Thursday
AUGUST 04

Cooling Systems

In I.C. engine the temp^{r} of the gases inside the cylinder may vary from 25°C to 2750°C during the cycle. So if an engine is allowed to run without external cooling, the cylinder walls, cylinder and piston will tend to assume the average temperature of the gases to which they are exposed, which may be order of the order of 1000° to 1500°C is such in this range of temp^{r}. The metals will lose their characteristics and piston may expand considerably and engine may siege.

So cooling system is provided for following reasons

1) The even expansion of the piston in the cylinder may result in siezure of the piston.

2) High temp^{r} of the piston & cylinder Important
liner reduces strength.

3) Overheated cylinder may lead to pre-ignition of the charge

4). Physical & chemical changes may occur in lubricating oil which may cause sticking of piston rings and excessive wear of cylinder

About 25 to 35% of the heat is carried away the cooling system.

Mainly two methods.

1. Air cooling 2. Liquid Cooling

Fig

This liquid cooling may be

1) Thermo Syphon cooling
2) Forced or pump cooling
3) Cooling with thermostatic regulator
4). Pressurised water cooling
5) Evaporation cooling

Figs.

These things you are supposed to get in previous semester

Important

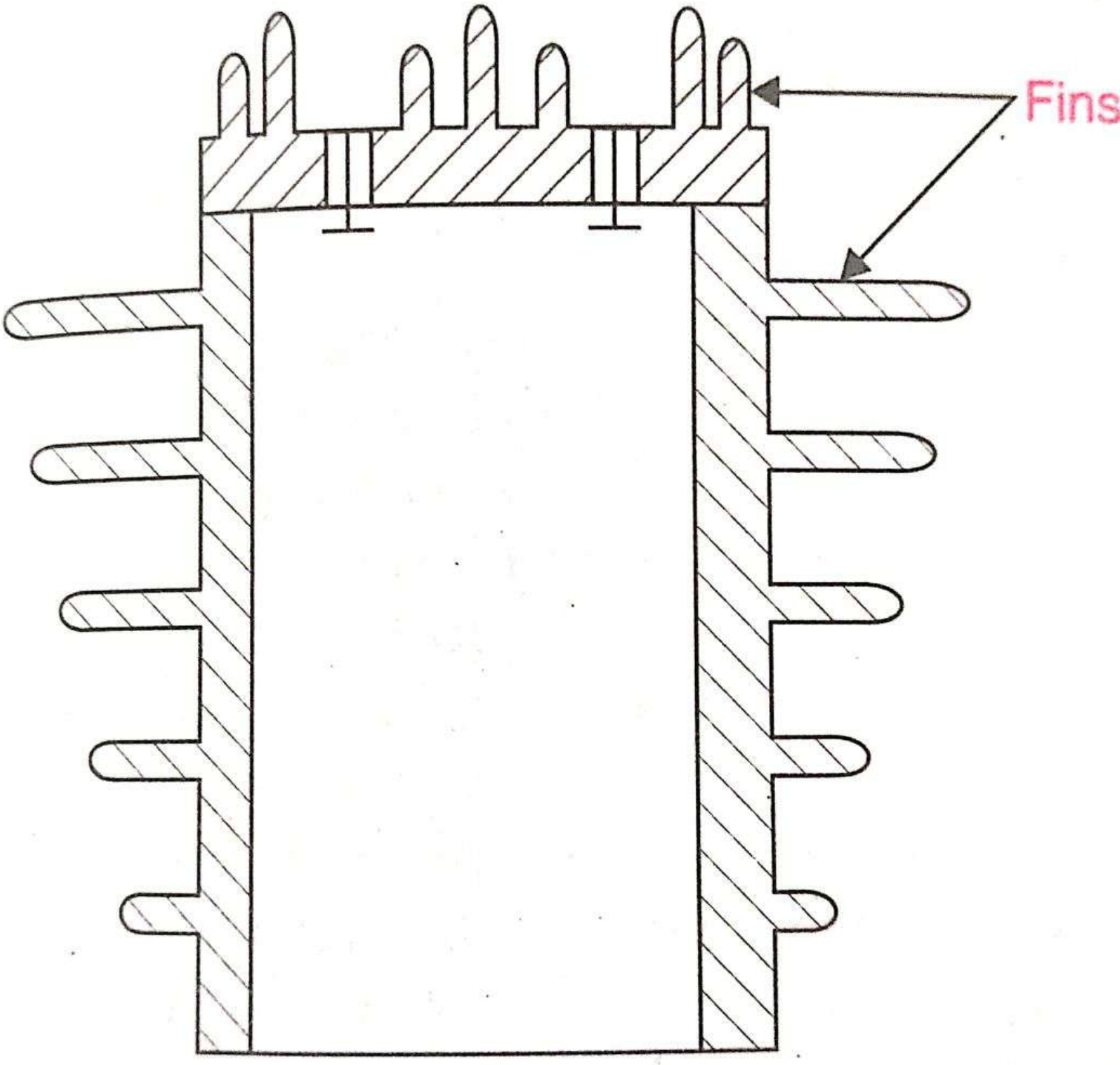


Fig. 4.17. Air cooling.

