

Title : Braking Systems (Automobile Engineering)

Date: 27/03/2020 (11:30 am to 12:30 pm)

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Lecture No : 03 (8th sem MED)

Source of information : Automobile Engineering / Tech-Max Publications, Page

No. 4-69 to 4-78

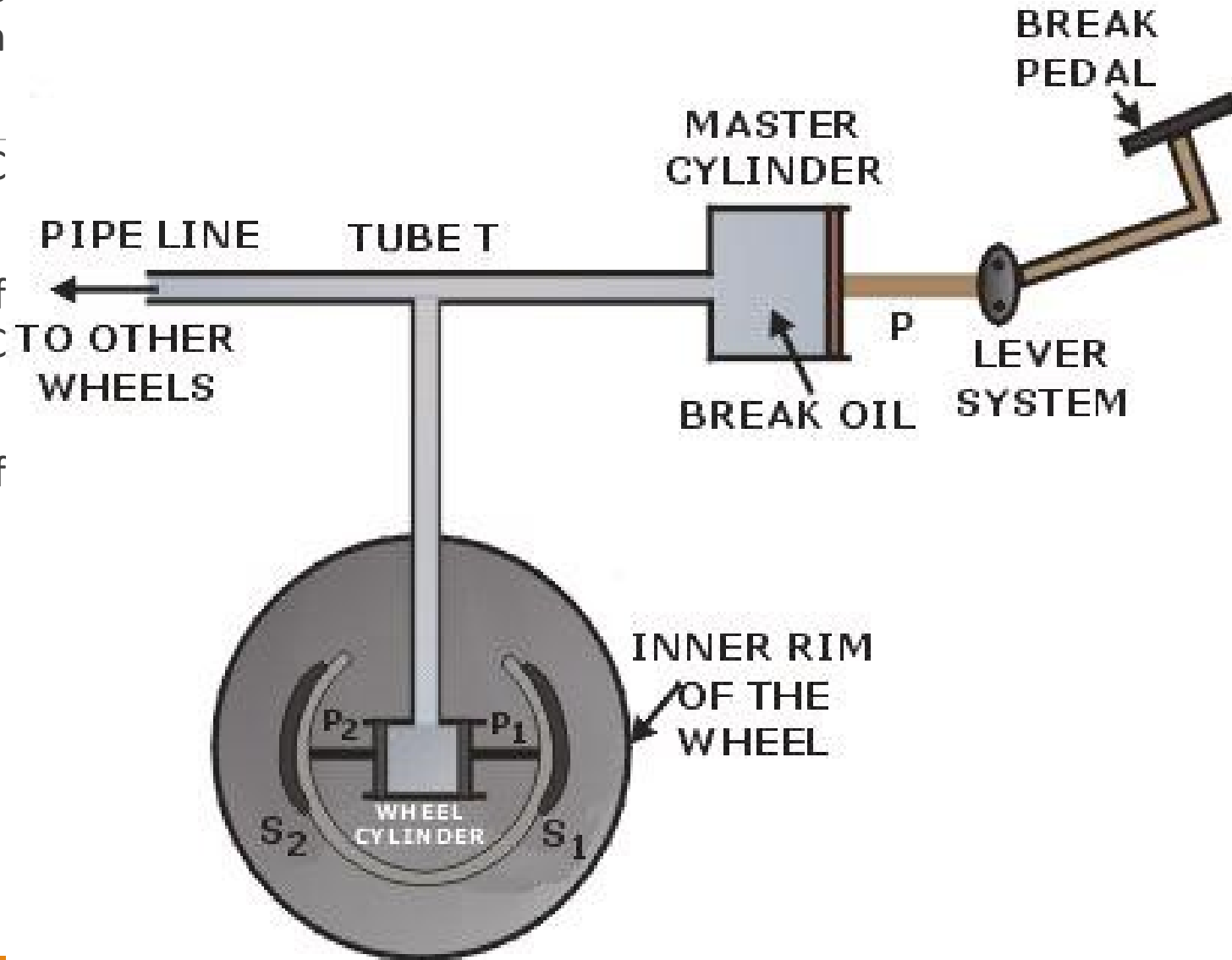
Hydraulic brakes

Hydraulics is the use of a liquid under pressure to transfer force or motion, or to increase an applied force.

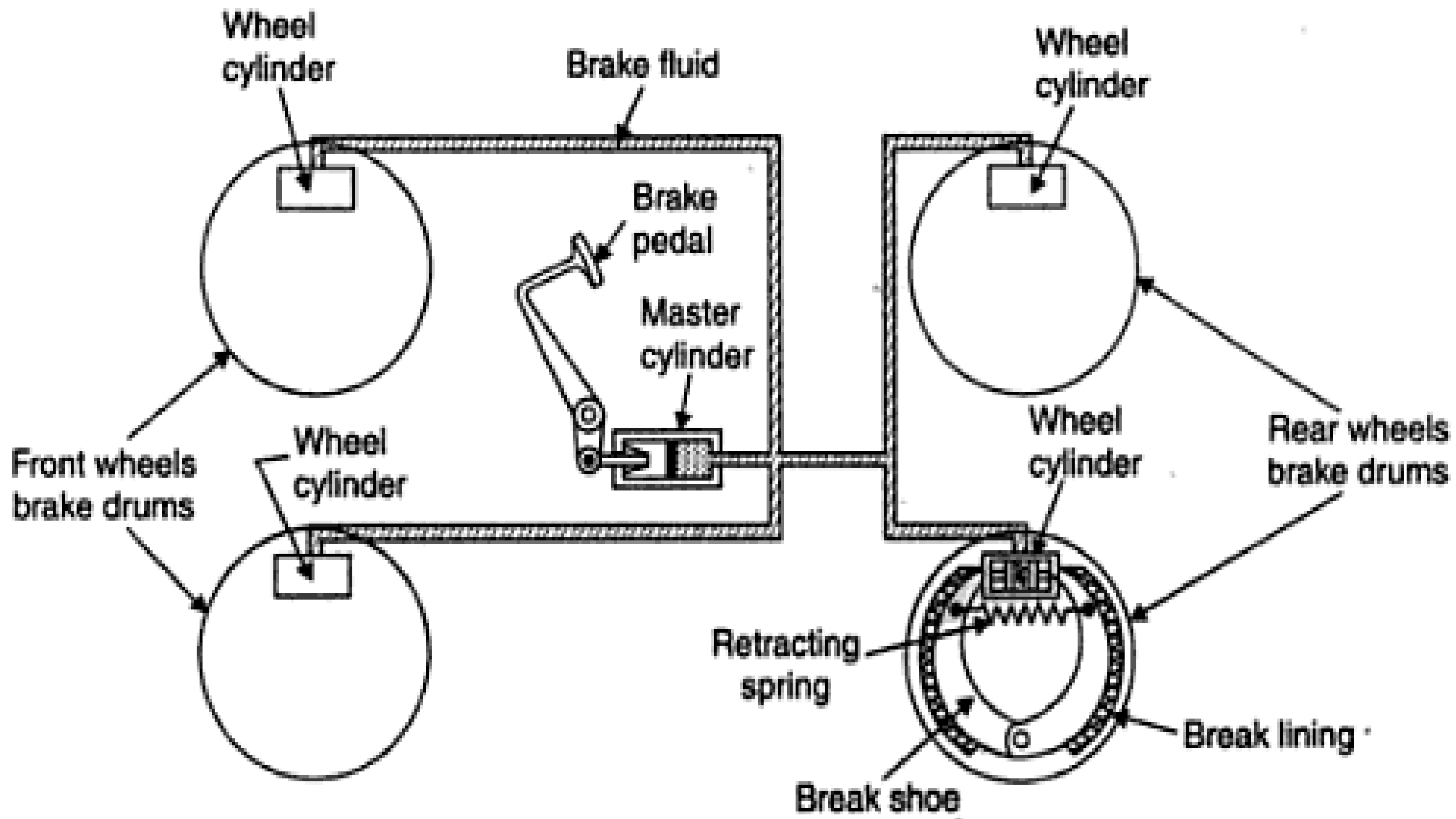
The pressure on a liquid is called HYRAULIC PRESSURE.

And the brakes which are operated by means of hydraulic pressure are called HYDRAULIC BRAKES.

These brakes are based on the principle of Pascal's law.



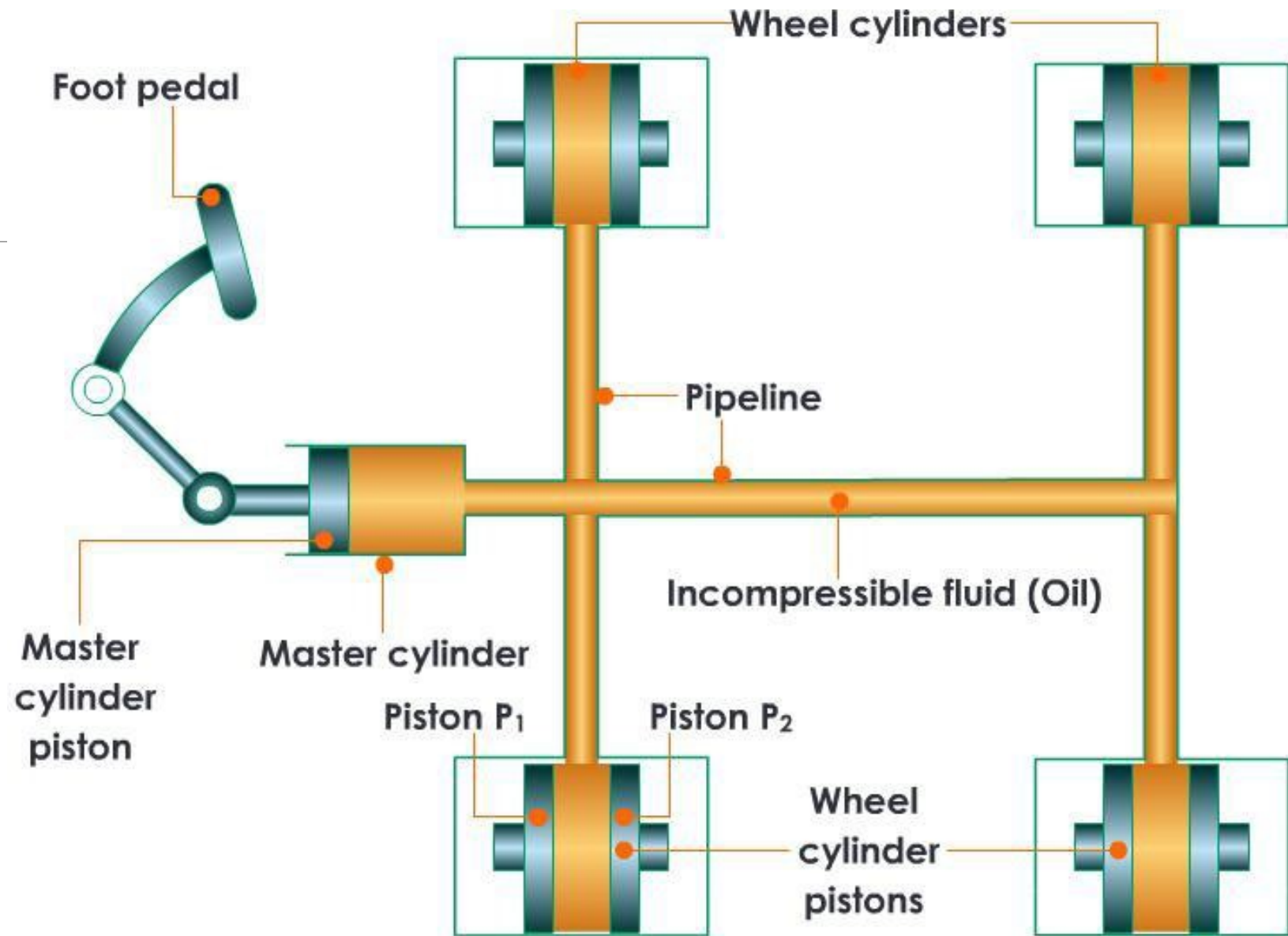
Hydraulic Brake



PASCAL'S LAW

The pressure exerted anywhere in a mass of confined liquid is transmitted in all directions throughout the liquid.

Applied in hydraulic lifts, hydraulic brakes etc.



Advantages :

1. Equal braking effort to all the four wheels (since fluid exerts equal pressure every where in the circuit).
2. The system is simple in construction.
3. Less rate of wear (due to absence of joints compared to mechanical brakes).
4. The system is mostly self-lubricating.
5. Increased braking effort.
6. High mechanical advantage.
7. Flexibility in brake lines.
8. The hydraulic brakes can also provide differential braking action between the front and rear brakes by using the wheel cylinder of different size for the front and rear wheels.

Disadvantages :

1. Even slight leakage of air into the braking system makes it useless.
2. The brake shoes are liable to get ruined if the brake fluid leaks out.
3. This system is suitable only for applying brakes *intermittently*. For parking purpose separate mechanical linkage has to be employed.

Hydraulic brake fluid

Most fluid are based on polyglycol and other additives

- 1. Should be non-compressible.**
- 2. Must remain fluid at low temperature.**
- 3. Should not rust corrode or rust metallic parts in the brake system.**
- 4. Mix satisfactorily with other makes of hydraulic fluids.**
- 5. Must be chemically stable.**
- 6. Should not soften the rubber parts used in the hydraulic brake system.**
- 7. Must act as a lubricant to the moving parts inside the system.**
- 8. Must retain all its characteristics for a maximum long period.**

Power brakes

1. Air brakes

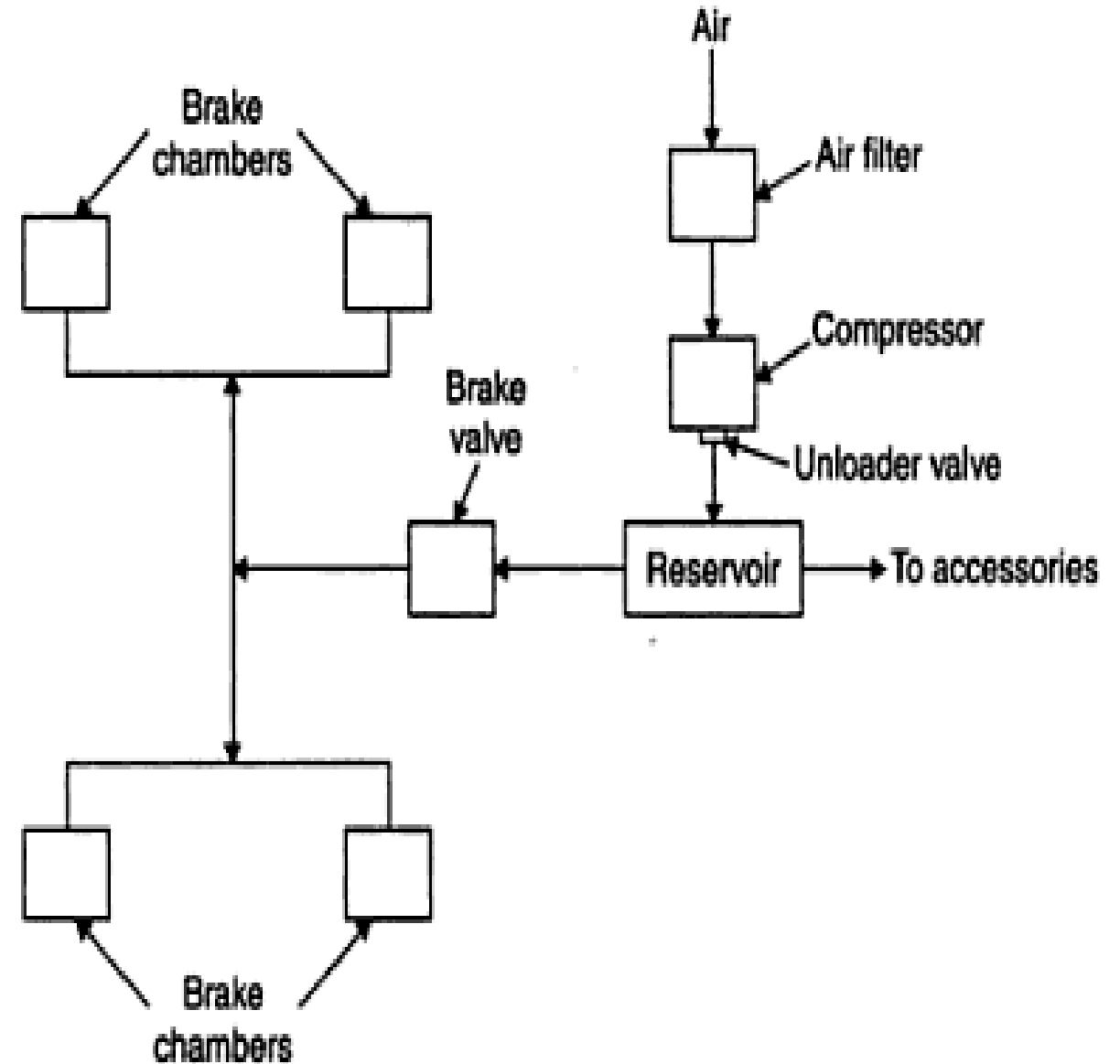
Air brakes are applied by the pressure of compressed air.

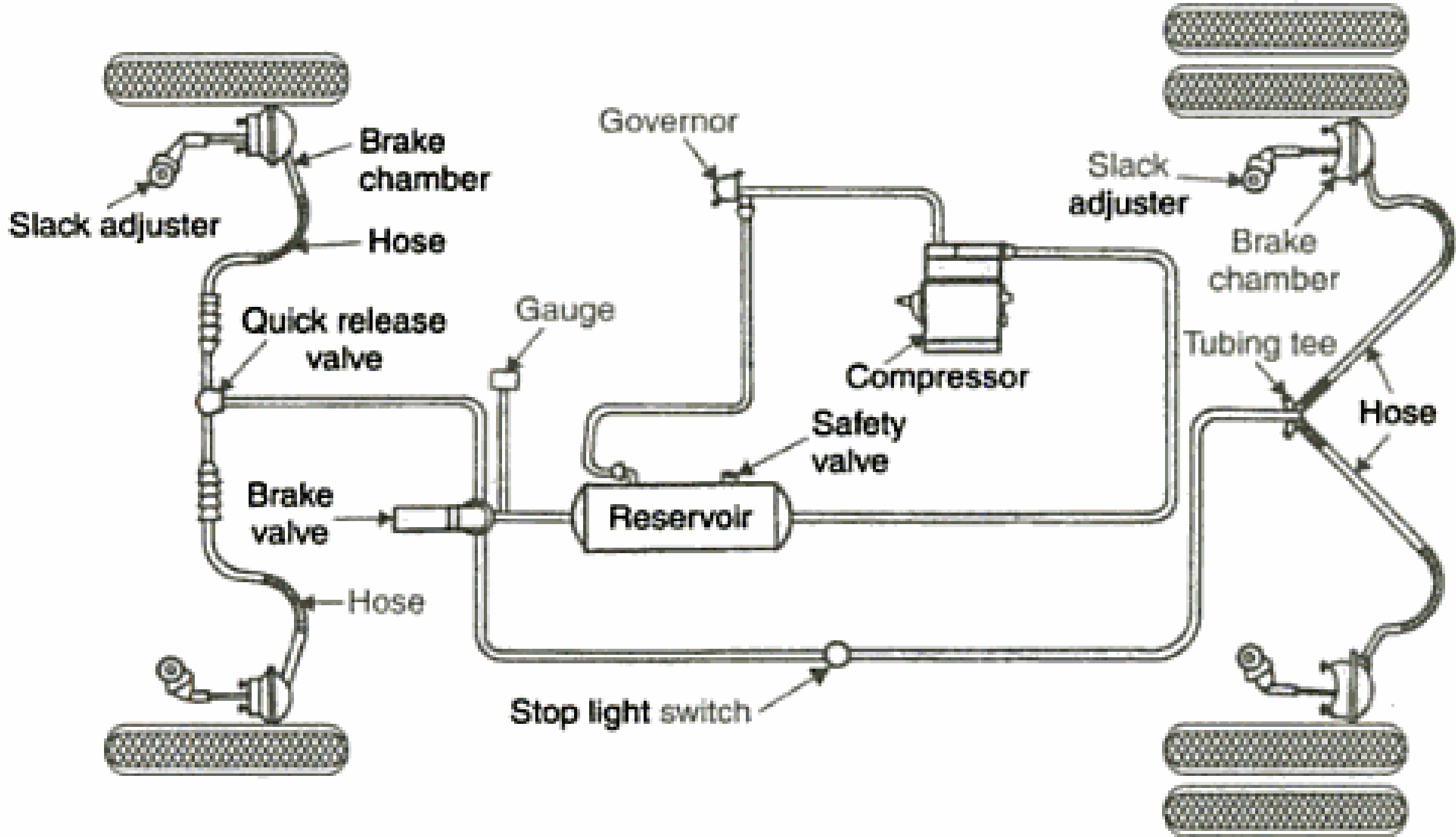
Air pressure applies force on brakes shoes through suitable linkages to operate brakes.

