Anaesthetic machines, also known as anesthesia delivery systems or anesthesia workstations, are essential medical devices used to administer anesthetic gases to patients to induce and maintain anesthesia during surgical and other medical procedures. They allow healthcare providers to manage pain, consciousness, and other physiological states safely. Here's a summary of their key components, functions, and safety features:

It is primarily designed to protect patient safety and support healthcare providers by standardizing the operation and testing of anesthesia delivery equipment.

Key Components

1. **Gas Supply and Delivery**:
    - Provides a controlled supply of medical gases, including oxygen, nitrous oxide, and sometimes air, from compressed gas cylinders or a central gas supply.
    - Includes flowmeters that regulate the rate of gas flow for each gas, typically measured in liters per minute.
2. **Vaporizer**:
    - A vaporizer is used to convert liquid anesthetic agents (such as sevoflurane, isoflurane, or desflurane) into vapors and precisely mix them with carrier gases to deliver specific concentrations.
    - Vaporizers are designed to work at a specific temperature and pressure to ensure accurate dosing.
3. **Breathing System**:
    - Connects the anesthetic machine to the patient via an endotracheal tube or mask.
    - Consists of various parts like hoses, valves, filters, and reservoirs that help in delivering, recirculating, or eliminating gases.
4. **Ventilator**:
    - Assists or controls patient breathing during anesthesia, ensuring adequate ventilation when spontaneous breathing is inadequate or suppressed.
    - Provides control over variables like tidal volume, respiratory rate, and pressure, often with alarms and fail-safes.
5. **Scavenging System**:
    - Collects and removes exhaled anesthetic gases from the operating environment to prevent exposure to medical staff.
    - Prevents waste gases from contaminating the room air, improving safety and compliance with occupational health standards.
6. **Monitors**:
    - Anesthetic machines are equipped with monitoring systems for essential parameters such as oxygen levels, carbon dioxide, respiratory rate, and anesthetic gas concentrations.
    - Advanced models include integrated patient monitoring for ECG, blood pressure, and other vitals to assess real-time physiological changes.

Safety Features

- **Fail-safe Mechanisms**: Automatically shut off or reduce gas flow if oxygen levels drop below safe limits.
- **Alarms**: Alert operators to changes in oxygen levels, gas supply, or ventilator function.
- **Pressure Relief Valves**: Prevents excessive pressure build-up in the system, protecting the patient's lungs.
- **Backup Power**: Many machines have battery backups to continue functioning during a power outage.

Operating Procedure

Anesthesia machines require careful setup and regular checks, including verifying gas supplies, calibrating vaporizers, setting appropriate ventilator parameters, and checking all connections and alarms. Continuous monitoring is crucial throughout the procedure to make adjustments and respond to any changes in patient status.

Maintenance and Calibration

Regular maintenance and calibration are necessary to ensure accurate gas and vapor delivery. Anesthetic machines are subject to rigorous safety standards and inspections to maintain performance and safety for patients and healthcare providers.

These machines are fundamental in medical settings where surgery or complex medical procedures are performed, making anesthesia administration safer and more precise.