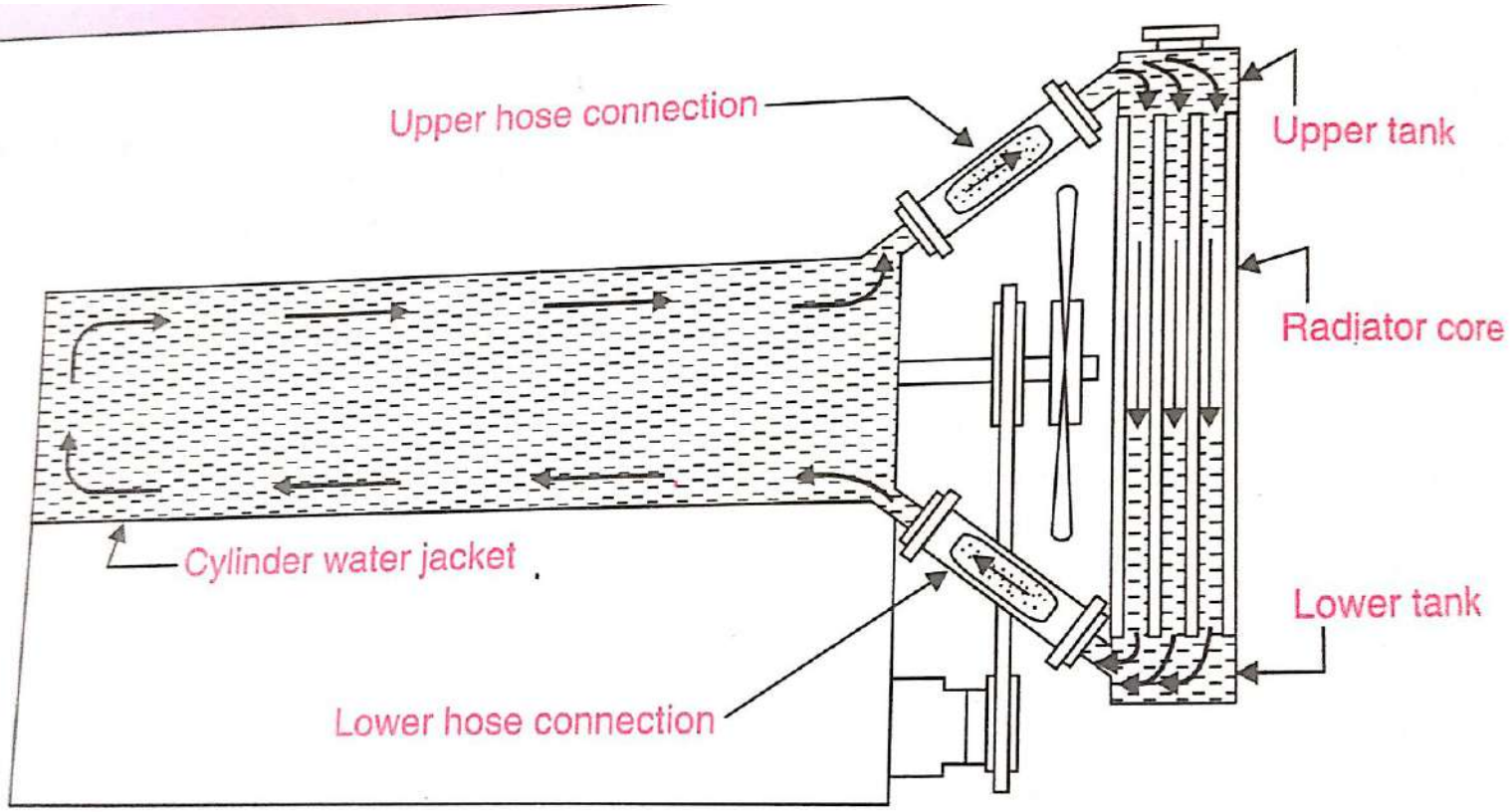


Fig. 4.18. Thermo-syphon cooling.

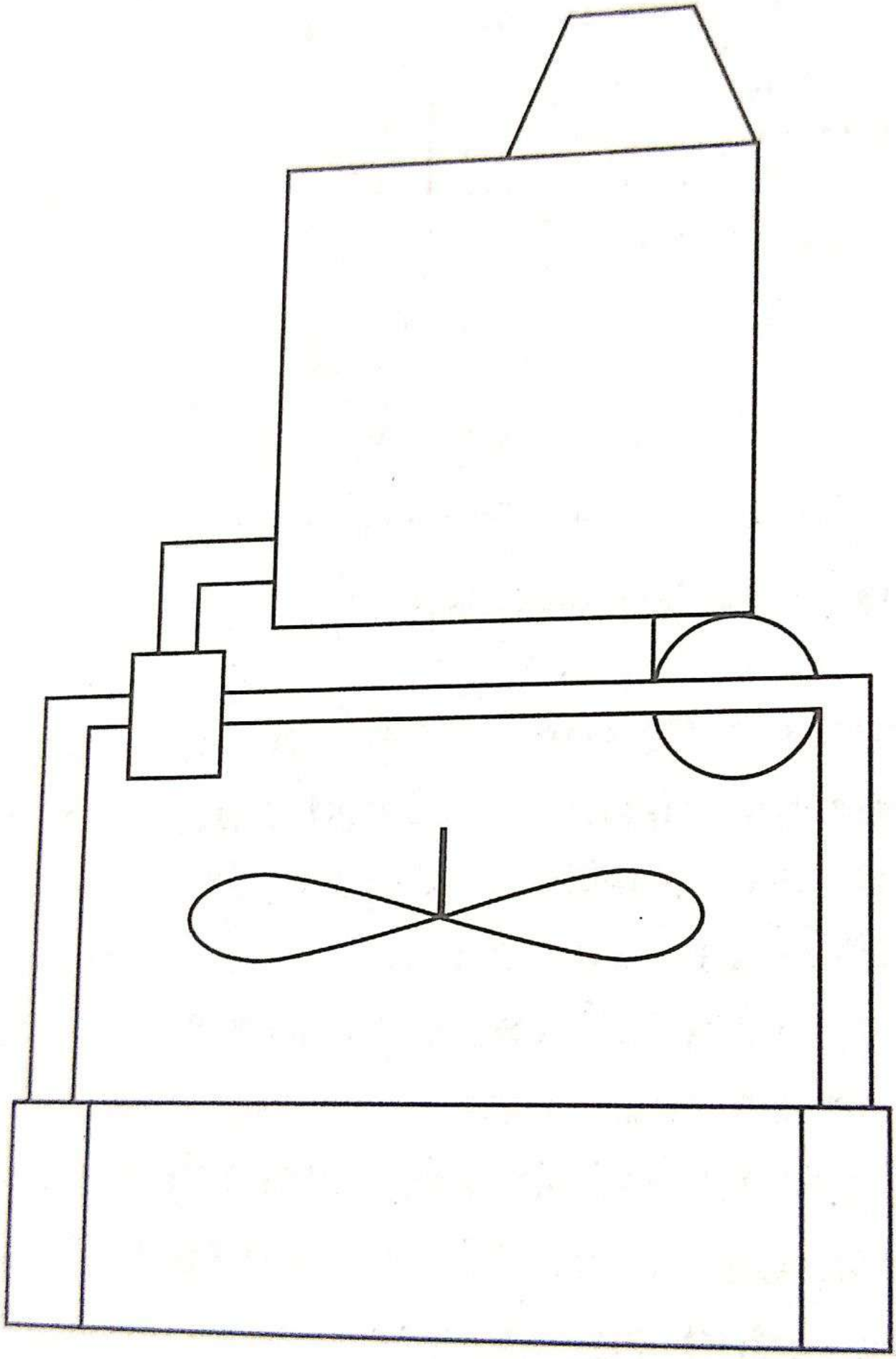


Fig. 4.19. Forced or pump system.

