* Anesthesia Machine Dr. ibraheem

* gases → essential: Oxygen, Air
→ Anesthetic: N_2O

* Sources of gases:-

↑ Pressure System

Cylinders

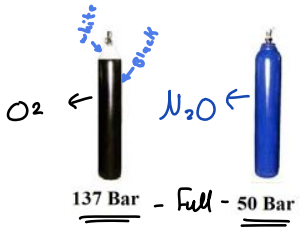
OR

↓ Pressure System

Central pipeline supply

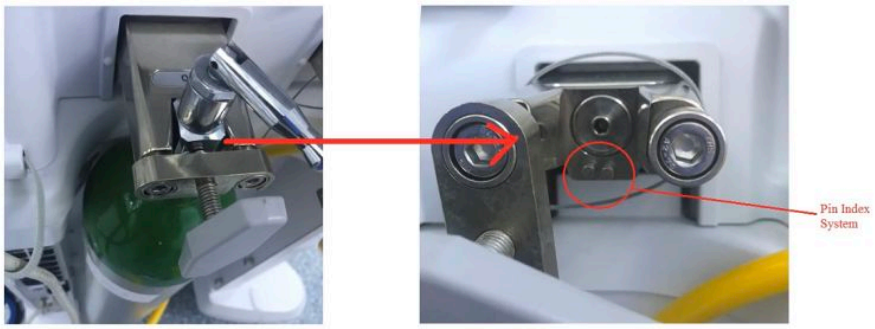
~173 Bar — These pressures are not suitable for the body's normal physiology! So we need to ↓ these Pressures into values close to normal pressure values (760 mmHg) through: pressure reducing valves → 1st function of Anesthesia Machine:- ↓ of Stored gas pressure.

— 4 Bar



✱ Safety system in Gas Sources :-

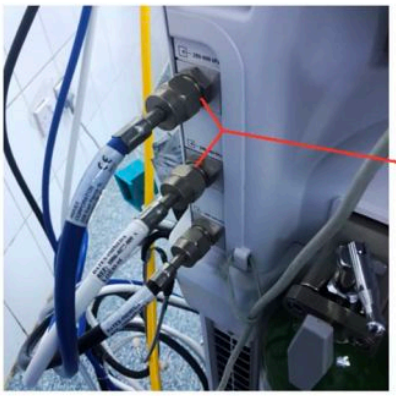
" Pin index system "



" color coded safety system"

GAS	USA	INTERNATIONAL
oxygen	Green	White
Carbon dioxide	Gray	Gray
Nitrous oxide	Blue	Blue
helium	Brown	Brown
Nitrogen	Black	Black
air	Yellow	White & black

"different diameter index system"



Central pipeline supply

Different Diameter Index system

* now after gases are ready to be used &-

→ they leave to Anesthesia Machine through "Fresh GAS outlet" a next to this FGO there's a switch that'll direct direction of gas from this outlet either to → outside so i can connect it to anesthesia breathing circuits "mapelson system"

* semi - open breathing circuits

Best for spontAneous breathing

Mapelson A (Magil Circuit)

Best for controlled ventillation

Mapelson D (Bain Circuit)

Mapelson (E without bag) (F with Bag, or Jackson Rees circuit)

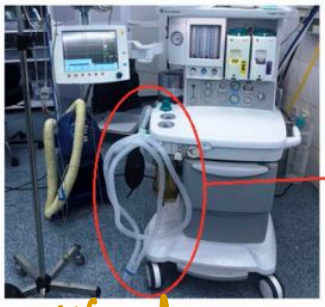
if we add bag to mapelson E

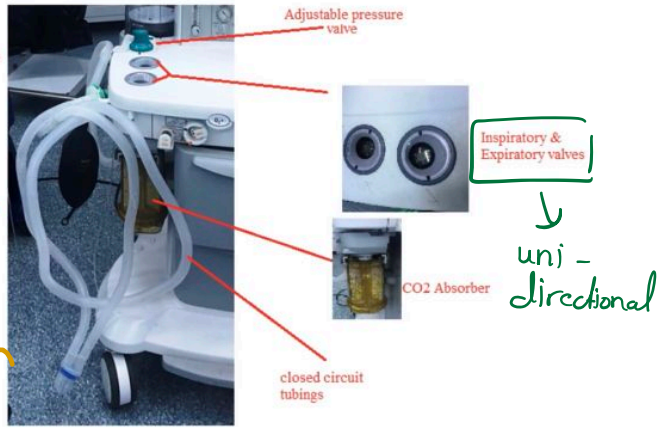
* disadvantages → need (large volume) of gases to expel remaining gases & prevent re-breathing

