ANAESTHETIC EQUIPMENTS TECHNOLOGY
ANAESTHETIC BREATHING SYSTEMS
3RD YEAR –LECTURE 2

BY

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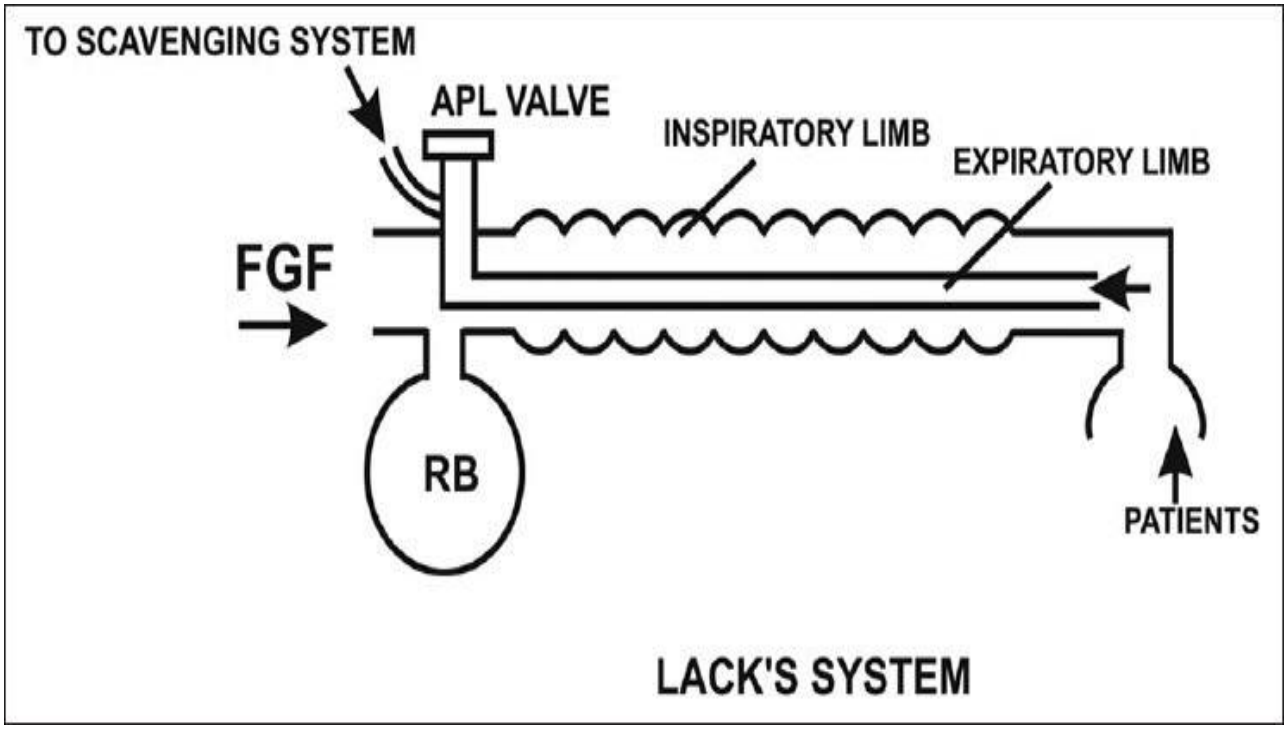
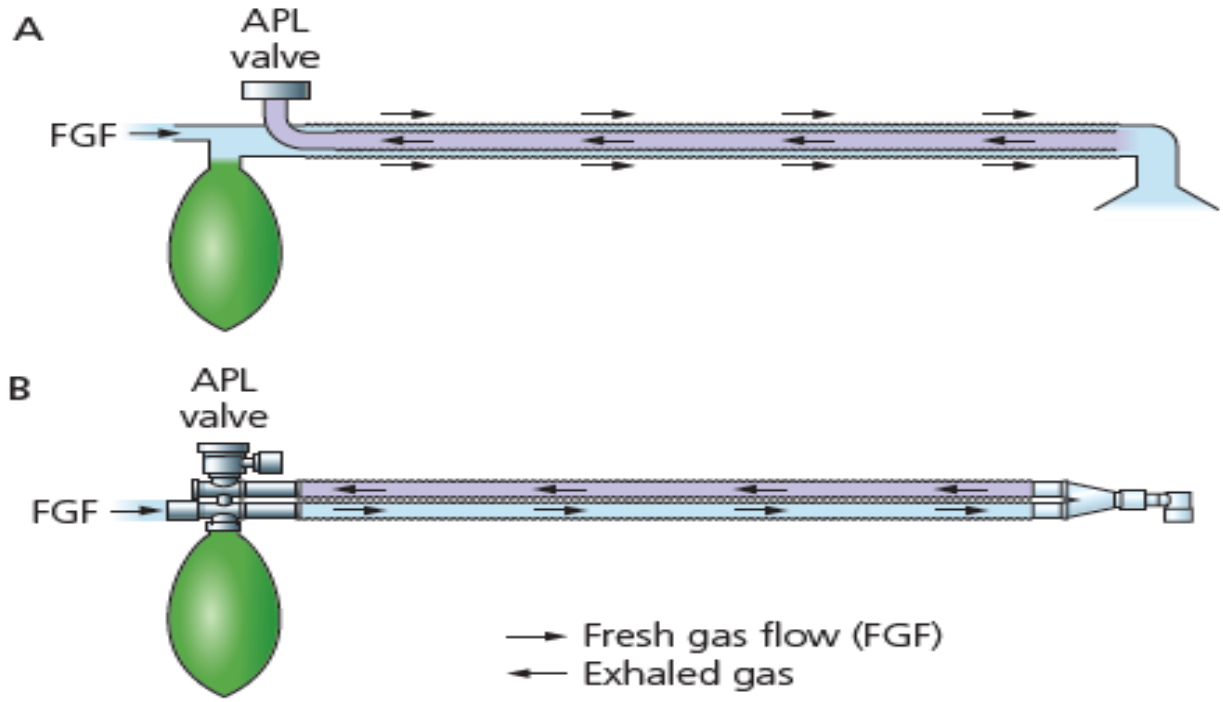
The Lack Circuit

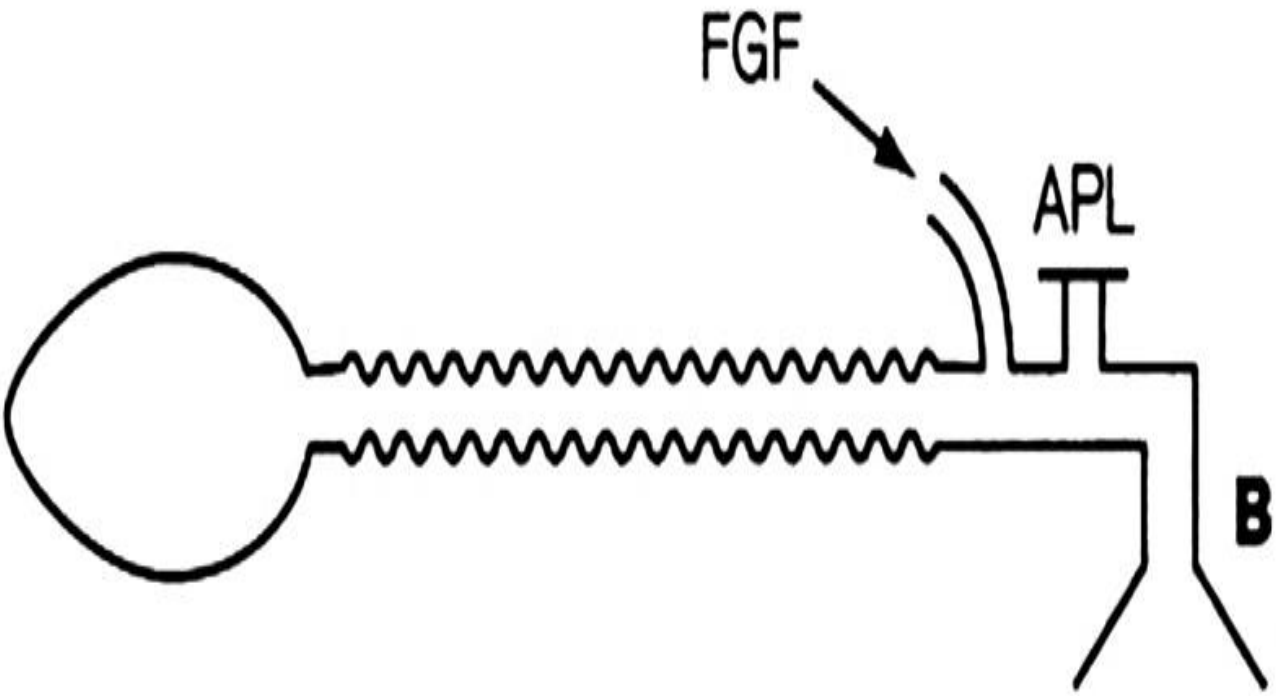
- In Magill system is that the expiratory valve is attached close to the patient
- The Lack circuit is a modification of Mapleson A system
- The inner tubing is wide enough to prevent an increase in the work of breathing
- The expiratory valve is placed next to the reservoir bag, by the common gas outlet.
- The fresh gas flows required for both spontaneous and controlled ventilation are as described for the standard Mapleson A system

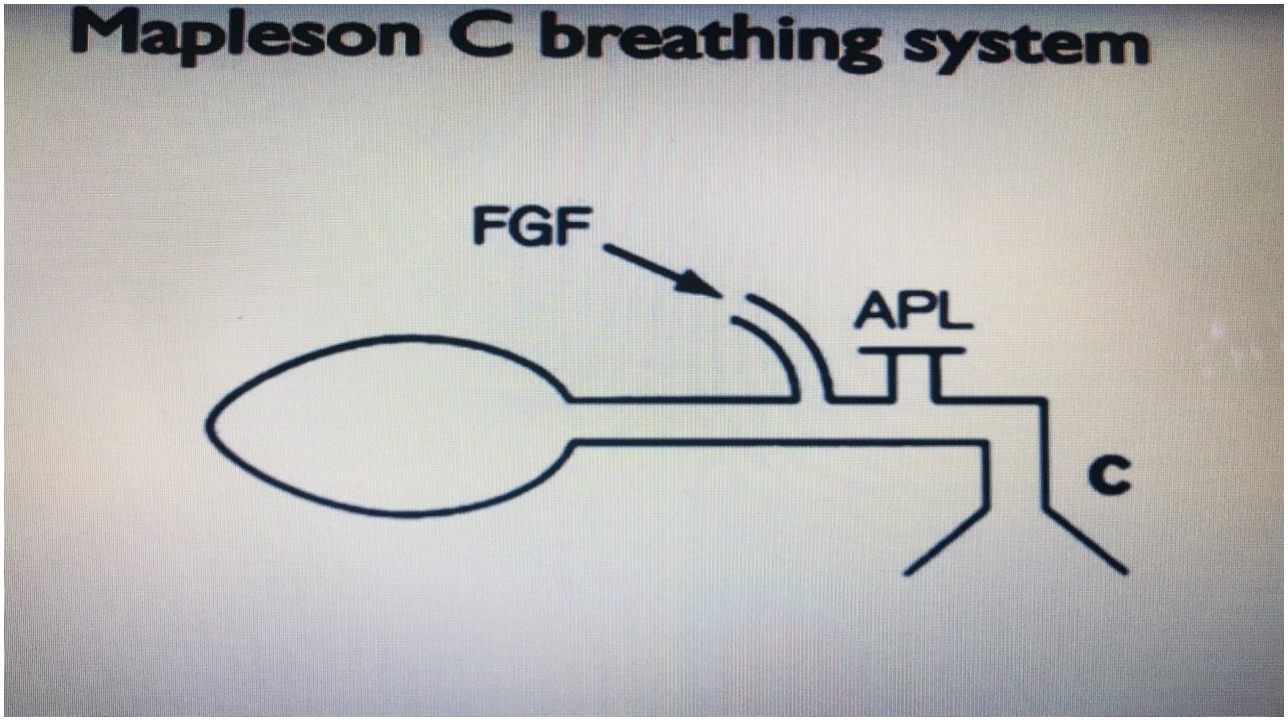

TO SCAVENGING SYSTEM
APL VALVE
INSPIRATORY LIMB
EXPIRATORY LIMB
FGF
RB
PATIENTS
LACK'S SYSTEM


A
APL valve
FGF
B
APL valve
FGF
Fresh gas flow (FGF)
Exhaled gas

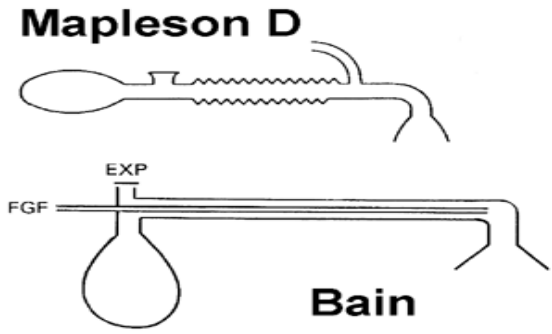
The Mapleson B and C breathing systems

- They are similar in construction,
- The fresh gas flow entry and the expiratory valves located at the patient end of the circuit.
- They are not commonly used in anesthetic practice, although the C system is used on intensive care units.
- During controlled ventilation, the B system is more efficient due to the corrugated tubing acting as a reservoir



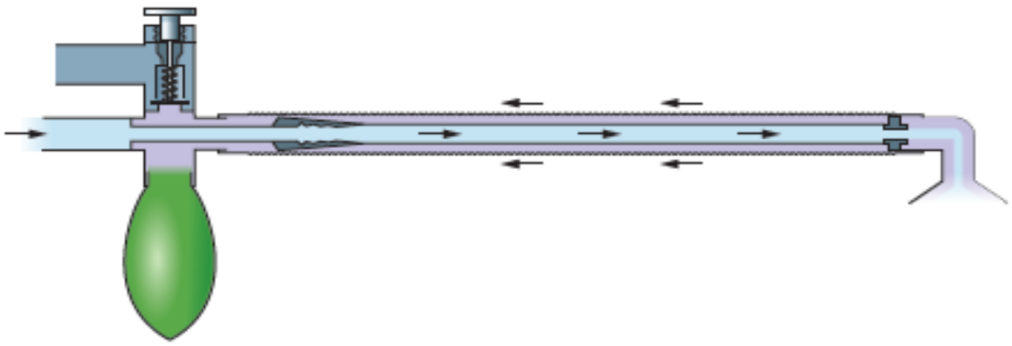


- Mapleson C (also known as the Waters circuit) is lightweight and compact. It is used in resuscitation situations as an alternative to self-inflating bag. By adjusting the APL valve, it allows positive end-expiratory pressure (PEEP) with a visual and tactile ventilation monitor.

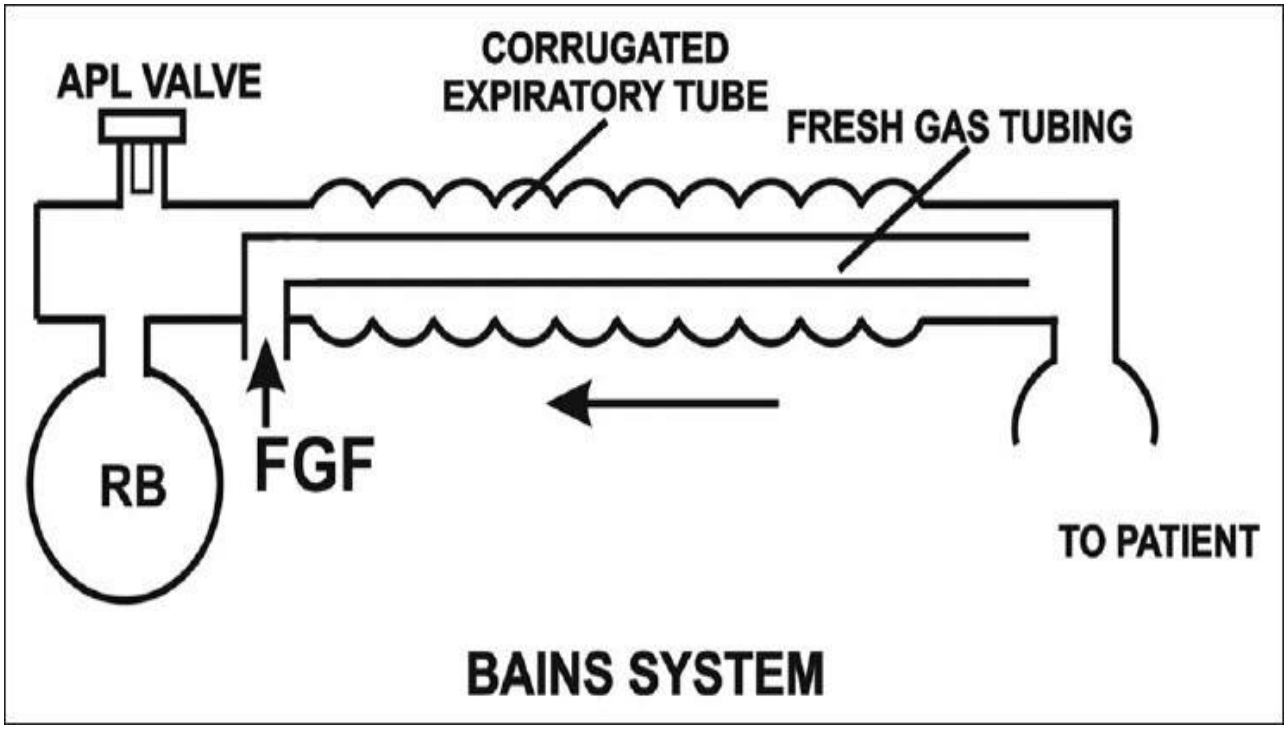


The Bain Circuit

- It is a modification of the Mapleson D
- It is a co-axial circuit
- Fresh gas flows down the central narrow bore tubing to the patient and exhaled gases travel in the outer corrugated tubing.
- The reservoir bag may be removed and replaced by a ventilator
- It is lightweight and compact at the patient end. It is useful where access to the patient is limited, such as during head and neck surgery.



- The internal tube can kink, preventing fresh gas being delivered to the patient.



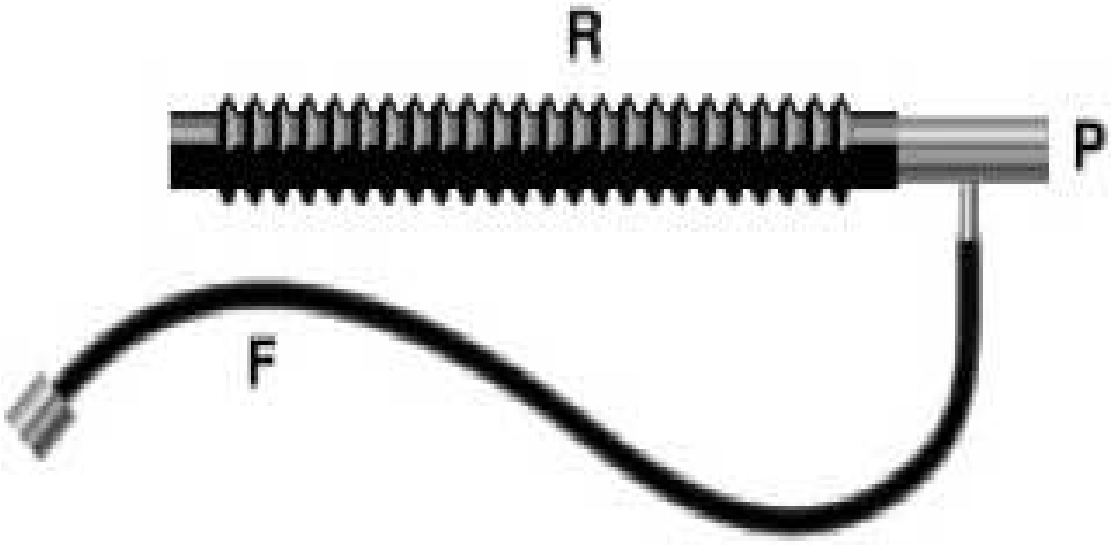
T-piece system (Mapleson E and F)

- This breathing system used in anaesthesia for children up to 25–30 kg body weight. It is suitable for both spontaneous and controlled ventilation.
- They are all functionally similar.
- They act as T pieces.
- FGF delivered to the patient end of the circuit and differ only in the presence of valves or breathing bags at the expiratory end of the circuit.
- There are no valves and there is very little resistance to breathing
- It is known as the ayre's t-piece

Components Mapleson E

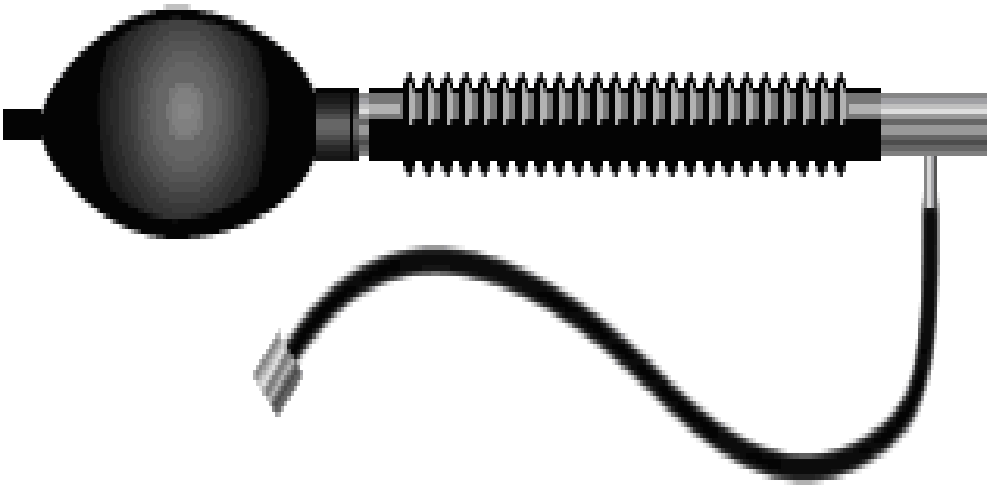
- A T-shaped tubing with three open ports.
- Fresh gas from the anaesthetic machine is delivered via a tube to one port.
- The second port leads to the patient's mask or tracheal tube. The connection should be as short as possible to reduce dead space.
- The third port leads to reservoir tubing. Jackson-Rees added a double-ended bag to the end of the reservoir tubing (making it Mapleson F).
- A recent modification exists where an APL valve is included before a closed-ended 500 mL reservoir bag. A pressure relief safety mechanism in the APL valve is actuated at a pressure of 30 cm H2O. This design allows effective scavenging.

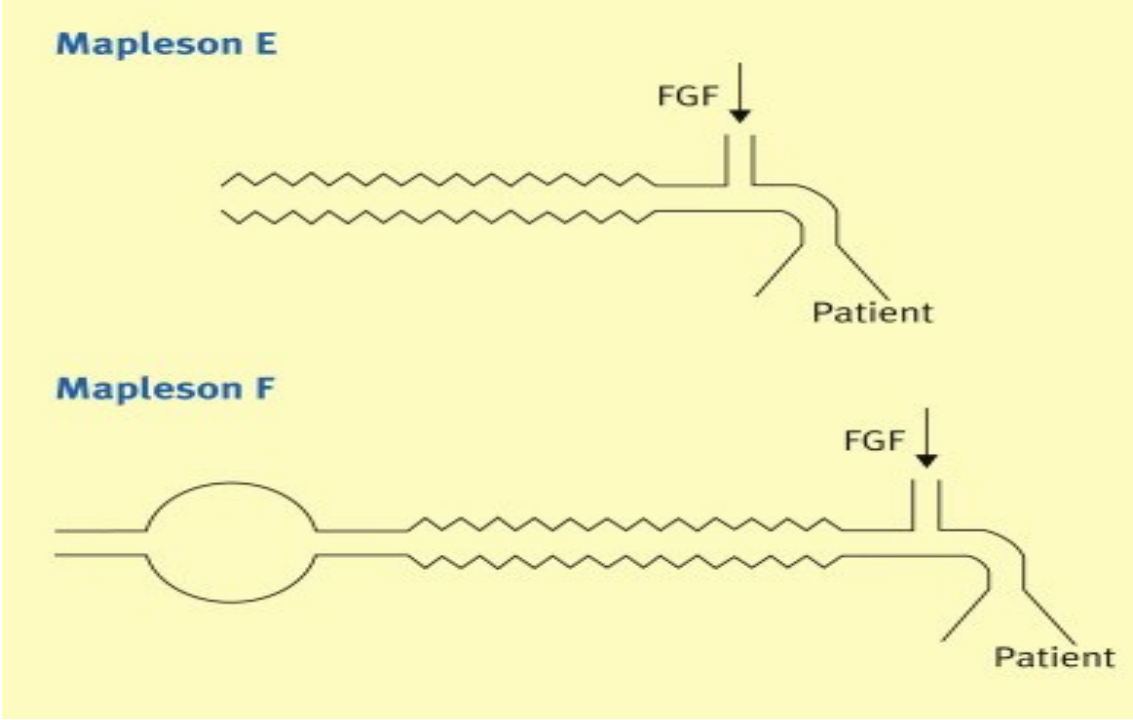
Mapleson E System



Mapleson F system

- Jackson-Rees modification
- It has an open bag attached to the expiratory limb
- Classified as a Mapleson F system
- Movement of the bag can be seen during spontaneous breathing, and the bag can be compressed to provide manual ventilation.
- This system is suitable for children up to 25–30 kg





A T-piece breathing system.

Intersurgical T-piece incorporating an APL valve and closed reservoir bag to enable effective scavenging.

Mapelson sys	Uses	Spont. Vent.	Controlled Vent.
A	Most efficient in spont. Vent.	1 X MV	2–3 X MV
B & C	Not efficient rarely used	2–3 X MV	2–3 X MV
D	Controlled vent	2–3 X MV	1 X MV
E	uncommon	2–3 X MV	2–3 X MV
F	Pediatric pt <25Kg	2–3 X MV	2–3 X MV
Lack	Not commonly used	1 X MV	2–3 X MV
Bain	Most common coaxial sys used	200–300 ml/kg/min	70 ml/kg/min

The Humphrey A D E Circuit

- Combination of the Mapleson A, D and E Systems
- It can therefore be used efficiently for spontaneous and controlled ventilation in both adults and children
- Single circuit that can be changed from a Mapleson A system to a Mapleson D by moving a lever on the metallic block
- Depending on the position of the control lever at the Humphrey block
- Both parallel and coaxial versions exist with similar efficiency. The parallel version will be considered here.

The Humphrey A D E Circuit

- During spontaneous ventilation

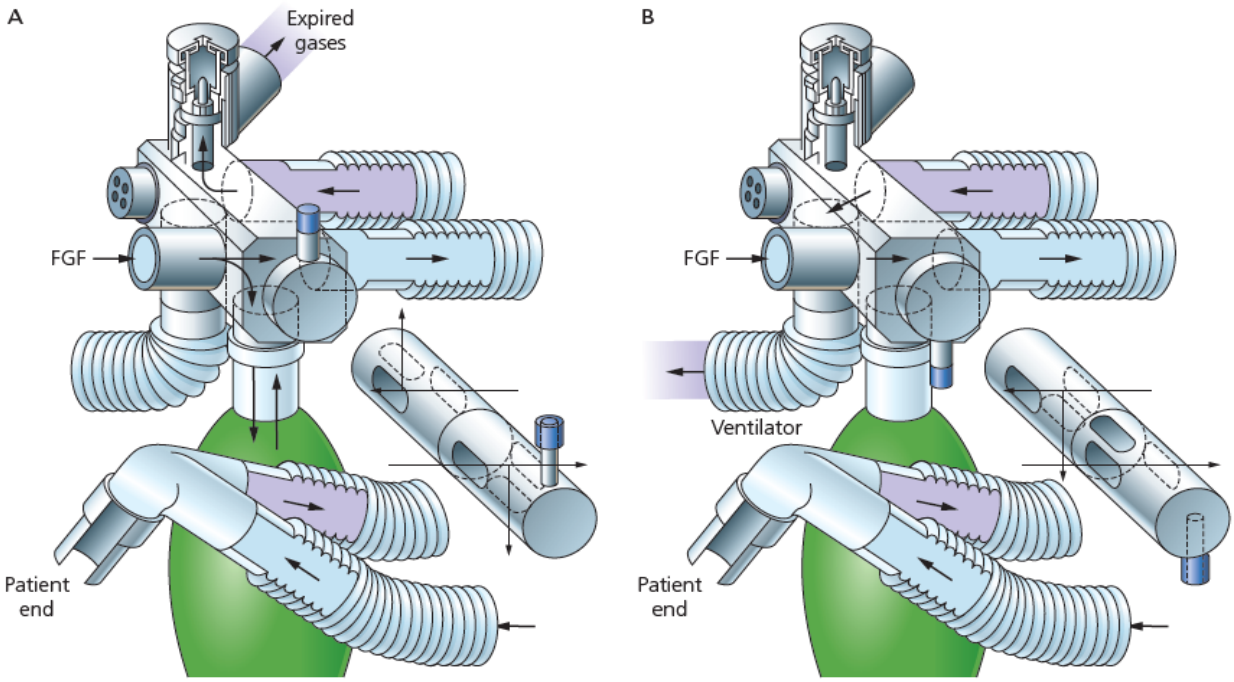
a. an FGF of about 50–60 mL/kg/min is needed in adults

b. the recommended initial FGF for children weighing less than 25 kg body weight is 3 L/min. This offers a considerable margin for safety.

- During controlled ventilation

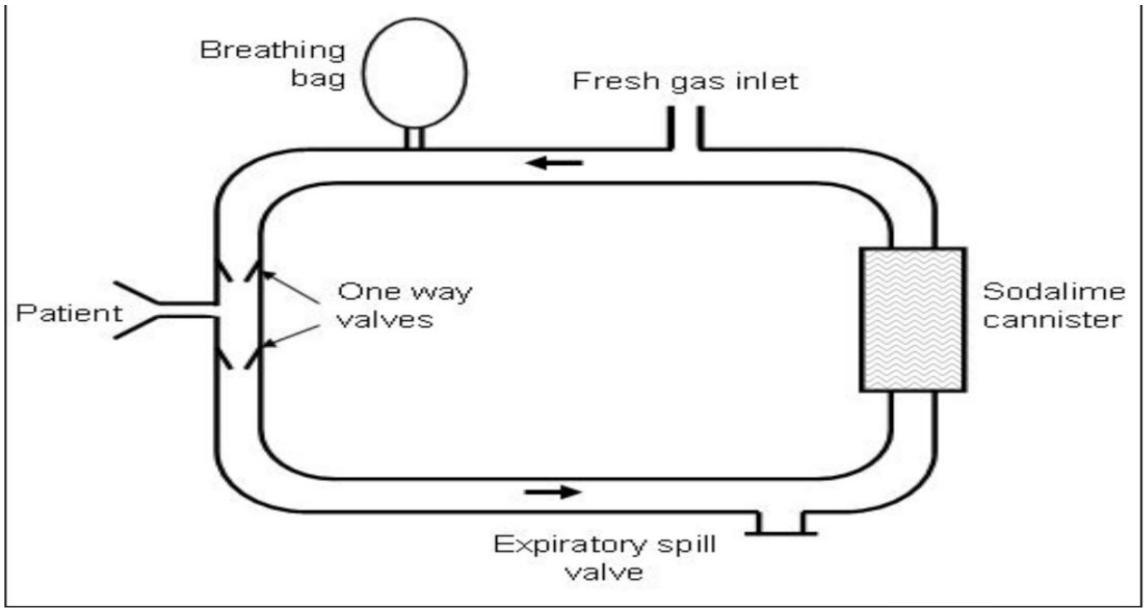
a. an FGF of 70 mL/kg is needed in adults

b. the recommended initial FGF for children weighing less than 25 kg body weight is 3 L/min. However, adjustment may be necessary to maintain normocarbia.



The humphrey A D E circuit

Design Of Circle System

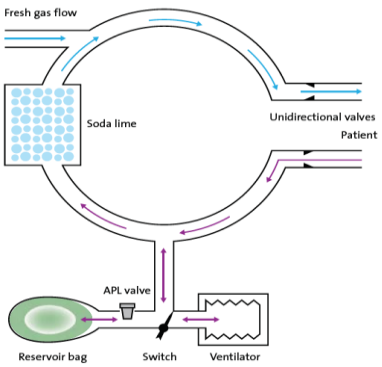


Circle Systems

- It is to absorb CO2 from the expired gases which are then recirculated to the patient. These circuits require smaller amounts of fresh gas each minute.
- Soda lime (a mixture of 94% calcium hydroxide and 5% sodium hydroxide, and 1% potassium hydroxide)
- Soda lime also contains silica and a chemical dye which changes color with pH.
- When around 75% of the soda lime has changed color it should be replaced.
- The soda lime canister should be mounted vertically on the anesthetic machine
- Fresh soda lime contains 35% water by weight
- Anther Barylime, which consists of barium hydroxide (80%) and calcium hydroxide (20%).

Colour changes can be from white to violet/purple (ethyl violet dye), from pink to white (titan yellow dye) or from green to violet. Colour changes occur when the pH is less than 10

1 kg can absorb more than 120 L of CO2.



Classified the FGF used in anesthetic practice into the following categories:

- Metabolic flow: About 250 mL/min.
- Minimal flow: 250–500 mL/min.
- Low flow: 500–1000 mL/min.
- Medium flow: 1–2 L/min.