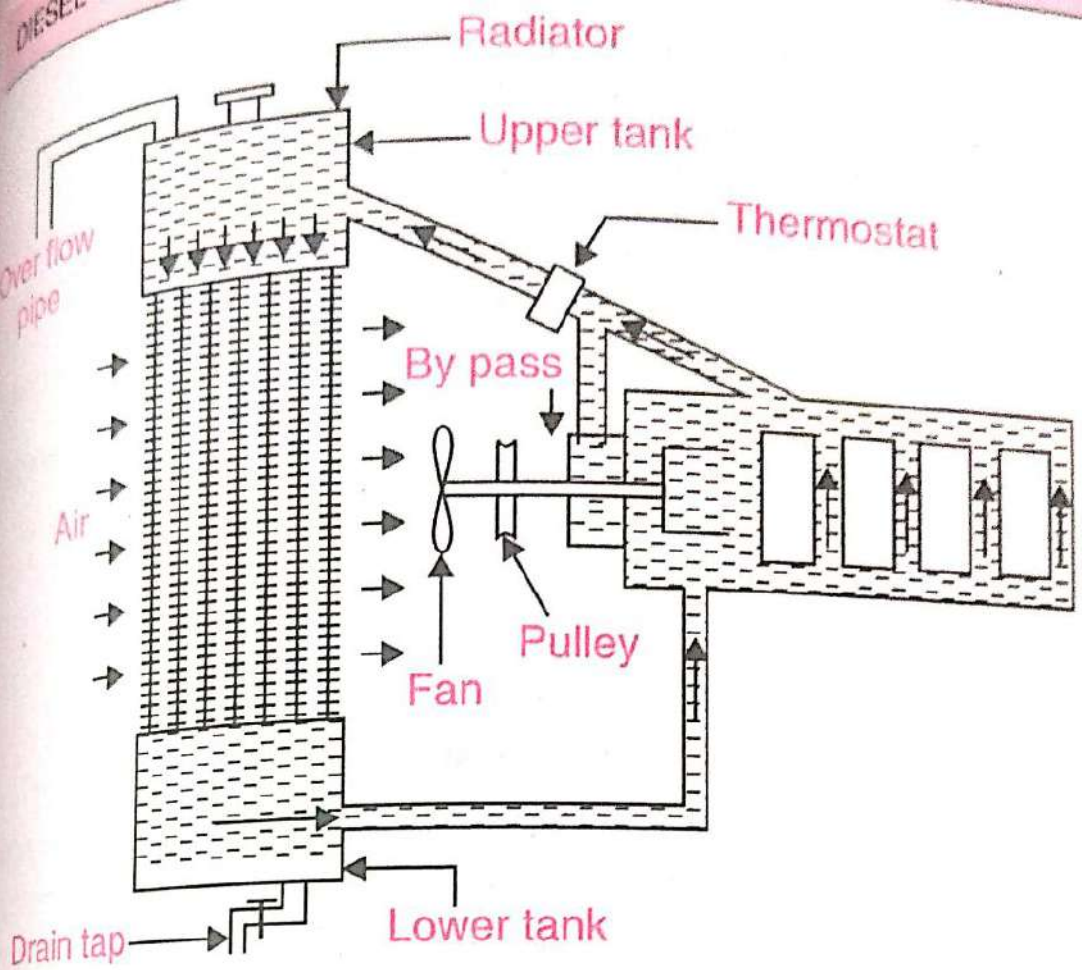


Fig. 4.20. Thermostatically controlled cooling system.

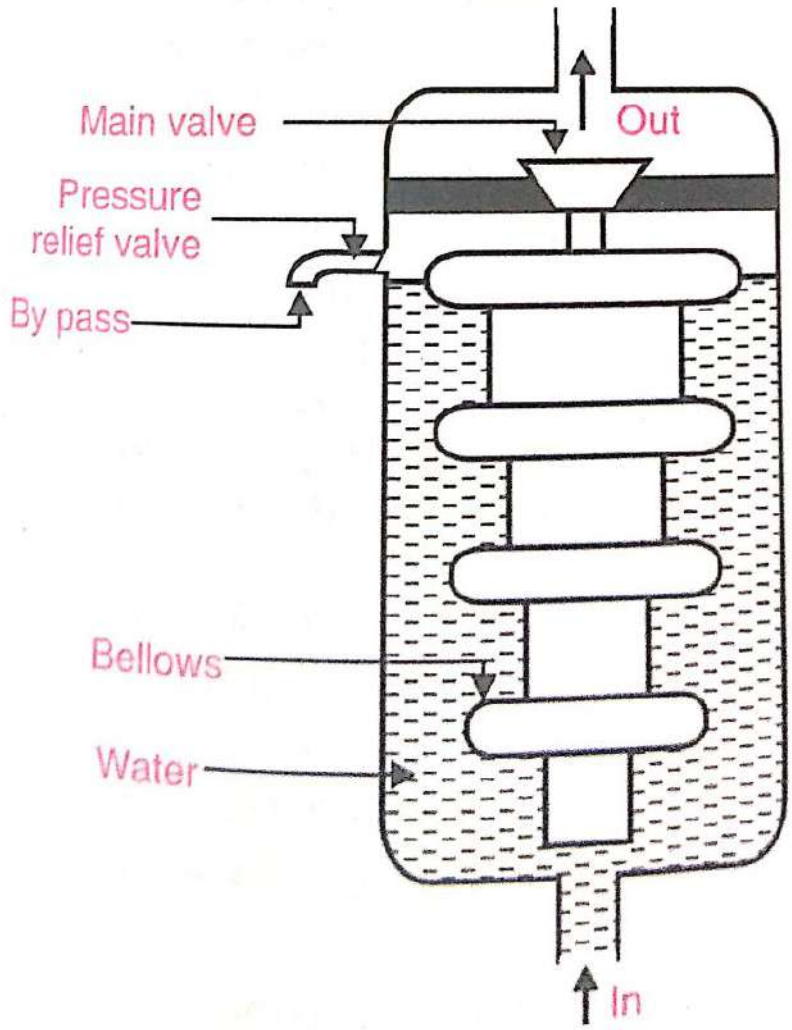


Fig. 4.21. Typical thermostat

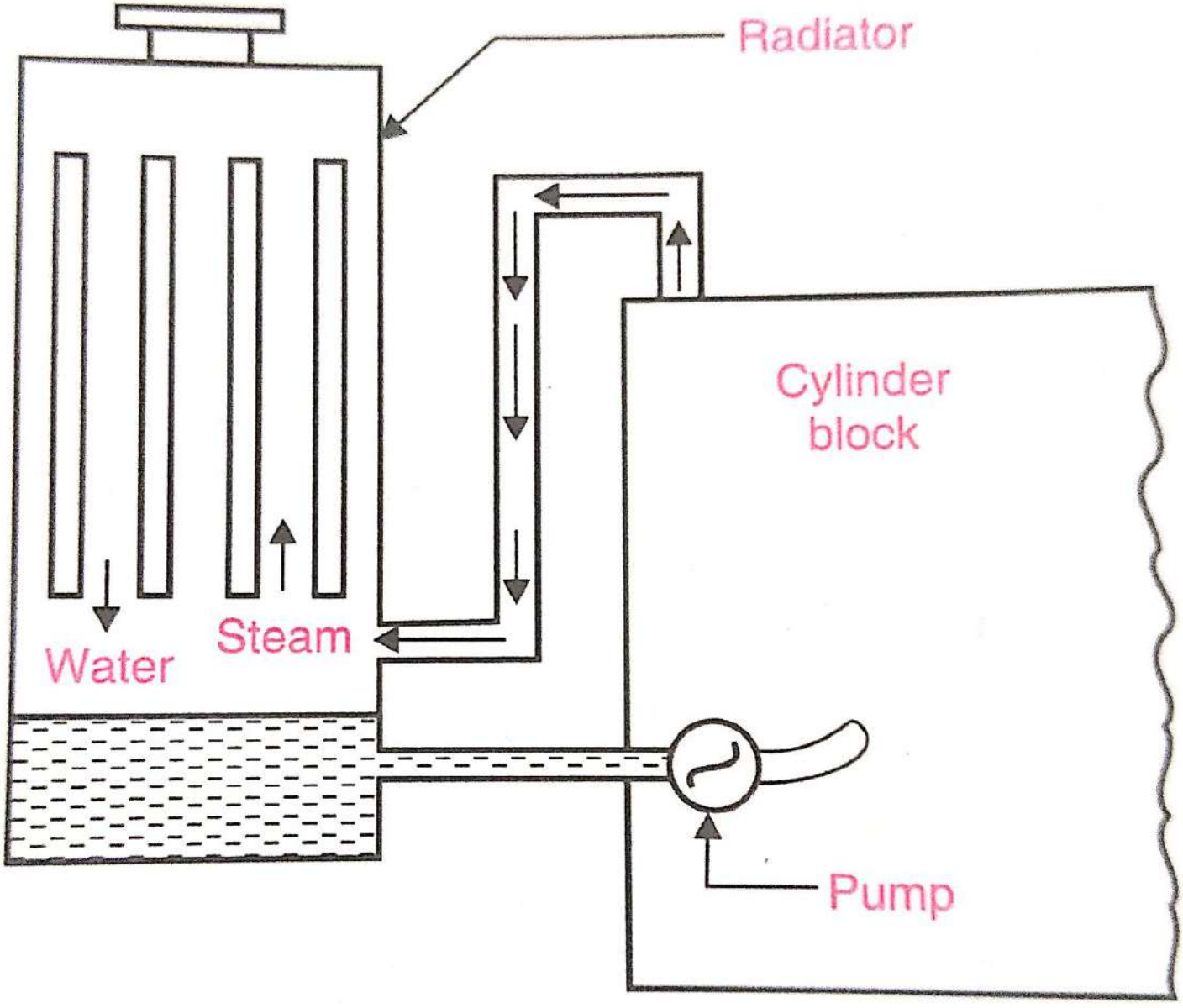


Fig. 4.22. Evaporating cooling.