→ breathing circle

* closed circle system ⇐ الهواء الي راجع من

اردين بزجح نغطيه باه مرة تانية لكن بعد ما يمر بال soda lime





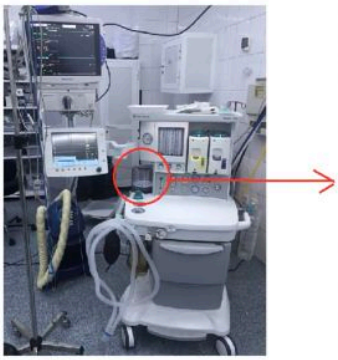
uni - directional

inspired gas humidified & warm

* من الحسنات كاي ال circle انو بستخدم كمية قليلة من الغاز

* disadvantages :- so many connections = need ↑ attention.

* Ventillator of Anesthesia Machine ⇒ simple ventillator with limited options



أغير اتجاه استخدام الغازات ⇐ بين ال Ventillator وبين ال Breathing circuit

* Vapoures :· inhalational anesthetic agents

→ Vapourizers :· devices that convert vapour into gas.

* each vapour has its own [Saturated vapour pressure] ⇒ u CAN'T use the vapourizer of a certain substance for another one

→ this piece is called [Dial] & it determine the dose of the vapour that is going to the patient

*ex:· 1 volume% means that each 100 ml of gases going to Pt composed of
- 1ml من بخار المادة المعنية
- 99ml غازات حاملة

⇒ 2nd Function of Anesthesia machine :· evaporation of liquid inhalational anesthetic agents & delivering them at required concentrations!

* regarding the amount of GASES that i want to deliver to the pt during surgery :-

→ unit :- L/min

→ determined through Flow meter

Rotating bobbin

↳ diameter ↑ As you go up ↑ to ↑ the flow

As the bobbin goes up

→ safety Anti-hypoxia system mechanism in the flow meter :-

https://healthprofessions.udmercy.edu/academics/na/agm/Images/agm104.jpg

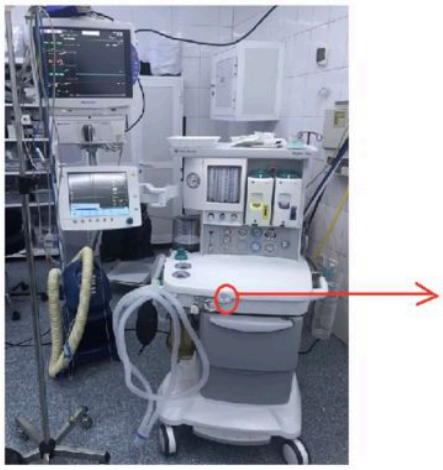
→ this part ensures that N_2O won't be open without opening of oxygen (3:1)

N_2O O_2

& FiO_2 shouldn't be less than 23%

⇒ 3rd Function :- providing flow of Required medical gases at specific rates!

* Accessory parts of Anesthesia machine:-



↳ oxygen Flush ⇒ air leaves under pressure of Ubar

to clean system from particles of anesthesia

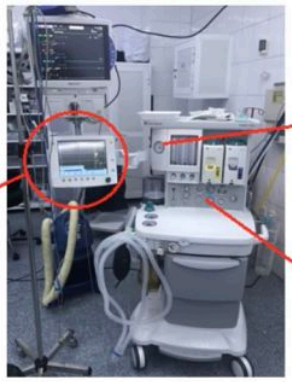
*if u press on it while patient is on ventillator

this'll cause Barotrauma !

* Monitoring Of Anesthesia Machine:

(↑ in kinking / Broncho constriction)

حديث في ضغط في الأنابيب الواحدة الكرفس



Airway and tubing pressure monitor

ventilator settings & spirometry monitor

Gas supply pressue monitor

↓

monitor pressures in breathing circuit

⊕

control panel to ventillator from which i can determine (Tidal volume, RR, IE ratio)

& either cylinder / Pipelines

TABLE 3–2 Classification and characteristics of Mapleson circuits.