An air compressor is used to compress air. This compressor is run by engine power

Main parts of an air brake

1. Air compressor
2. Unloader valve
3. Reservoir
4. Brake valve
5. Brake chamber
6. Quick release valve
7. Relay valve
8. Warning signal





Advantages :

Air brakes entail the following *advantages* :

1. Much more powerful than the ordinary mechanical or hydraulic brakes (that is why these are exclusively used in *heavy vehicles*).
2. Simplified chassis design.
3. The compressed air from reservoir, apart from braking, can be used for tyre inflation, windscreen wipers, horns etc.

Disadvantages :

1. Involve relatively more parts.
2. The air compressor uses a certain amount of the engine power.

Power brakes

2. Air hydraulic brakes

An air hydraulic brake system is shown in figure.

This system combines the use of compressed air and hydraulic pressure for brake operation.

The air hydraulic brake system has an air hydraulic power cylinder that contains an air cylinder and a hydraulic cylinder in tandem.

Each cylinder is fitted with a piston and a common rod.

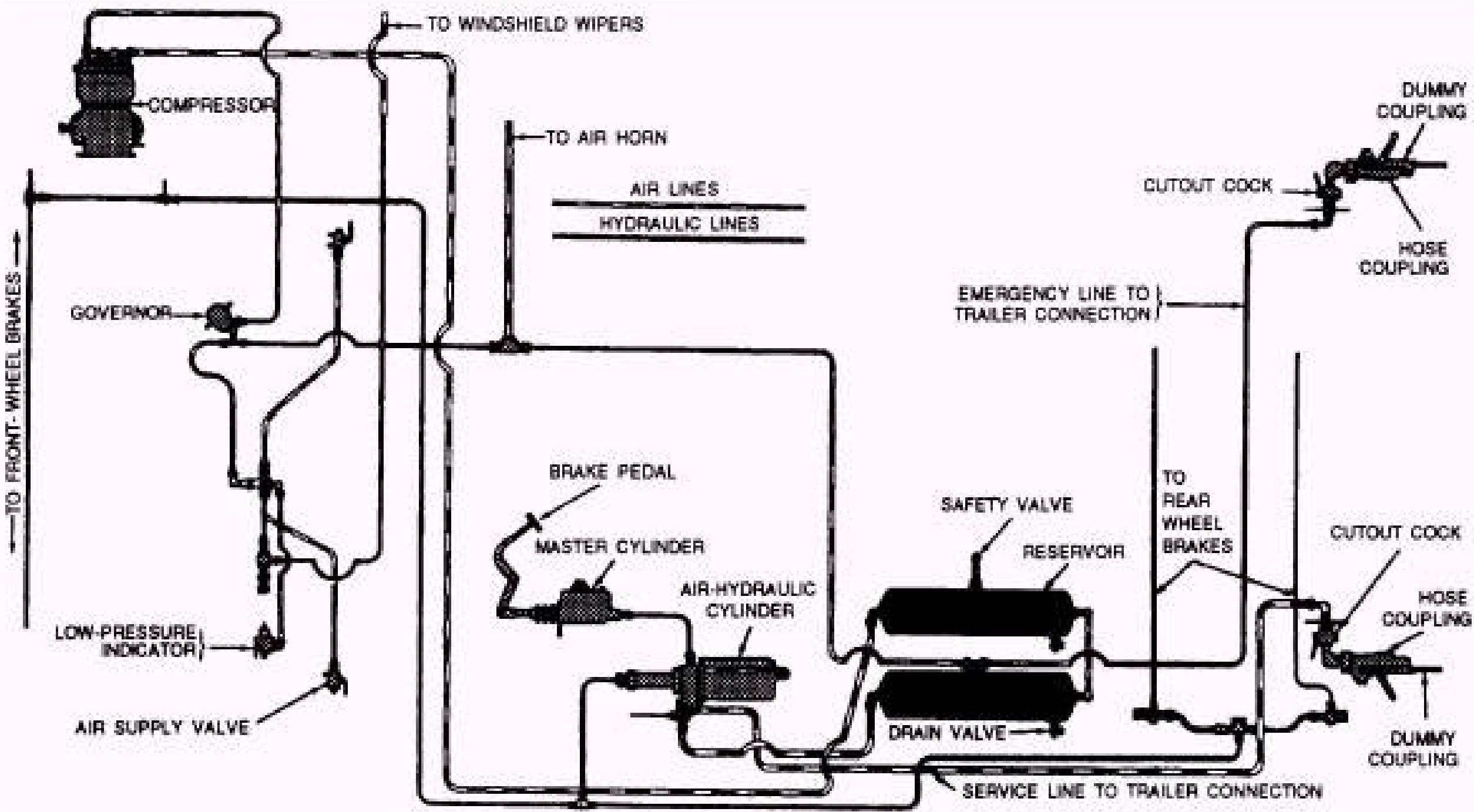
The air piston is of greater diameter than the hydraulic piston.

This difference in the two pistons results in much greater hydraulic pressure than air pressure admitted to the air cylinder.

Valve action varies with the amount of pressure applied to the brake pedal.

When heavy brake pedal pressure is applied by the operator for hard braking, the hydraulic pressure in the master cylinder (which operates the valves) causes greater valve movement.

As a result, the valve admits more air pressure into the air-over-hydraulic power cylinder and this higher air pressure causes a stronger braking action.



Power brakes

3. Vacuum brakes

*Any mechanism which adds to the driver's effort in applying the brakes is called a **servo mechanism** (It may be mentioned that servo is also used in place of power cylinders), although that effort remains a considerable part of the total braking effort required.*

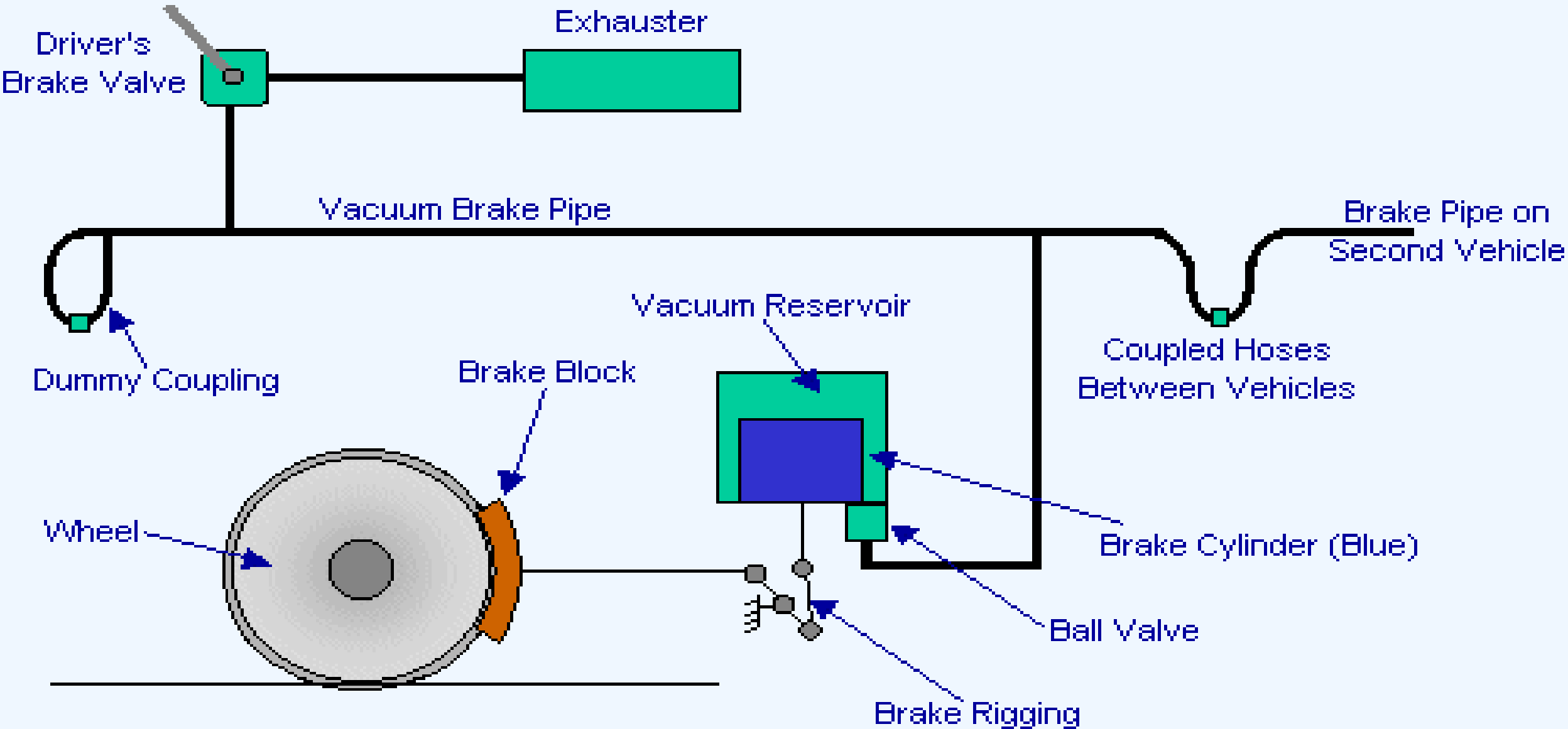
Initially mechanical servos were used, but after the introduction of vacuum operated servos these have become obsolete.

In the vacuum brakes the suction from the engine inlet manifold is utilised for brake application.

There are *two types* of vacuum brakes, both incorporating a piston or a diaphragm operating in a cylinder and provided with suitable linkage for brake application. A small vacuum reservoir is also there to provide enough vacuum for several brake applications even after the engine has stopped.

First type. In this system both sides of the piston are *exposed to atmosphere* when brakes are in the released position. For applying brakes, engine vacuum is applied on one side of the piston, subjecting the same to differential pressure and thus operating the linkage. This system is called "*atmospheric suspended*" system.

Second type. In this case both sides of the piston are *subjected to engine vacuum* in the brakes released position. To apply brakes, one side is exposed to atmosphere which provides the desired force on the piston. This system is called "*vacuum suspended*" system. This system is preferred over the first system since this is comparatively *more rapid in action*. These days *vacuum suspended brakes are predominantly used*.



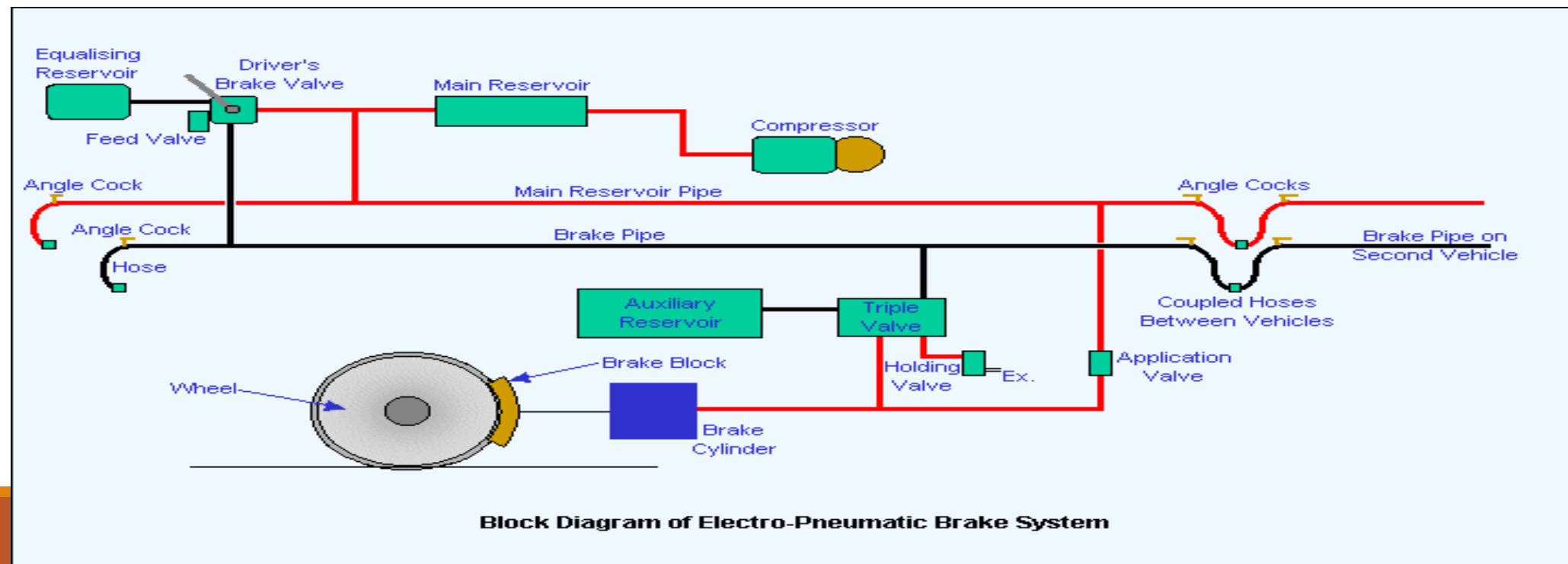
Block Diagram of Basic Vacuum Brake Equipment

Power brakes

4. Electric brakes

In an electric brake the current from the battery is utilized to energize an electromagnet within the brake drum. This actuates a cam to expand the brake shoes. When current stops, the cam and brake shoes are returned to the release position by retractor springs. The severity of braking is controlled by means of a rheostat, which is operated by the driver through the foot pedal.

Hydraulic pressure has also been used to apply electric brakes. As pedal is pressed more, hydraulic pressure actuates the rheostat to increase current to the electromagnet.



Advantages :

Electric brakes claim the following *advantages* :

- 1. Simple in design and installation.**
- 2. Simplified operating linkage (only one cable for each drum).**
- 3. Less time-lag between the pressing of brake pedal and application of brakes at the wheels.**
- 4. Much better control over the braking effort.**
- 5. Absence of grab.**
- 6. No adjustment required during its lining life.**
- 7. For trailer brakes, this type offers much simplified connections ; simply one cable has to be carried to the trailer side.**

SOME MORE POINTS

Most modern cars have disc brakes on front wheels and drum brakes on rear wheels and some wheels have disc brakes on all four wheels.

To increase safety, most modern car brake systems are broken into two circuits, with two wheels on each circuit.

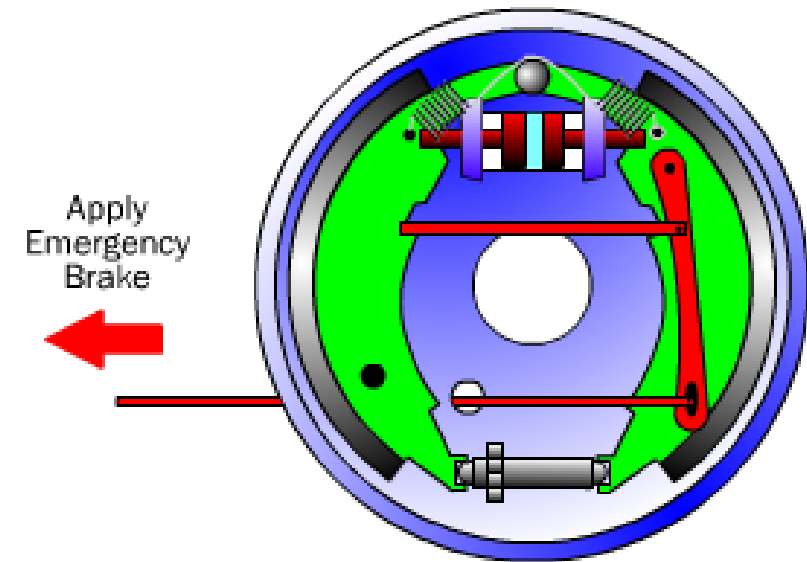
If a fluid leak occurs in one circuit, only two of the wheels will lose their brakes and the car will still be able to stop when we press the brake pedal.