Saturday
AUGUST 06

Lubrication System

Lubrication is the admittance of the oil between two surface having relative motion.

Purpose

1) To reduce friction & wear between the parts having relative motion.
2) To cool the surfaces by carrying away the heat during friction
3). To seal a space adjoining the surface
4) To clean the surface carrying away the carbon and the metal parts caused by wear.
5) To absorb shock between bearings and the other parts & consequently reduce wear & tear.

Sunday 07

Classification

1. Wet sump lubrication system
2. Dry sump lubrication system.
3. Mist lubrication system.

Important

Wet sump lubrication can be further classified as a) Splash system b) Semi Pressure c) full pressure system

Fig:-

Engine Starting system

1) Starting by an auxiliary engine
2) Use of electric motors for Self Starters
3) Compressed air system.

Combustion Phenomenon in CI engines

In CI engines the combustion occurs by the high temp produced by compression of the air called auto ignition. For which a minimum compression Ratio of 12 is required. The efficiency of the cycle increases with higher values of CR. (Comp Ratio)

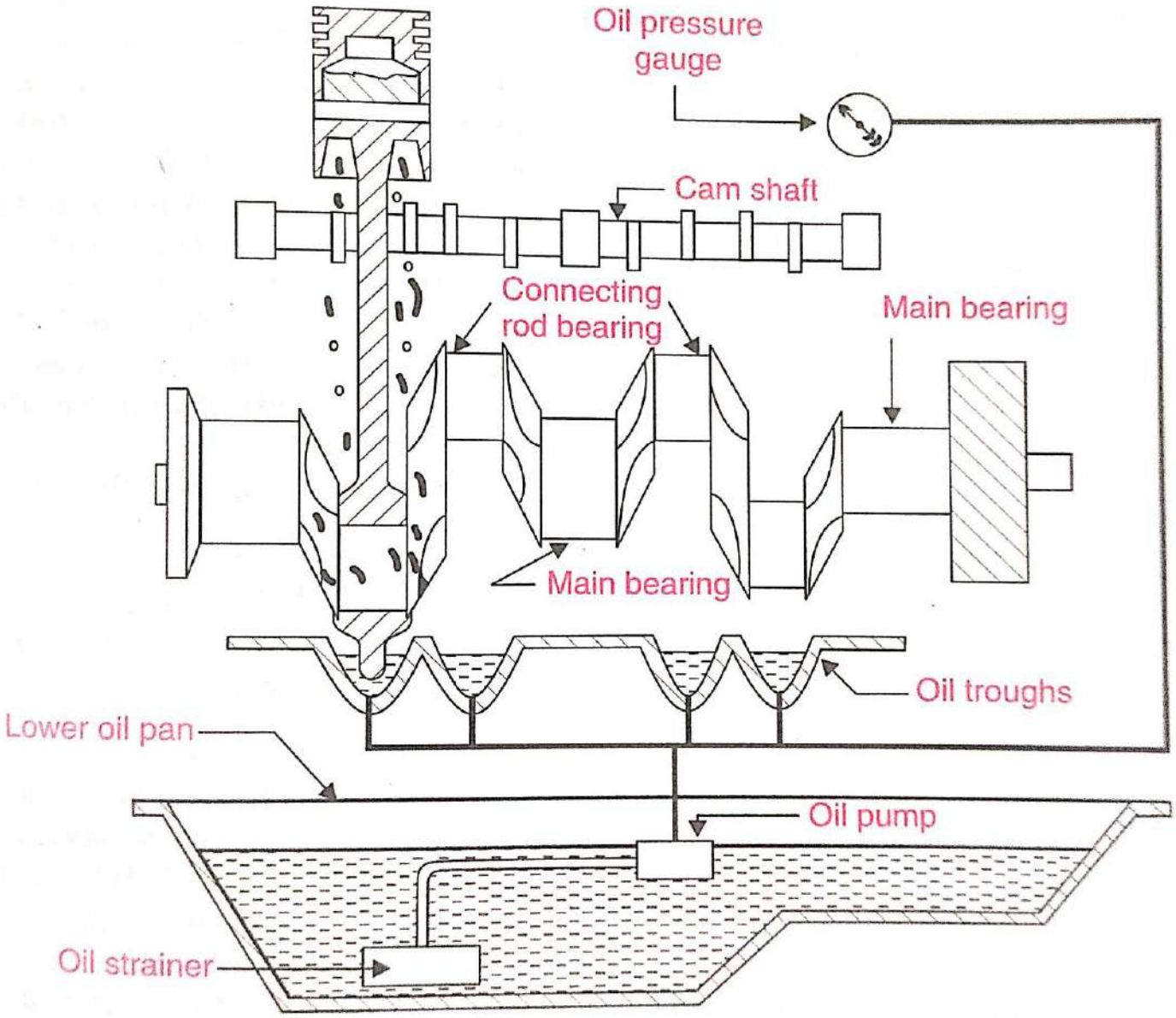


Fig. 4.23. Splash system.

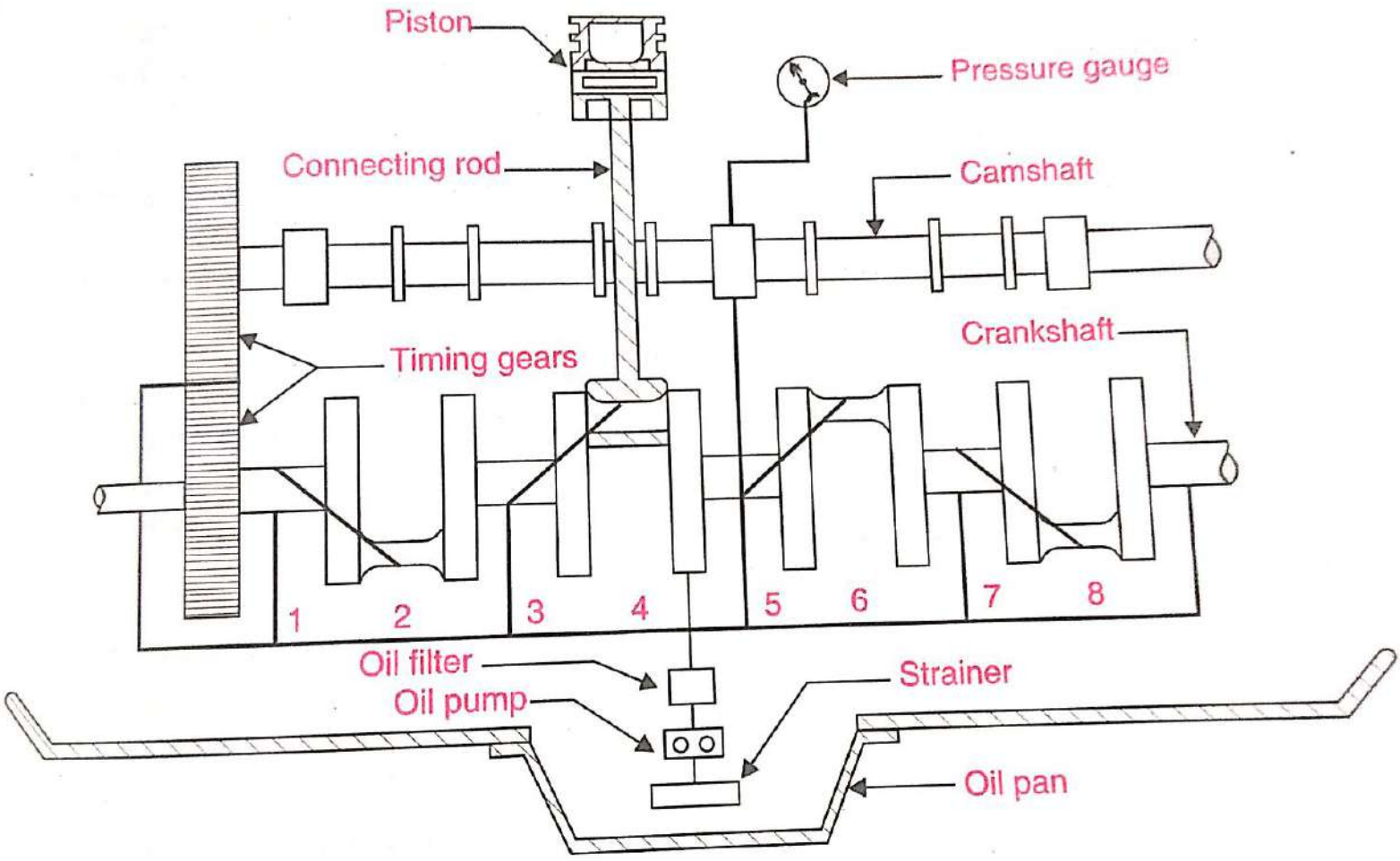


Fig. 4.24. Full pressure system.

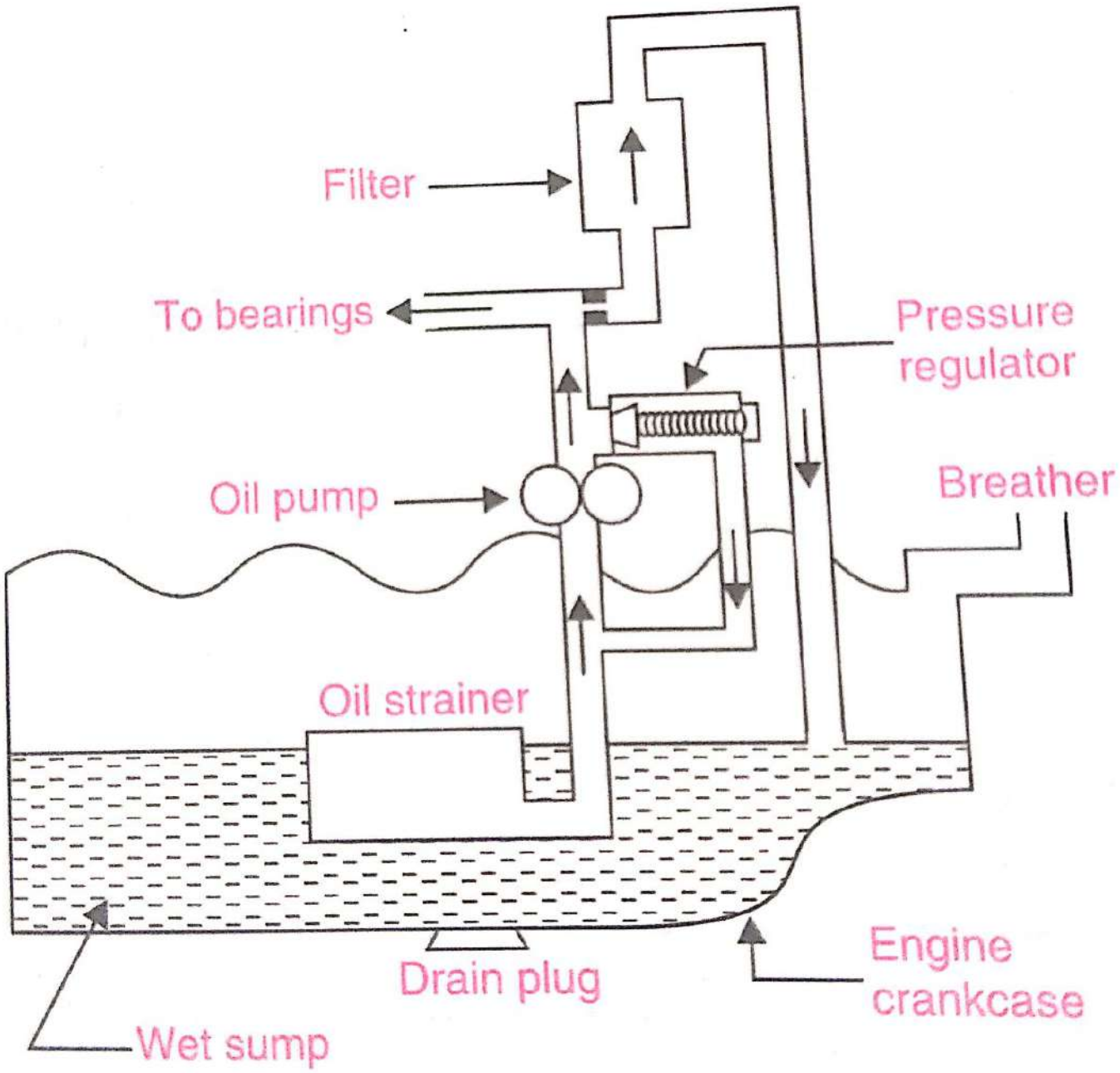


Fig. 4.25. Wet sump lubrication system.

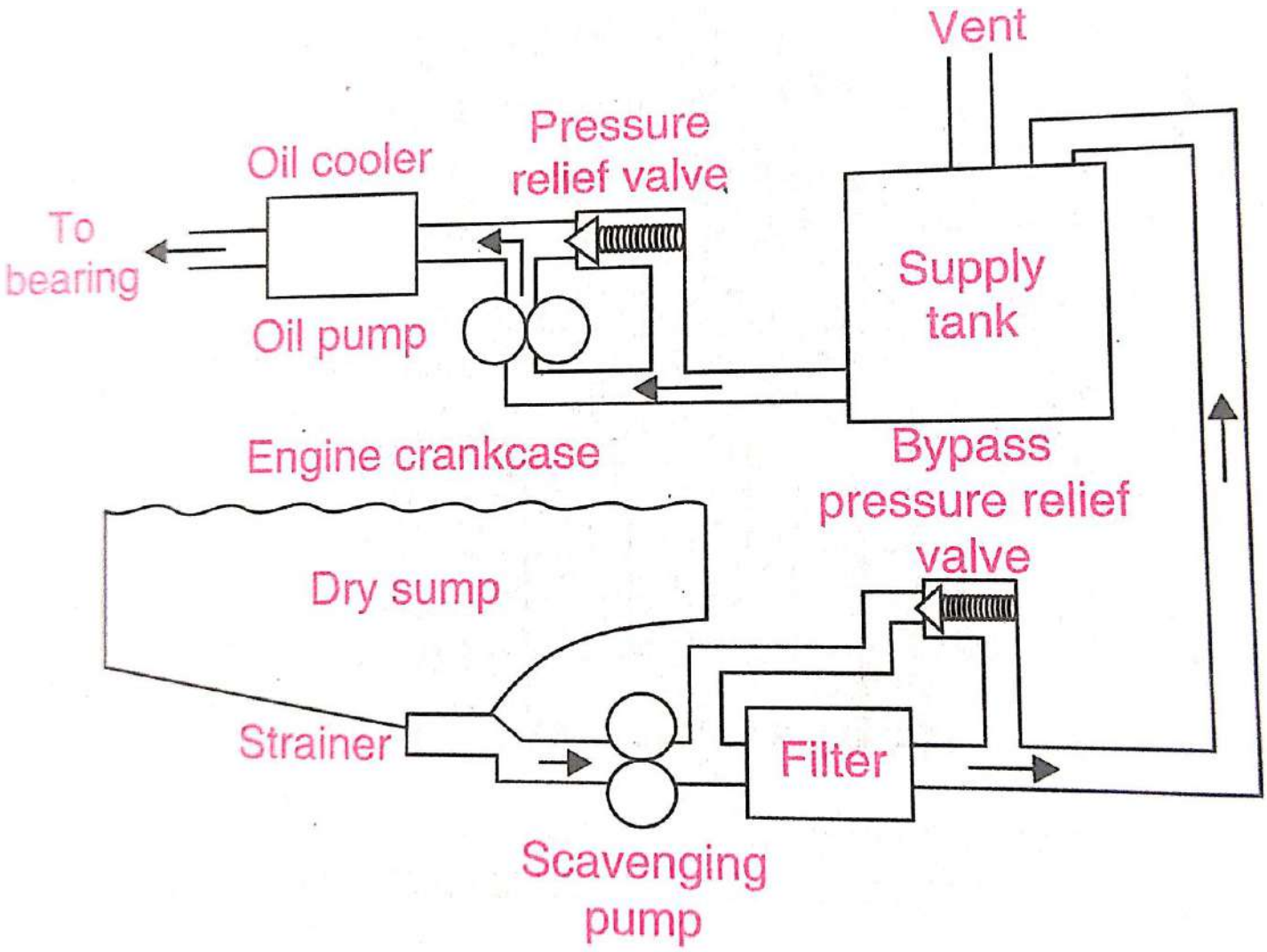


Fig. 4.26. Dry sump libication system.

of air in this vicinity. As soon as the vapour and the air in contact with it reaches a certain temperature, ignition will take place. Once the ignition starts, a flame established the heat required for further evaporation will be supplied from that released by combustion. The vapour would be burning as fast as it can find fresh oxygen. So it will depend on further continuation of burning process due to availability of O_2 and subsequent to the shape of the combustion chamber head..

There are three phases of CI engine combustion → Fig =

1) Ignition delay period
2) Period of rapid or uncontrolled combustion
3) Period of controlled combustion

followed by 4) After burning

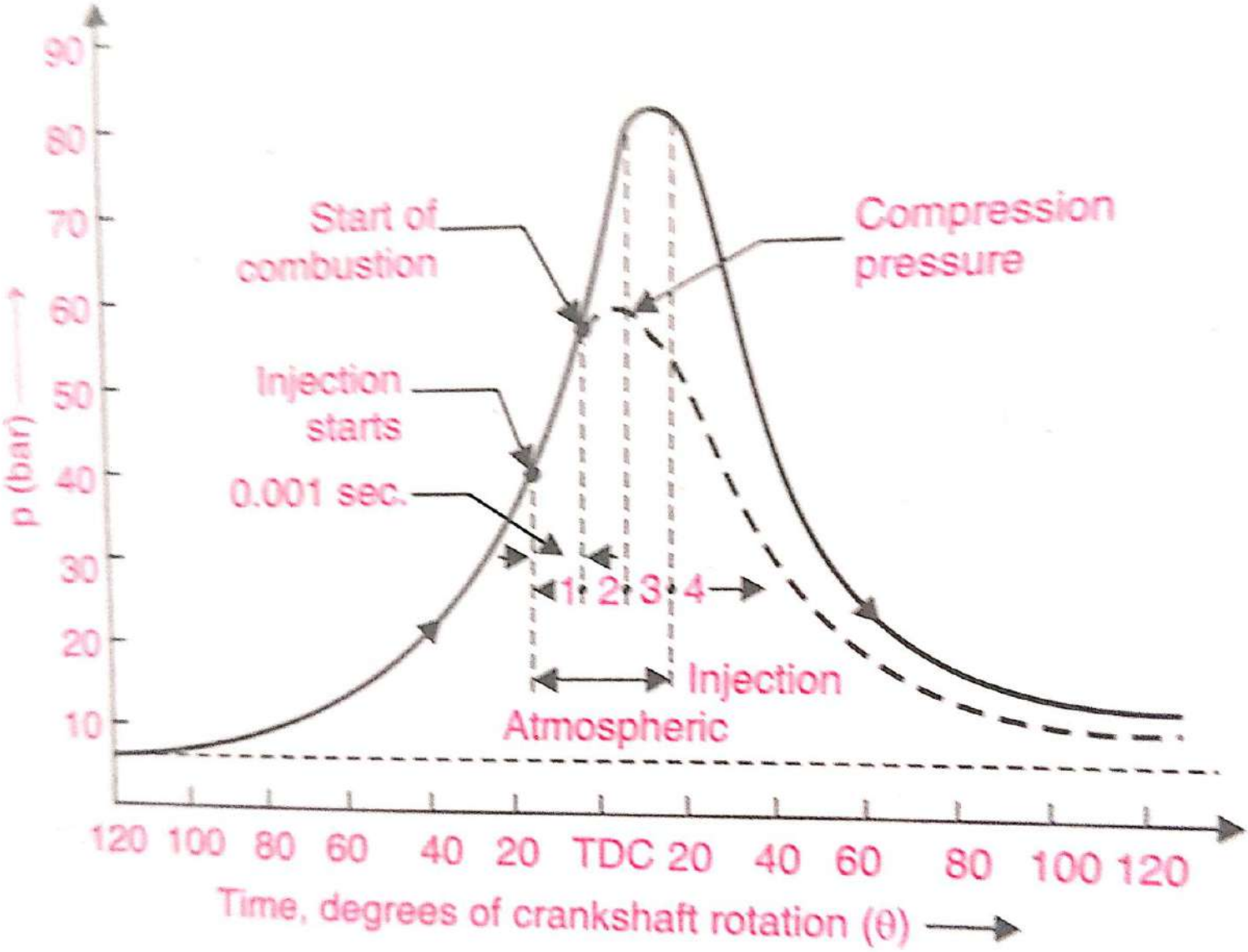


Fig. 4.27. Combustion phenomenon of C.I. engine.

Delay period.

It is the time (~~following~~) immediately following injection of the fuel. during which, the ignition process is being initiated and the p^r does not rise beyond the value it would have due to compression of air. This delay period is @ 13^0. of the crank rotation. The time decreases with increase in speed of the engine.

If the delay period is increased it leads to knocking

Diesel knock

If the delay period in CI engines is long a large amount of fuel will be injected. and accumulated in the chamber. The auto ignition of this large amount of fuel may cause high rate of p^r. rise and high max^m. pressure which may cause knocking in Diesel engines

12 Friday AUGUST

Cetane Number

The cetane rating of fuel is a measure of its ability to auto ignite quickly when it is injected into the compressed & heated air in the engine. (diesel)

The Cetane Number is a measure of the influence of the diesel fuel has in determining the ignition delay. Higher the cetane rating of the fuel lesser is the propensity for diesel knock. It is a mixture of cetane ($C_{16}H_{34}$ high ignitability) and α-methyl-naphthalene ($C_{11}H_{10}$) (low ignitability) are used. The mixture is made by volume & ignitability of the test fuel is quoted as the percentage of cetane in the reference mixture which has the same ignitability.

Important

for higher speed engines, the cetane number required is about 50, for medium speed @ 40 & low speed @ 30

Combustion Chamber design.

For specific design

1. The Non turbulent type
   i) Open combustion chamber
2. The turbulent type
   i) turbulent chamber
   ii) Precombustion Chamber
   iii) Energy cell.

Figures

Supercharging

The purpose of supercharging is to raise the volumetric efficiency above that value which can be obtained by normal aspiration.

Important

Three possible methods to increase the consumption of an engine

i) Increasing the piston displacement

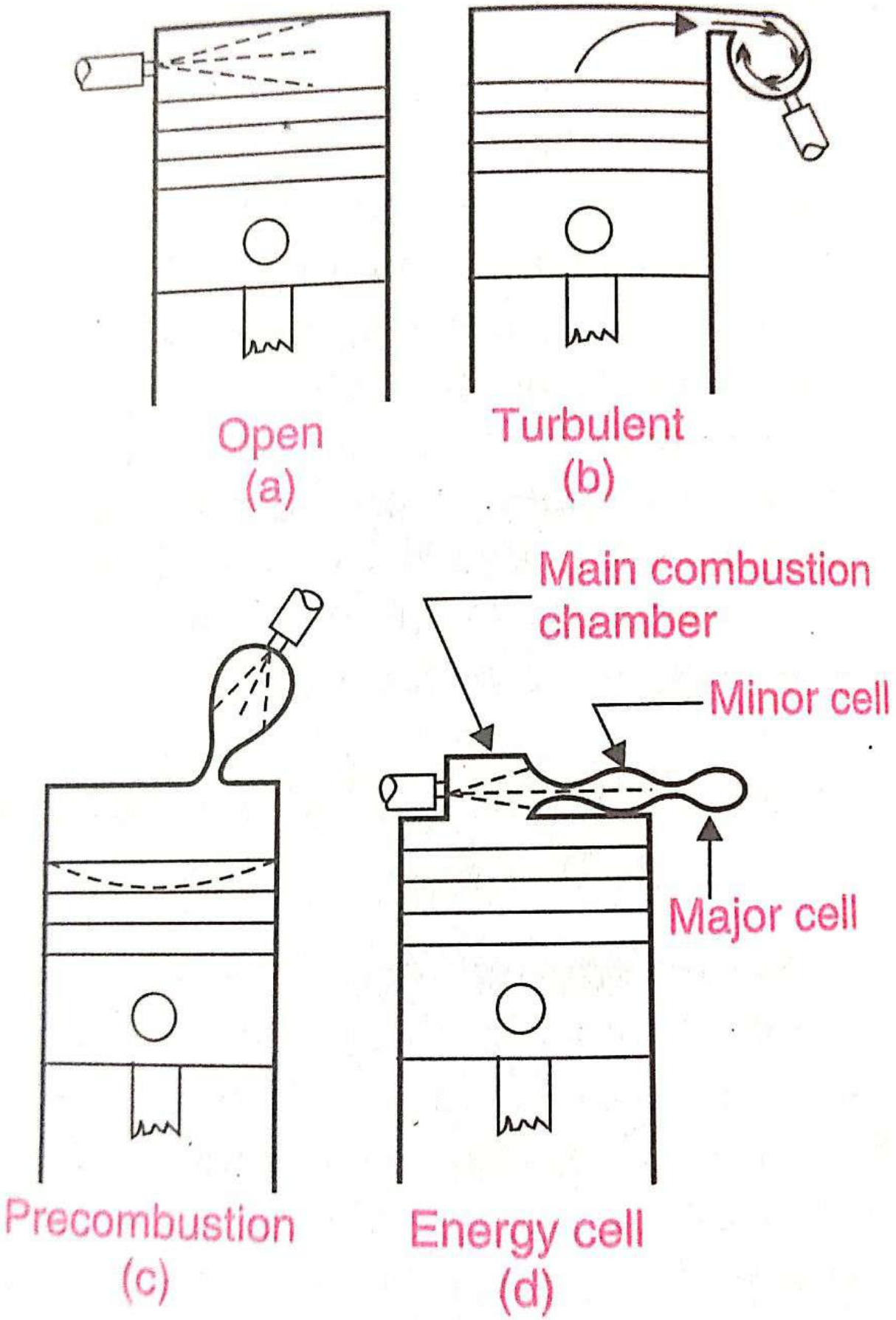


Fig. 4.28. Some commonly used C.I. engine combustion chambers.

Operation of a diesel power plant

When diesel alternator sets are put in parallel, 'hunting' or 'phase swinging' may be produced due to resonance unless due care is taken during design & manufacture of sets. It occurs due to resonance b/t the periodic disturbing forces of the engine and natural frequency of the system. 'Hunting' results from the tendency to each set trying to pull the other into synchronism. and is characterised by flickering of lights.

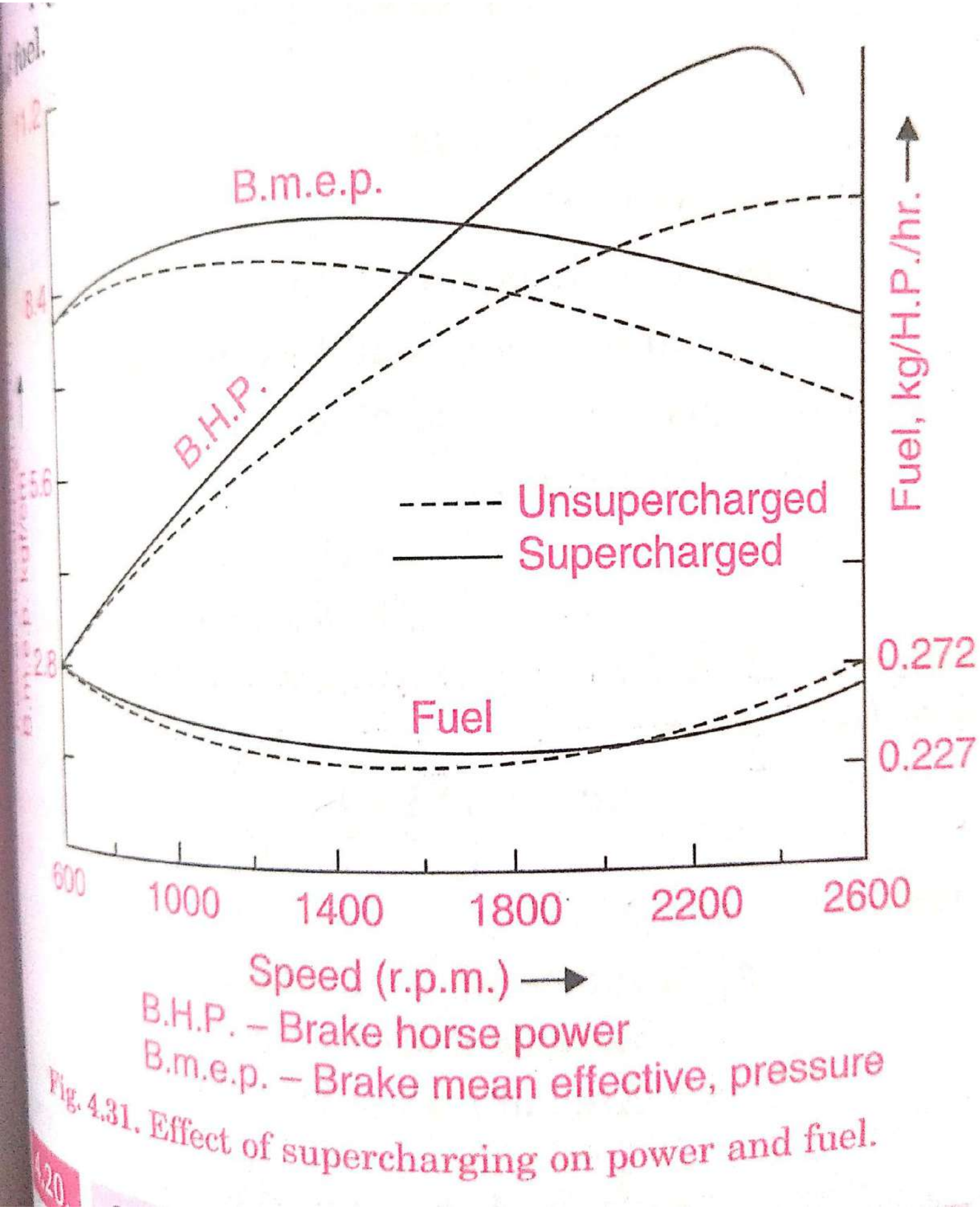
For good performance following points should be taken care of

1) It is necessary to maintain the cooling temp within the prescribed range

Important

and use of very cold water should be avoided.

2) During operation, the lubrication system should work effectively and



B.H.P. – Brake horse power

B.m.e.p. – Brake mean effective, pressure

Fig. 4.31. Effect of supercharging on power and fuel.

and requisite pr and temp^r maintained.

3) The engine should be periodically run even when not required to be used and should not be allowed to stand idle for more than 7 days.

4) Air filter, oil filter and fuel filter should be periodically serviced or replaced.

5) Periodical checking of engine compression and firing pr & exhaust temp^r should be made.

Types of Diesel engine used for diesel power plants

Two stroke cycle engines are favoured.

Important

layout of Diesel Power Plant

Fig ⇒

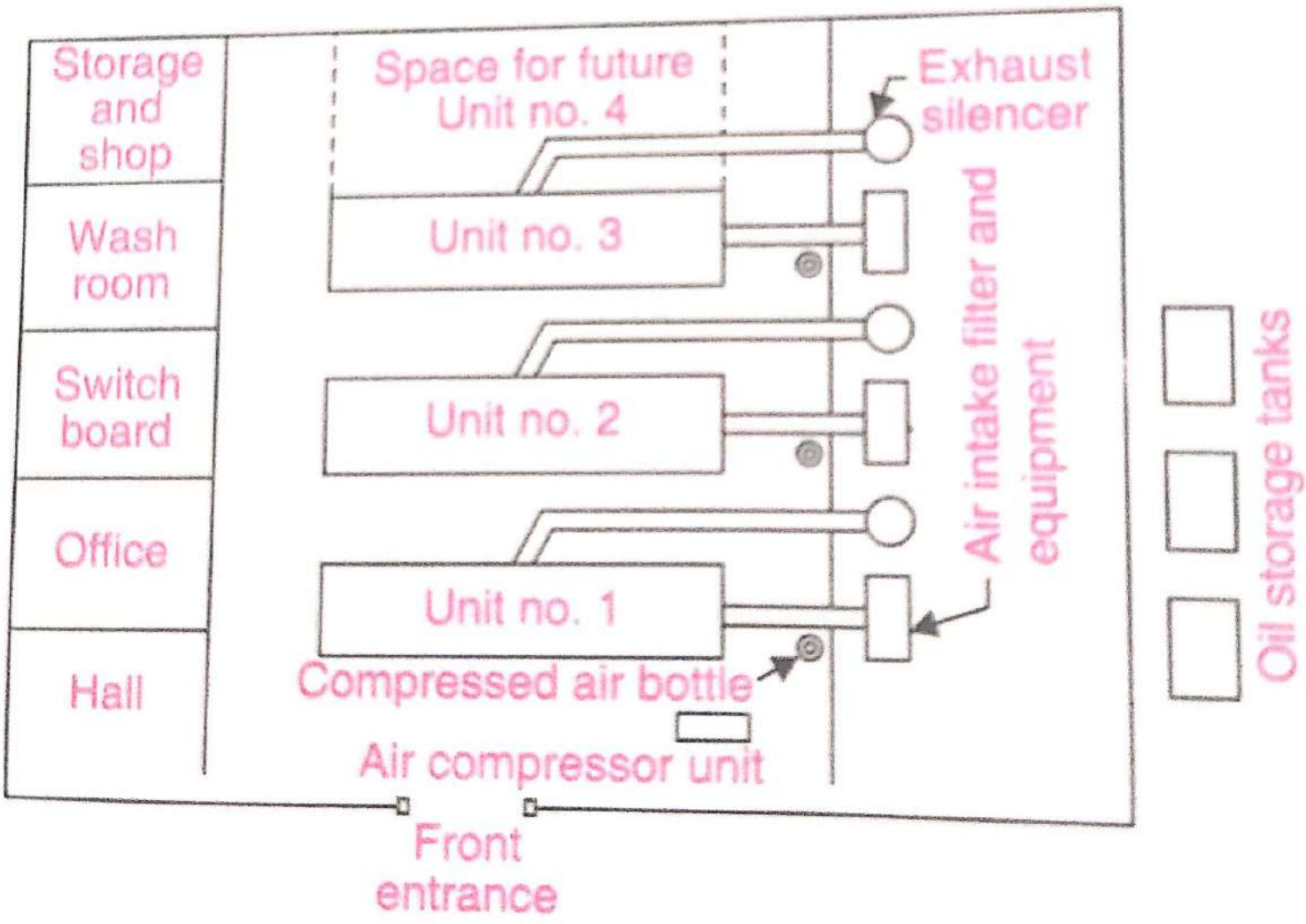


Fig. 4.32. Layout of a diesel engine power plant.