Mapleson Class	Other Names	Configuration[1]	Required Fresh Gas Flows: Spontaneous	Required Fresh Gas Flows: Controlled	Comments
A	Magill attachment	APL valve; Breathing tube; FGI; Breathing bag; Mask	Equal to minute ventilation (≈80 mL/kg/min)	Very high and difficult to predict	Poor choice during cotrolled ventilaton. Enclosed Magill system is a modification that improves efficiency. Coaxial Mapleson A (Lack breathing system) provides waste gas scavenging.
B		FGI; APL valve	2 × minute ventilation	2–2½ × minute ventilation	
C	Waters' to-and-fro	FGI; APL valve	2 × minute ventilation	2–2½ × minute ventilation	
D	Bain circuit	APL valve; FGI	2–3 × minute ventilation	1–2 × minute ventilation	Bain coaxial modification: fresh gas tube inside breathing tube (see Figure 3–7).
E	Ayre's T-piece	FGI	2–3 × minute ventilation	3 × minute ventilation (I:E-1:2)	Exhalation tubing should provide a larger volume than tidal volume to prevent rebreathing. Scavenging is difficult.
F	Jackson-Rees' modification	FGI; APL valve	2–3 × minute ventilation	2 × minute ventilation	A Mapleson E with a breathing bag connected to the end of the breathing tube to allow controlled ventilation and scavenging.

[1]FGI, fresh gas inlet; APL, adjustable pressure-limiting (value).

Slide #: 14

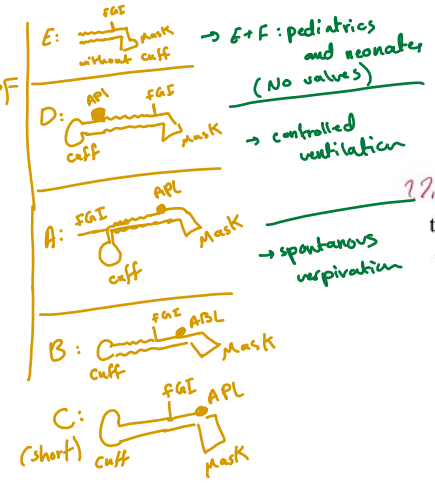
Inspect the attached photo.

Identify this breathing circuit class

Mapleson F (Jackson - Rees' circuit)

Where is it used?

pediatric anesthesia



Inspect the attached picture.

Identify this piece of anesthesia equipment: Pediatric anesthesia

Mapleson F (Jackson-Rees' circuit)

How much fresh gas flow is needed to prevent re-breathing during spontaneous ventilation when using it?

- 2.5 - 3 X minute ventilation
- if it was controlled 2 X minute ventilation

Inspect the two gas source cylinders used during Anesthesia.

1:- Mention the name of gas in each cylinder.

A:- Air

B:- N_2O

2:- Which Cylinder has its content in both gas and liquid states?

N_2O

3:- What anesthetic properties does the gas Cylinder B have? ↓ hypoxic drive

Slide 12

Identify the numbered items in the attached photo.

1:- vaporizer

2:- flow meters

3:- Airway & tubing pressure monitor

4:-

Identify the numbered anesthesia machine parts shown.

1- Flowmeters

2- Vaporizer

3- Nitrous oxide

4- Air

What is the function of the numbered parts on this Anesthesia machine.

1) vaporizer (Liquid to vapor)

2)

3) ventilation (to deliver oxygen to the patient)

4) absorb CO_2

1- What airway management is used in this figure? Head tilt + chin lift

2- What Mapleton class is the anesthesia circuit being used? F

3- How many valves does this circuit contain? no valves

4- How much fresh gas flow is needed to prevent rebreathing when using this circuit? 2 X minute ventilation

The attached figures show the connections of Anaesthetic gas supplies to the anaesthesia machine:

A- Which one is a high pressure system: A

B- Which one provides gases at pressures about 2 bar? B

Identify the numbered anesthesia machine parts shown.

1) Iso flowm. Vaporizer

2) Flowmeters

3) Bellows

4) CO_2 absorber

Slide # 11

Inspect the attached photo.

1) What does this canister contain?

Soda lime

2) Which anesthesia circuit is it used in?

Circle system

Slide: 6

1- What is this machine used for during Anesthesia care? Barr hugger warming up the patient.

B- Mention 3 possible problems that are prevented by its use.

1: hypothermia

2: infection

3: delayed recovery

Slide # 9

Inspect the attached photo and complete the following sentences based on medical gas colour-coding system:

A- Cylinder 1 is for Oxygen.

2- Cylinder 4 is for Air.

3- Cylinder 3 is for Nitrous oxide.

4- Cylinder 2 is for Carbon dioxide.