HAND Brakes

The emergency hand brake on a car has to be actuated by a different power source than the primary braking system.

The drum brake design allows for a simple cable actuation mechanism.

When the emergency brake is actuated, a cable pulls on the lever, which forces the two shoes apart



Anti-lock brake systems (ABS)

The theory behind anti-lock brakes is simple.

A skidding wheel has less traction than a non-skidding wheel.

By keeping the wheels from skidding while you slow down, anti-lock brakes benefit you in two ways: You'll stop faster, and you'll be able to steer while you stop.

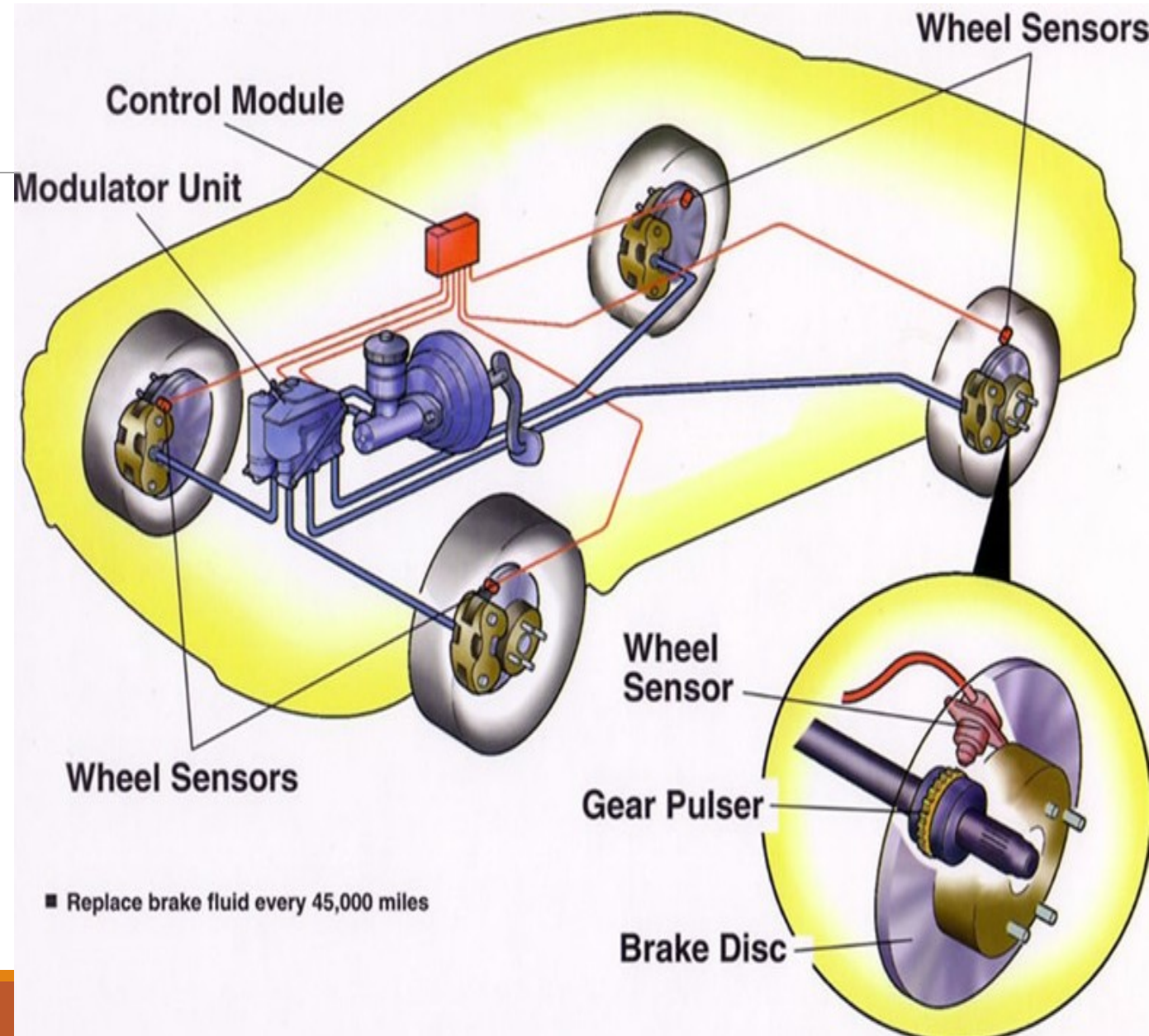
There are four main components to an ABS system

Speed sensors

Pump

Valves

Controller



Assignment No.04

1. Give the comparison between hydraulic brake and mechanical brake What do you mean by under steering and over steering?
2. Explain with neat sketch Air hydraulic brake.
3. Explain Antilock Braking System in detail.
4. Explain with neat sketch Electric brake.

Note:- Kindly write the above assignment in Separate notebook which you have submit it on 31/3/2020.

- If any query regarding above topic kindly contact me on my mobile no.:-9998213196

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Thank You