal operation, the machine regulates gas supply (Air or oxygen). This gas is then mixed with anesthesia vapors and delivered to the patient using a breathing system and patient tubes.

The gas of oxygen/air and anesthetic agent goes to the patient during the inspiration phase. After exchange of gases in the patient lung, the gas enriched with CO2 comes back to the Breathings system of machine and this is the expiration phase. The gas passes through the bellows and then flows through absorber canister. Here the CO2 is absorbed by the soda lime present in the absorber canister. This gas with reduced CO2 percent, circulates back into the system, mixes with fresh gas supply and is inspired by the patient.





Breathing system diagram

The Challenge

During the absorption of CO2 in the canister, heat and moisture are generated. The canister temperature may rise ~37°C to ~40°C. This warm gas flows to the flow sensors of the breathing system, which are at a cooler temperature (consider operation theatre temperature 20C). The vapor in the gas condenses in the breathing system and the inspiratory flow sensor during inspiration. Additionally, expired air from the patient is at 37C (body temperature) and moisture condenses at the expiratory flow sensor during expiration phase. This causes a lot of water to accumulate in the breathing system. This hampers flow sensor accuracy and monitoring capability.

Whether the breathing system is made of plastic or metal, this issue is observed. The breathing system already has a provision to ensure that the condensed water should flow towards the

absorber canister and collect there. Still the water accumulation is high and affects the fresh gas flow rate monitoring.

1. Students should come up with design alternatives to allow patient respiration while ensuring that water condensation is eliminated. Students can be creative with their design solutions.
2. Provide methods that ensure that water condensation is avoided, mention what component, material is used in the design.

LIMITATIONS: