AIM OF THE EXPERIMENT :- 5

To Study of working principle of petrol engine and diesel engine its construction details

Engine:-

engine is a device which is convert chemical energy of fuel in to a mechanical energy or mechanical work

Petrol engine contruction

(I) engine block
(II) engine handle
(III) valves
(IV) piston
(V) piston ring
(VI) carburator
(VII) Spark plug
(VIII) connecting rod
(IX) crank shaft

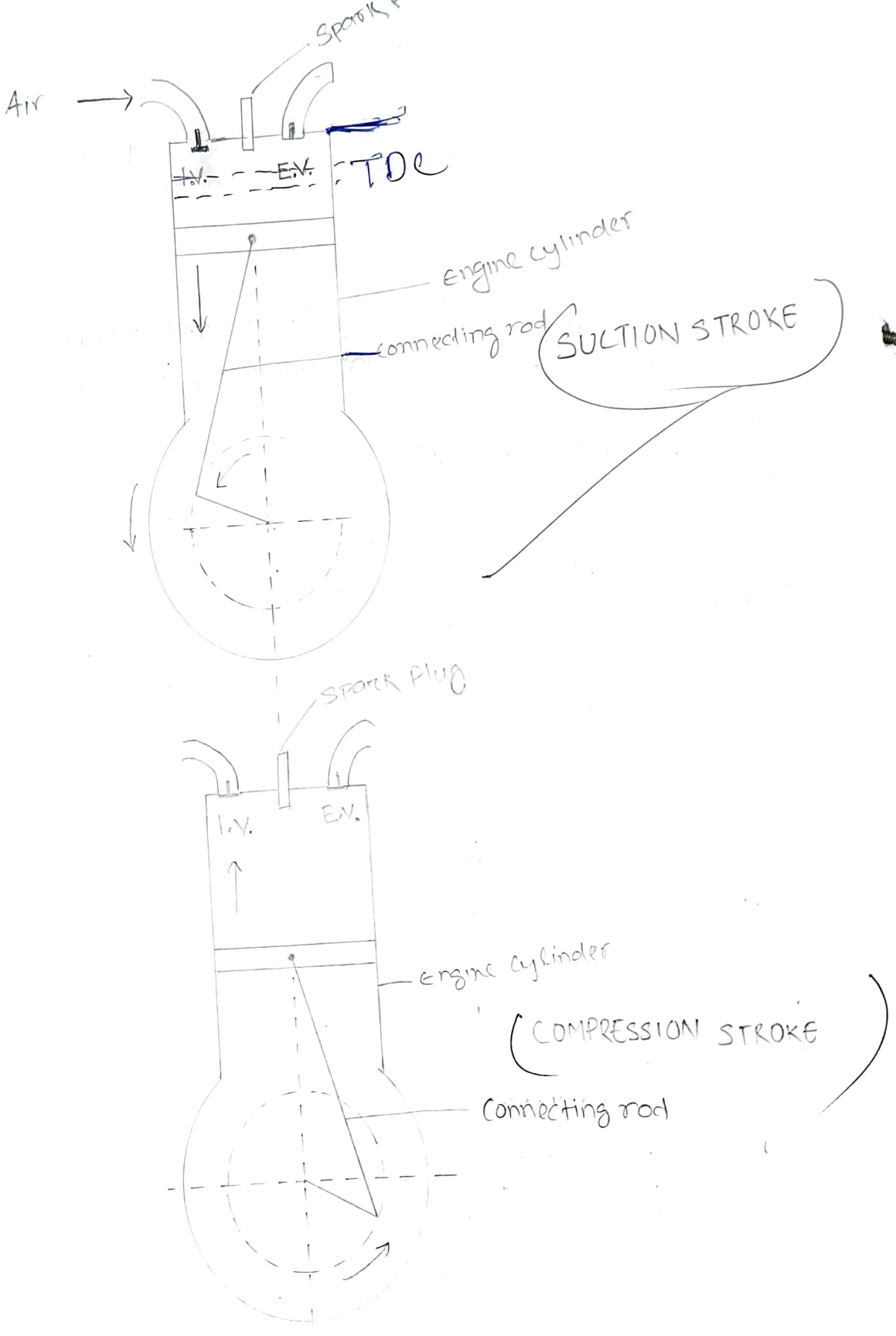
Diesel engine construction :-

(I) engine block
(II) engine node
(III) valve
(IV) piston
(V) piston ring
(VI) Injector
(VII) connecting rod
(VIII) crankshaft
(IX) Air filter

Working of petrol engine:-

Petrol engine are mainly two types
(i) Two stroke petrol engine
(ii) Four stroke petrol engine

FOUR STROKE PETROL ENGINE



Four stroke petrol engine :-

It is the four stroke system of this engine follow their.

1. Suction stroke
2. Compression stroke
3. Power stroke
4. Exhaust stroke

(1) SUCTION STROKE:-

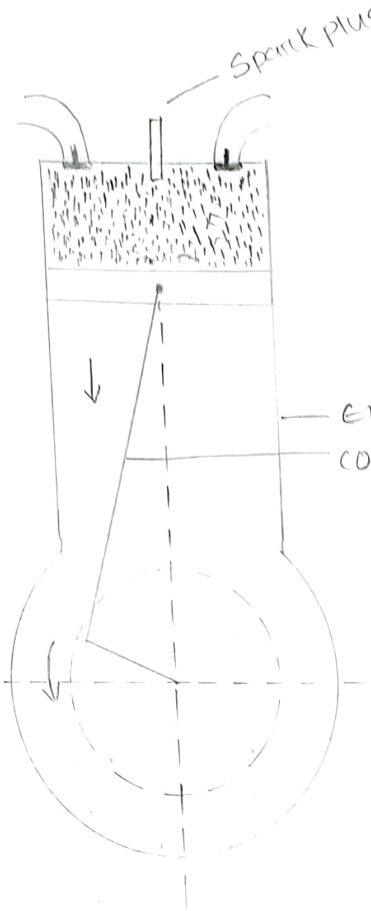
In suction stroke the piston moves the (TDC) to (BDC) so that a vaccume created inside the engine cylinder at this time, the inlet valve is open the air fuel mixture in to the engine cylinder through the inlet valve from the carbourator and the engine cylinder fill fuel mixture.

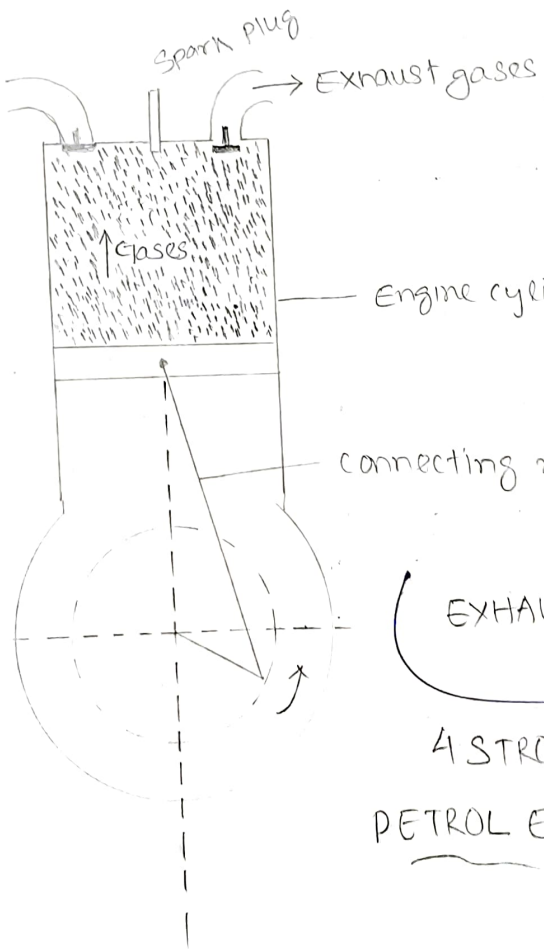
(2) COMPRESSION STROKE

This stroke being at B.D.C ~~to~~ on at TDC in this stroke just at the ~~same~~ suction stroke and ends at TDC in this stroke the piston compress the air fuel mixture in presentation for ignition during the power stroke (bellow) both the intake and exhaust valve are closed during this stage

(3) POWER STROKE:-

This is the start second of revolution of the four stroke cycle. At this pin the crankshaft has completed a fuel 360° revolution.





4 STROKE

PETROL ENGINE

while the piston is at TDC (The air of the compression stroke) the compressed air fuel mixture is ignited mixture is ignited by a spark plug (in a gasoline engine) or by heat generated by high compression (diesel engine) force fully returning the piston BDC this stroke produce mechanical work from the engine to turn the crank-shaft.

(4) EXHAUST STROKE :-

In this stroke this piston moves from the BDC to TDC at this time the exhaust valve at this time the exhaust is due to open the burning gases moves to the atmosphere through the exhaust valve

FOUR STROKE DIESEL ENGINE

① SUNCTION STROKE :-

In this stroke the piston moves the BDC to TDC so that a vaccume created inside the engine cylinder at this time inlet valve is open the air enter in to the engine cylinder through the inlet valve from the carburator and the engine cylinder fill up with air.

② COMPRESSION STROKE :-

In this stroke, piston moves from the bottom dead centre, during this intake both inlet and exhaust valve are closed. The air down into the cylinder during suction stroke.

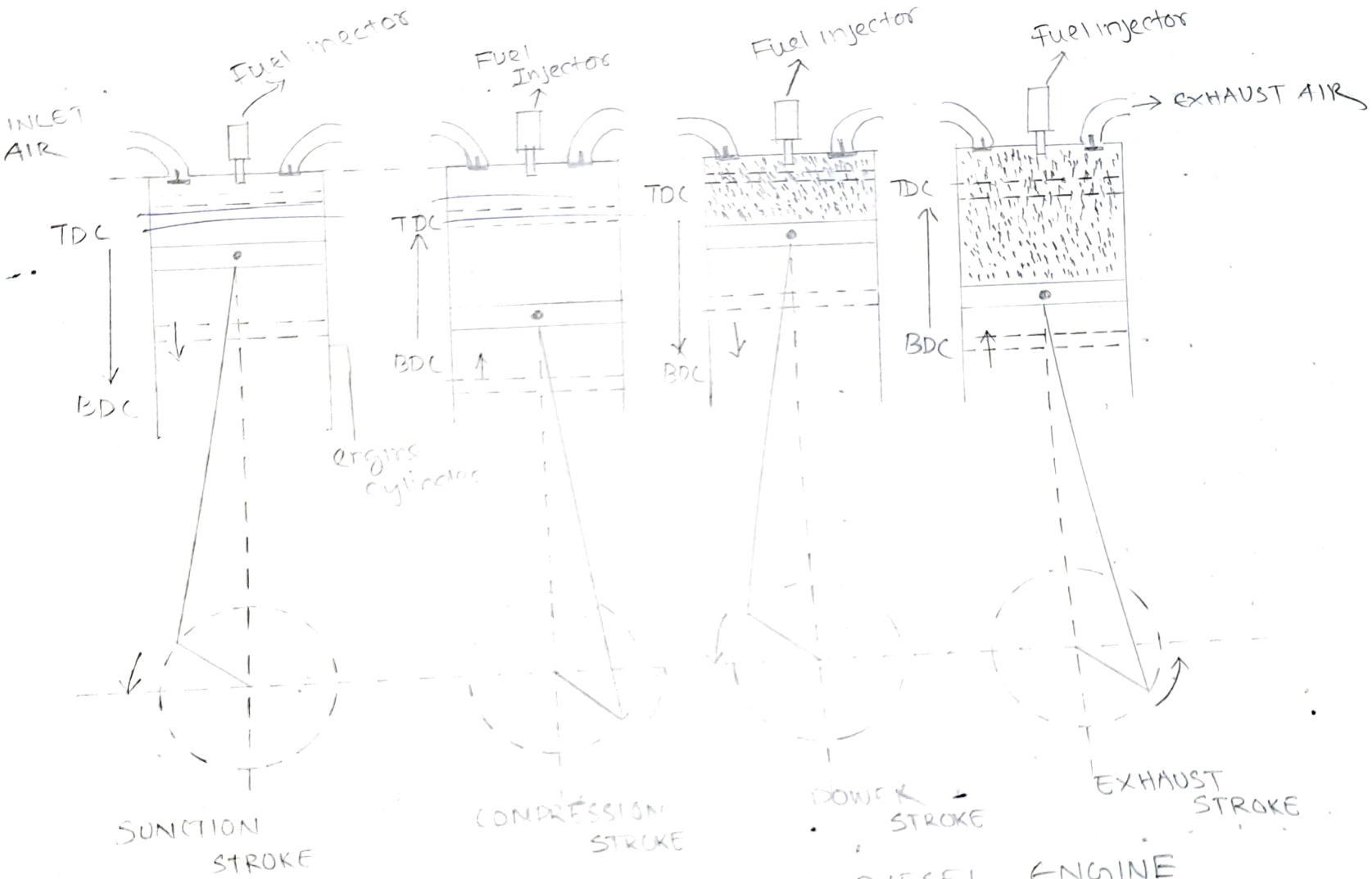


DIAGRAM OF FOUR STROKE DIESEL ENGINE

is entapped inside the cylinder and compressed due to the upward moment of the piston. In diesel engine, The compression ratio used is very high as a result, the air is finally compressed to a very high pressure upto 40 kilogram per centimeter square at this pressure.

POWER STROKE :-

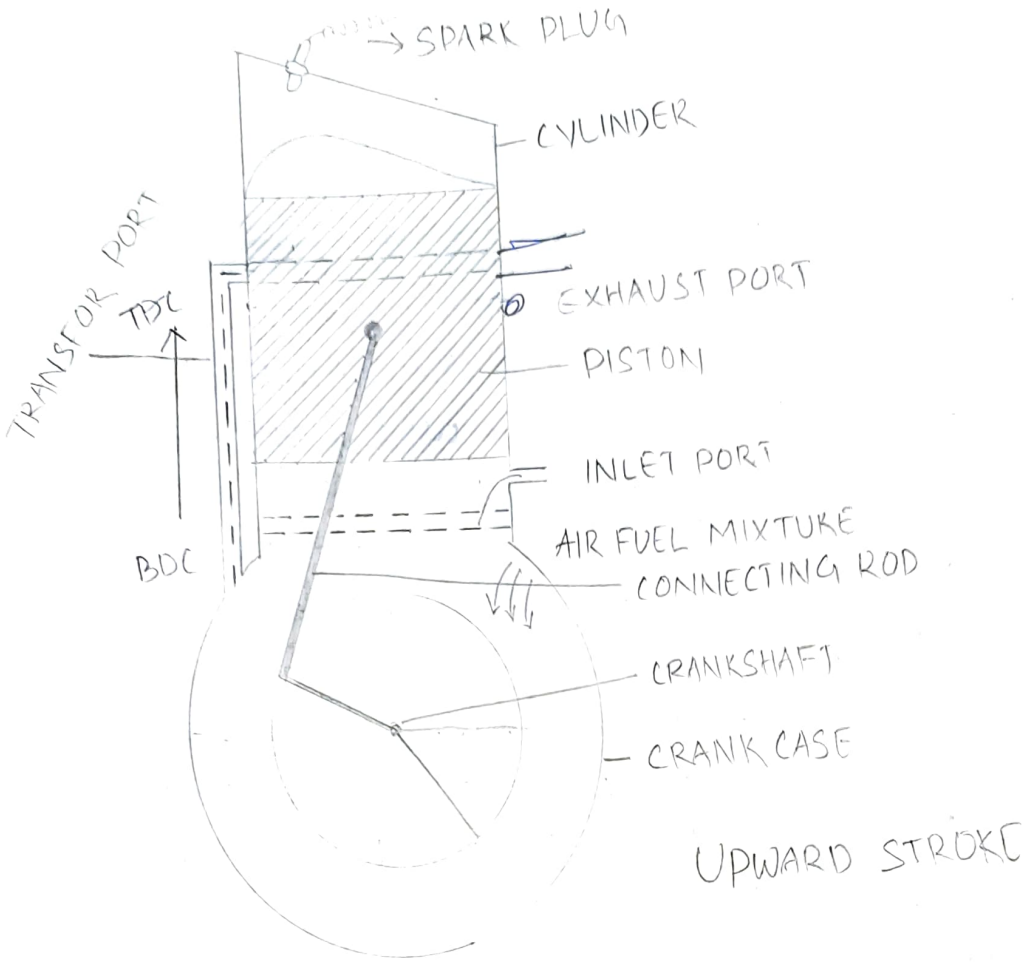
At the end of the compression stroke the injector inject the diesel to the hot compressed air so that the hot air ignite and the piston moves from T.D.C. to B.D.C.

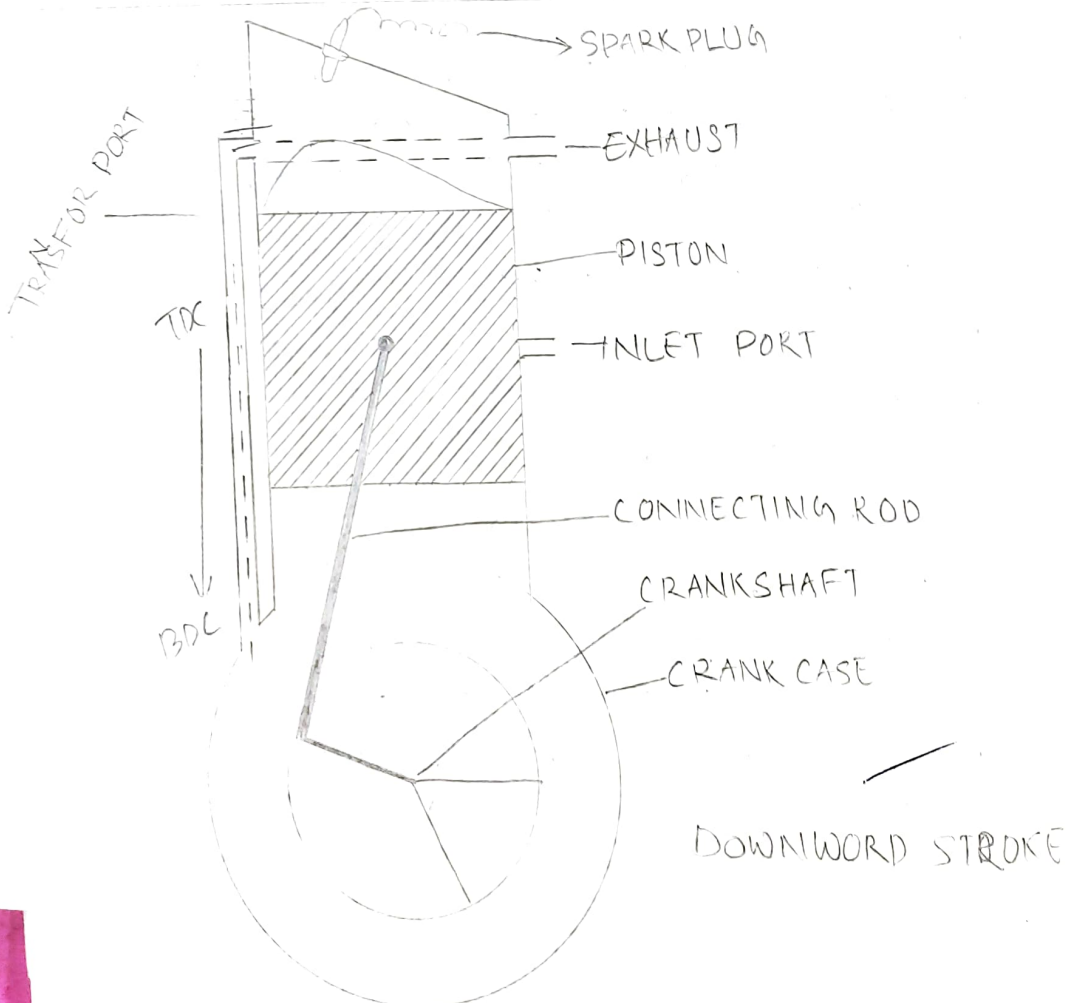
(4) EXHAUST STROKE :-

In this STROKE the piston moves from BDC to TDC at this time the exhaust valve in open the burning gases moves the atmosphere

TWO STROKE PETROL ENGINE :-

A two STROKE or two cycle engine is a type of internal combustion engine which complete a power cycle with two STROKE (up and down moment) of the piston during only a crankshaft revolution. This is on constrast to a four STROKE engine. Which require four STROKE engine of the piston to complete a power cycle during two crankshaft revolution. In a two STROKE engine the end of the combustion STROKE and the


SPARK PLUG
CYLINDER
TRANSFOR PORT
TDC
EXHAUST PORT
PISTON
INLET PORT
BDC
AIR FUEL MIXTURE
CONNECTING ROD
CRANKSHAFT
CRANK CASE
UPWARD STROKE


SPARK PLUG
EXHAUST
TRASFOR PORT
PISTON
TDC
INLET PORT
CONNECTING ROD
CRANKSHAFT
BDC
CRANK CASE
DOWNWORD STROKE

begining of the compression stroke happen symul-teniously with the intake and exhaust (or scanvening) function at the same time.

TWO STROKE engine often have a high power to waight ratio. power beaving being available in a narrow range, of rafetational speed called the power sanal. compressed to four stroke engine. two stroke engines heves greatly reduced member of moving parts and so can semore compact and significantly lighten.

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Experiment No - 4

AIM OF THE EXPERIMENT :-

Identification of various units of a vehicle.

VARIOUS PARTS OF VEHICLE :-

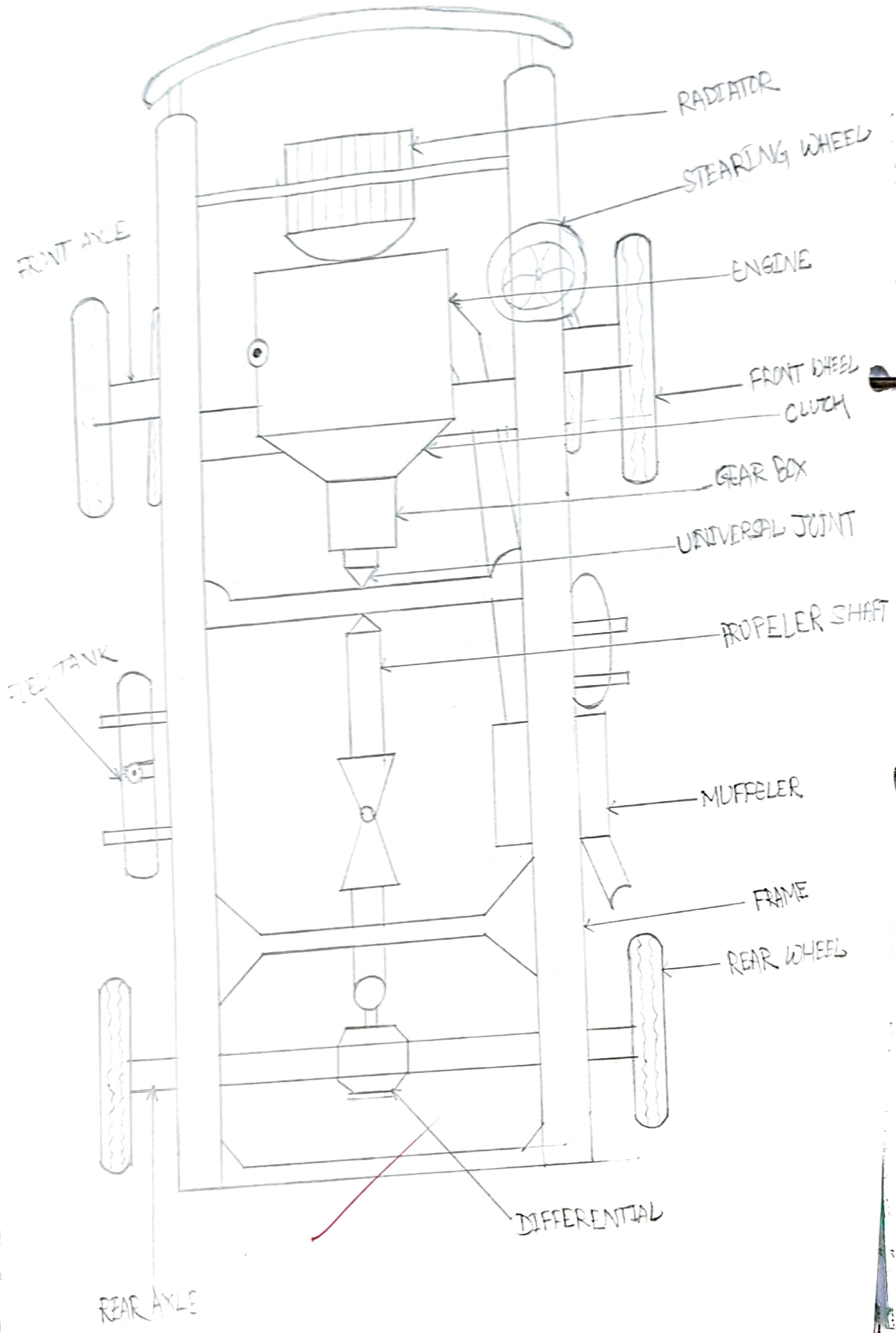
a) Wheel
b) Chassis frame
c) Fuel Tank
d) Front & Rear axle
e) Engine
f) Clutch
g) Gear box
h) Universal Joint
i) Propulsion Shaft
j) Differential etc.

Wheel :-

Wheels are connected to the front & rear axles. As power is supplied to either front or rear axle, axle shaft turns the wheels and the vehicle moves.

The wheel assemble consist of a rim, tyre and tube to perform it's function the wheel and the vehicle moves.

(i) Able to withstand the driving and braking torque and support the weight of the vehicle.
(ii) Able to absorb road shock.
(iii) Statically and dynamically balance the vehicle.
(iv) Able to grip the road surface.


RADIATOR
STEARING WHEEL
FRONT AXLE
ENGINE
FRONT WHEEL
CLUTCH
GEAR BOX
UNIVERSAL JOINT
PROPELER SHAFT
FUEL TANK
MUFFELER
FRAME
REAR WHEEL
DIFFERENTIAL
REAR AXLE

CHASSIS and FRAME :-

The main function of the chassis frame is to support all the units of vehicle & to take on the load of goods, passengers etc. The chassis frame is made of a steel section having two long sides section called long member & these two long members are joined together with the cross-members with the cross-members with the hell of rivet nut & bolts welding.

FUEL TANK :-

(i) The location of fuel tank on the vehicle varies from vehicle to vehicle.

(ii) The fuel tank is made of galvanised mild steel sheet coated with lead/tin alloy to protect against rusting some tanks are made of alluminium or plastic.

(iii) Internal baffleys with a passage for fuel tanks are provided to avoid fuel slashing, striking against the cell of the tank.

FRONT & REAR AXLE :-

The front axle has a beam mostly 'I' shaped on which the stub axle is fitted with the help of a king pin. The king pin is located with the I-beam by a cotter pin. The steering arm is fitted on the stub axle. At the

bottom of the stub axle, the stub axle arm is fitted. Both the ends of the stub axle are connected by the crank rod.

ENGINE :-

It is a device which is used to convert chemical energy into mechanical work.

Engines are of two types :- (i) IC engine
(ii) EC engine.

CLUTCH :-

While shifting gears, the speed of the sliding sleeve & the respective gear on the main shaft be synchonised to avoid gear collision or noise. This is achived by disconnecting the transmission of power from the engine, fly-wheel to the gear box with the help of clutch. It is used to engage & disengage the transmission of power from the flywheel to the gear box.

GEAR BOX :-

It is used to get different torques and speeds which are required to over come the following resistance.

- → Road Resistance
- → Air Resistance
- → Load on vehicle
- → Gradient Resistance.

By engaging different gears, engine torque is increased while speed is decreased in the top gear. The rpm & torque of the engine & gear box remain the same.

UNIVERSAL JOINT :-

In vehicle, the gearbox and rear axle are at different levels. A universal joint provides a flexible connection that allows the propeller shaft to transmit torque from the gearbox to the ups & downs on road, the angle between the gearbox & the rear axle changes. The universal joint accomodates this variation in an angle & permites smooth transmission of torque from the gear box to the rear axle.

PROPELLER SHAFT :-

The propeller shaft connects the gearbox & finally drive the pinion shaft of the differential is connected to the propeller shaft one universal joint is used in between the Propeller shaft & the pinion shaft of the differential.

DIFFERENTIAL :-

The final drives serves two purpose.

(i) It transmits power at a right angle.

(ii) It increase the torque by reducing the speed

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29/10/19

04/12/09/2019

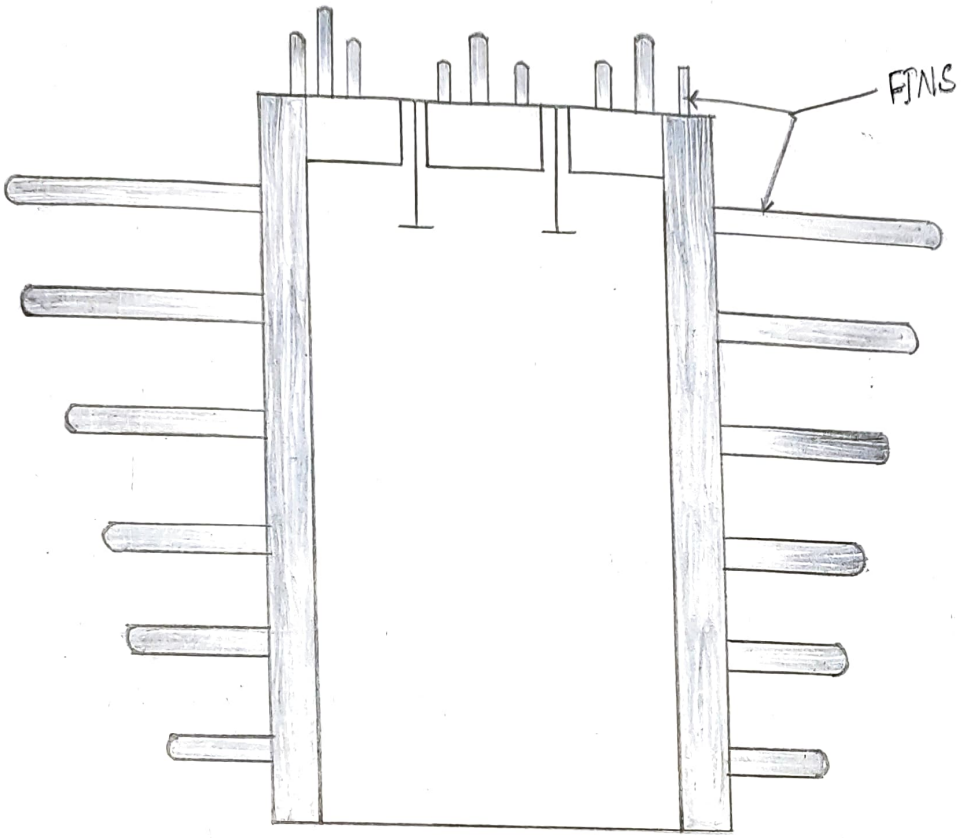
EXPERIMENT No-6

AIM OF THE EXPERIMENT :-

Study of different type of cooling system is used in a vehicle.

Introduction :-

During combustion of aire-fuel mixture great amount of heat is Produce (i.e-2500°c-3300°c. inside the engine cylindere. The temperature is so high that it will break the lubricating fill between the moving part. Hence the temp must be reduce by some means about 200°c-250°c at which the engine may works efficiently. A part of heat is removed along with exhaust gases and by the lubricating system, cooling system is required to remove the remaining person of excess heat. If the engine temp is to high, the engine will be overe heated. The fill of the lubricating oil will be burnt off, which may damage cylindere wall, piston and piston ring etc mechanical brakes occured Detonation may occureed. If the engine temperature is too cool an economical burening of fuel takes Plale and engine will less powere. An efficient cooling system removes 30-35% of the heat generated in the Combustion Chambere. Too much removal of heat decreases the thermal efficiency of engine. It removes heat at a faster rate when the engine is hot and at slow rate, when the engine is started, uncntill the engine reaches normal operating temperature.



AIR COOLING

Types :-

There are four types of cooling system.

(a) Air cooling
(b) Watere cooling
(c) Liquid cooling
(d) Steam cooling

Most automotive engine use air cooling and watere cooling and watere cooling method. Liquid and Steam Cooling methods are rarely use in actual practice.

Air cooling system :-

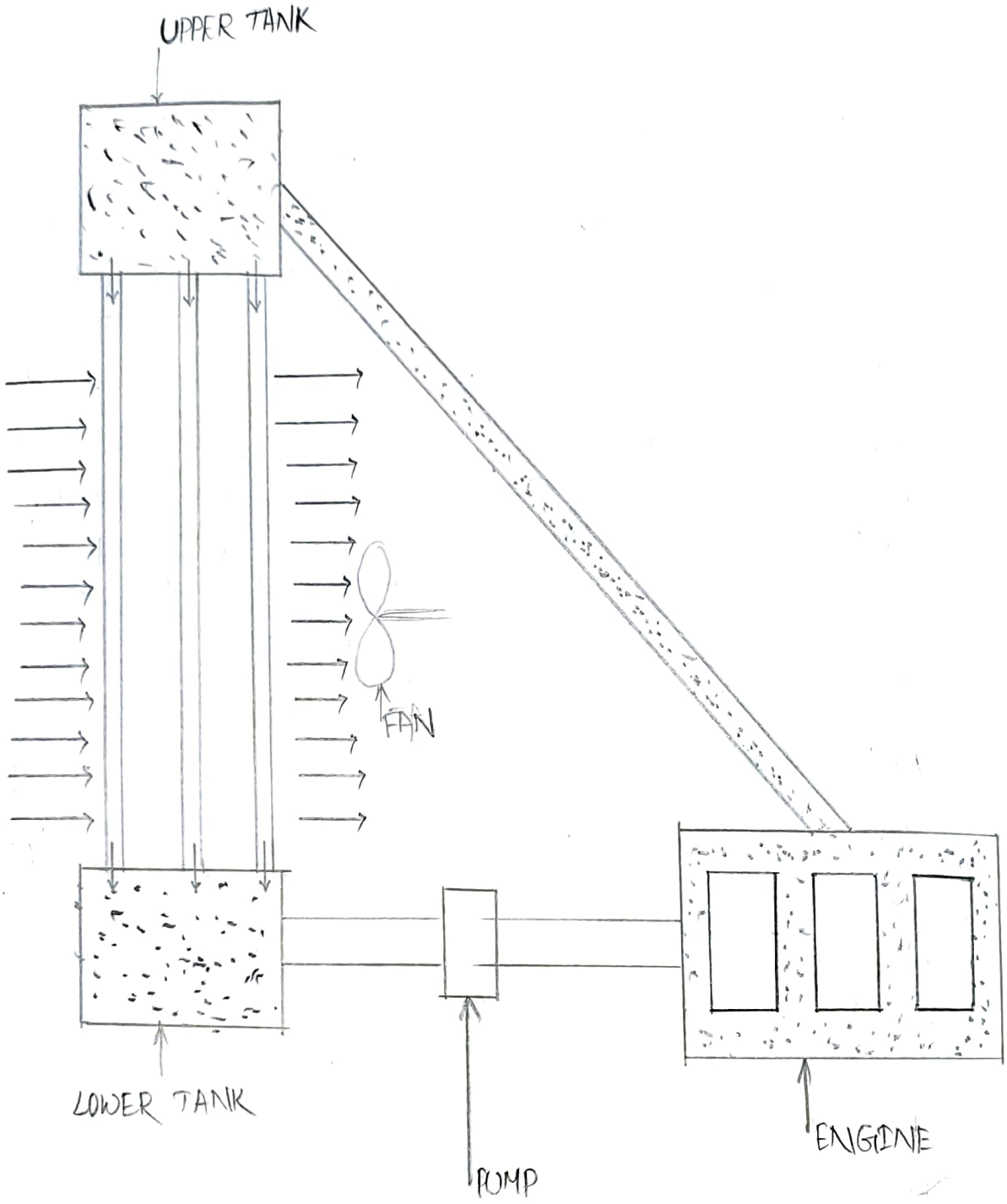
In this method of cooling the heat is dissipated directly to the atmosphere by air. After being conducted through the cylinders walls. fins and flanges an outer surface of cylinders and heads serves to increase the area opposed to the cooling air and so provide a large heat radiating surface.

Advantages :-

(a) Air cooling system lighter in weight due to absence of radiator, cooling jacket and coolant.
(b) Anti freeze solution no required.
(c) No. leaks to the cooling agent.
(d) No. topping of cooling system.

Disadvantages :-

(a) Less efficiency cooling.
(b) more noisy operation.
(c) Not easy to maintain equal cooling arround the cylinders.



(THERMO SYPHON TYPE COOLING SYSTEM)

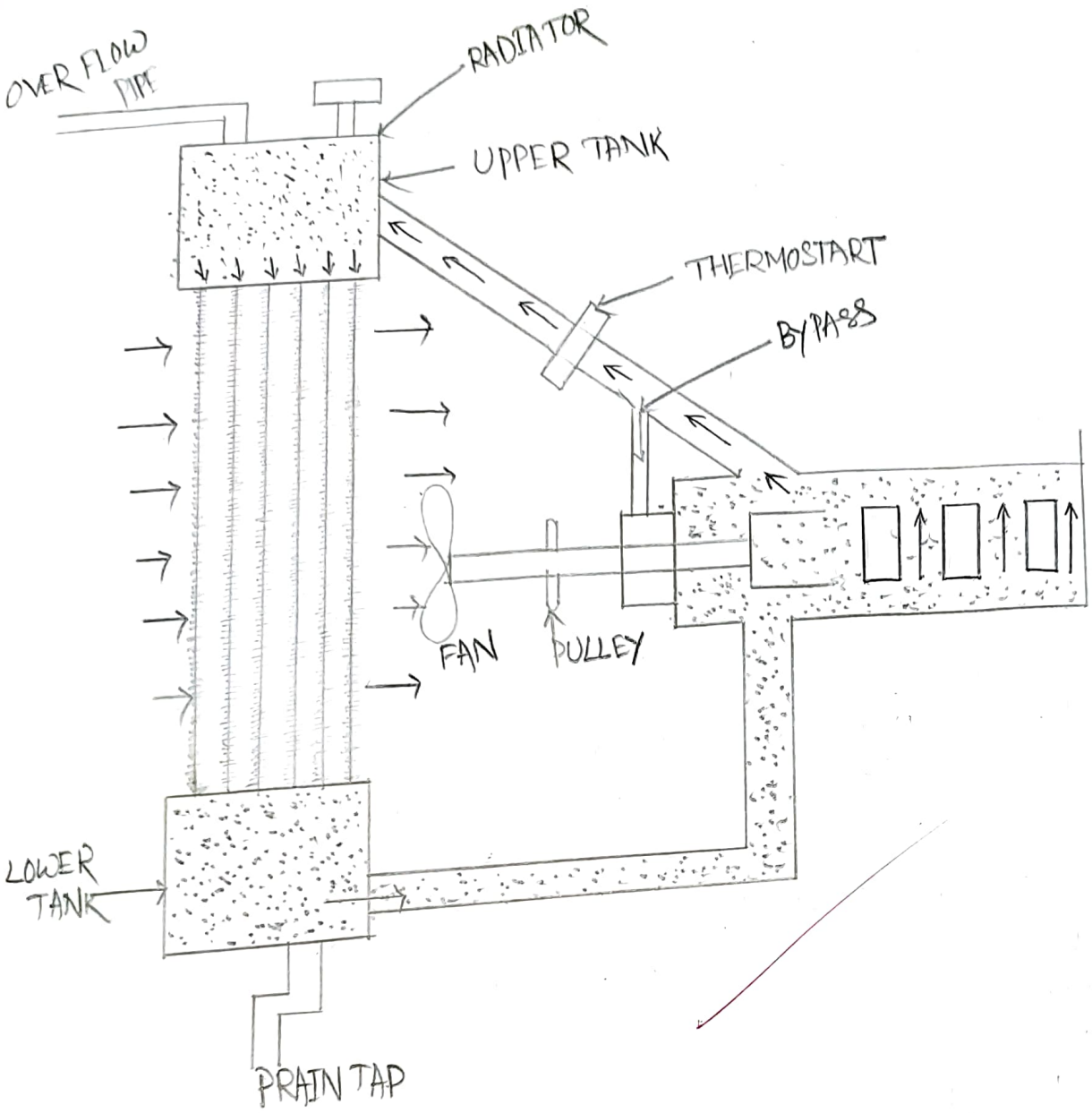
(d) Limited use in Scooteres, mopets, motore cyele.

Watere Cooling System :-

In this method watere is circulating through watere Jackets arround each of the combustion Chambers, Cylinderes, valve seat valve Stems. The circulating waters, when passes through the engine Jackets in the Cylindere block and the cylindere head take heat from the combustion. When it passes through radiatore it is cooled by aire drawn through the radiatore by a fan and by aire devlope by the forward motion of vehicle. After passing through radiatore, the watere again goes in the engine Jacket. Types of watere cooling system are two types :- (a) Theremo Syphon system
(b) Pump circulating system.

(a) Theremo syphon system :-

This system is on the principle of Convection by this system of watere cooling the circulating of watere is obtained due to differenf in density of hot and cold reations of the cooling watere. There is no pump to circulate the watere. The hot watere from the engine Jacket being lighter and rises of in this hose pipe and goes to the radiatore upper tank. It is cooled by the radiatore core by the withdrawn air from the atmosphere towards the engine by the help of radiatore fan & the



(PUMP CIRCULATION COOLING SYSTEM)

moment of vehicle. Hence the cool water drawn from copper tank to lower tank from where it goes in the engine jacket.

(b) Pump Circulating System :-

In this system of water cooling the circulation of water is obtained by a pump. The pump is driven by means of V-belt from a pulley. The system is more effective and efficient than thermosyphon system. The circulation of water becomes faster as the engine speed is increases.

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22/11/19

EXPERIMENT NO- 7

AIM OF THE EXPERIMENT :-

Testing of fuel injection system & adjustment of pressure of fuel injector.

THEORY :-

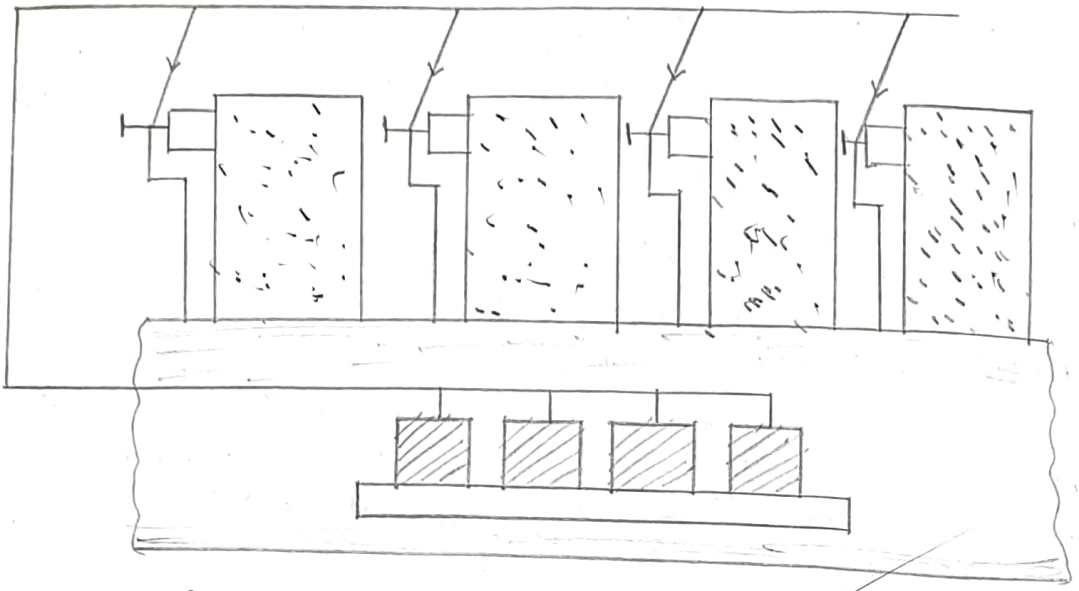
Fuel is injected into the cylinders at the end of the compression stroke; the pressure of fuel injected lies between 100 to 200 bar. During the process of injection the fuel is broken into very fine droplets. The droplets. The vaporise taking the burning starts the vaporisation of the fuel is accelerated as more heat available for burning reduces and therefore heat release is reduced.

FUEL INJECTION SYSTEM :-

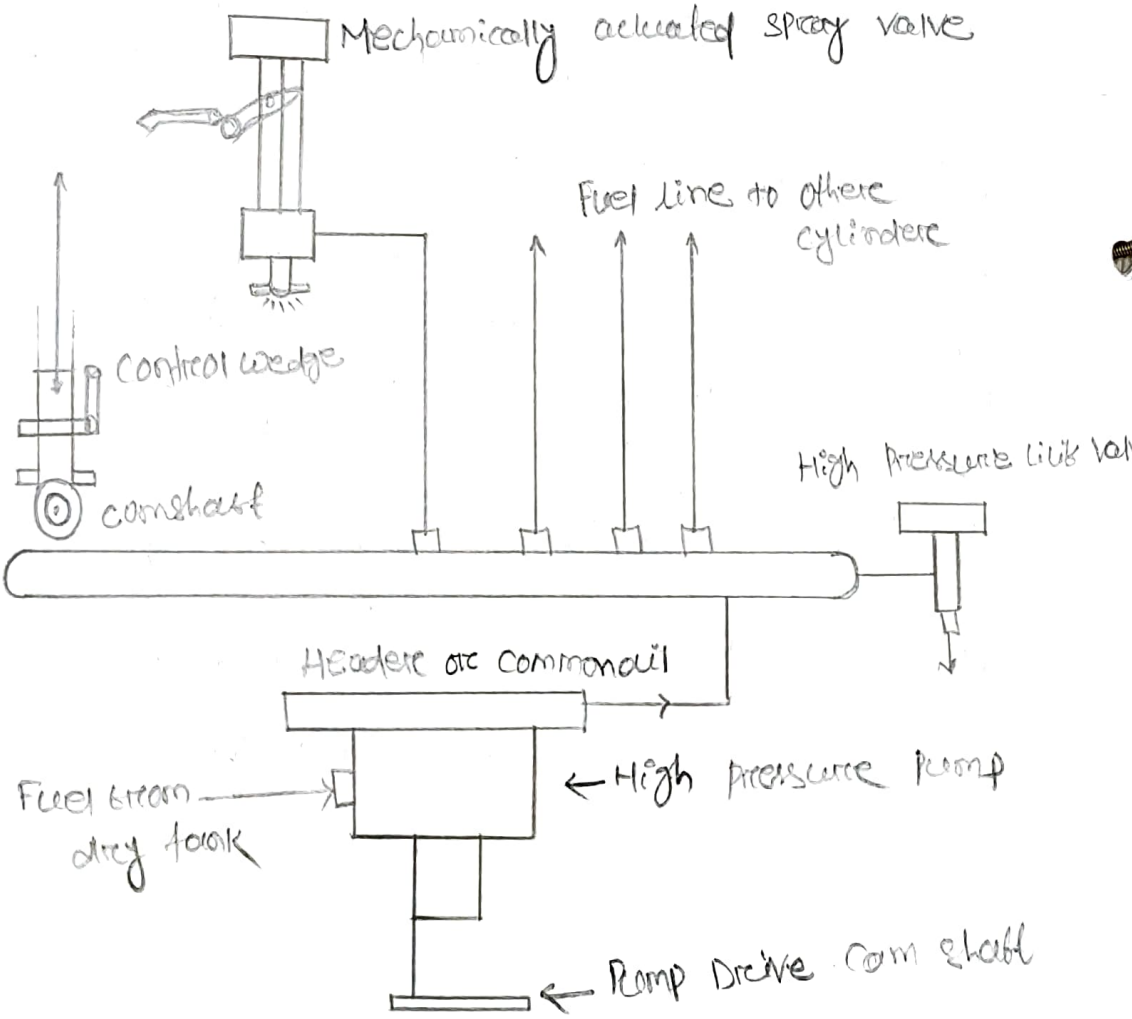
In compression ignition engines (diesel engine) two methodes of fuel injection or injection are used. These are :- a) Air Injection
(b) Solid or Airless Injection

a) AIR INJECTION :-

In this methode of fuel injection air is compressed in the compressore to a very high pressure much higher then develope in the engine cylinders at the end of the compression strokes and then injected through the fuel nozzle into the engine cylinders. The rate of fuel admission can be controlled by varying the pressure of injector air. Storage air bottles which are kept by an air compressor (driven by the engine) supply the high pressure air



(COMMON RAIL INJECTION SYSTEM)



⇨ SOLID / AIRLESS INJECTION :—

Injection of fuel directly into the combustion chamber without primary atomization is termed as Solid or Airless injection.

MAIN TYPES OF MODERN FUEL INJECTION SYSTEM :—

i) Common - Rail Injection System.
ii) Individual Pump injection systems.
iii) Distributor system.

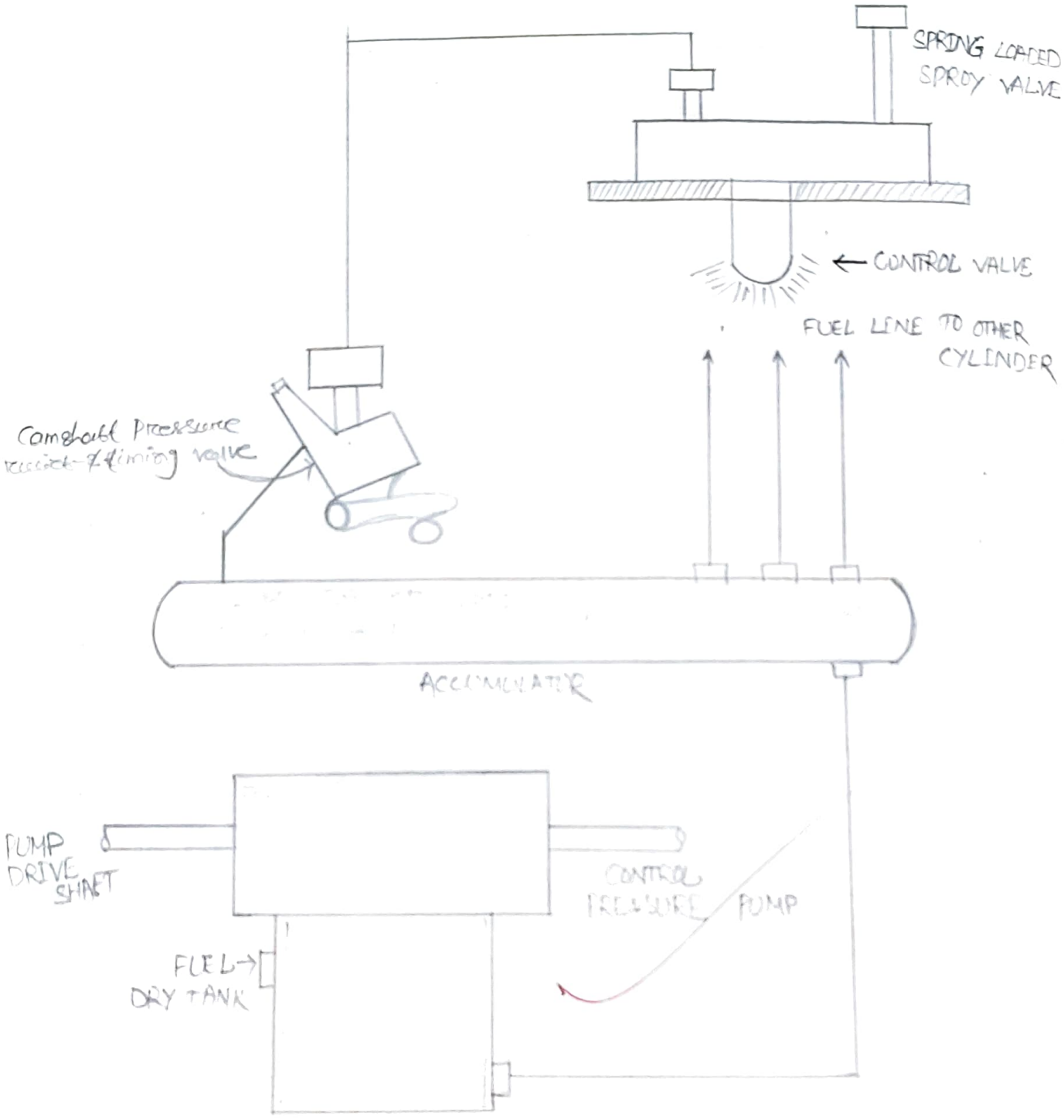
i) Common - Rail Injection System :—

figure-1 :— A single pump supplies high pressure fuel to header, a relief valve holds pressure constant. The control wedge adjusts the lift of mechanical operated valve to set amount and time of injection.

figure-2 :— Controlled-Pressure system has pump which maintains set head pressure, Pressure relief and timing valves regulate injection time and amount. Spring loaded spray valve acts nearly as a check.

ADVANTAGES :—

(i) The system arrangement is simple and less maintainance cost.
(ii) Only one pump is sufficient for multi cylinder engine.
(iii) It fulfills the requirement of either the constant load with variable speed or constant speed with variable load.


SPRING LOADED
SPRAY VALVE
← CONTROL VALVE
FUEL LINE TO OTHER
CYLINDER
Combustion Pressure
ACCUMULATOR
PUMP
DRIVE
SHAFT
CONTROL
PUMP
FUEL →
DRY TANK

(iv) variation in pump supply pressure will affect the cylinders uniformly.

DISADVANTAGES :-

(i) There is a tendency to develop leakes in the injection valve.

(ii) Very accurate design and workshop are required.

(ii) Individual Pump Injection system :-

In this system an individual pump or pump cylinders connects directly to each fuel nozzle pump meters charge and control injection timing. Nozzles contain a delivery valve actuated by the fuel-oil pressure. The design of this type of pump must be very accurated and precise as the volume of fuel injected per cycle is 1/20,000 of the engine displacement at full load and 1/40,000 of the engine displacement during idling. The time allowed for injection such a small quantity of fuel is very limited about 1/450 second at 1500 r.p.m. of the engine providing injection through 20° crank angle. The pressure requirements vaurey from 100 to 300 bare. In this system, the fuel is measured at a central point, a pump pressurised, meters the fuel and times the injection. From hence the is distributed to cylinders in correct firing order by a Cam operated poppet valves which open to admit fuel to the nozzles.

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EXPERIMENT NO - 8

AIM OF THE EXPERIMENT :-

Study of Lubrication System.

THEORY :-

Lubrication is essentially required in motor vehicle maintainance. To supply lubricating oil between the moving parts as simply term as lubrication system. Lubrication of moving parts is essential to reduce friction, wear and tear, temperature and to prevent seizure.

TYPES OF LUBRICATION :-

There are three types of lubricant.

a) ~~Liquid~~ Solid - (Graphite, mica, Soap, stone, carbon)

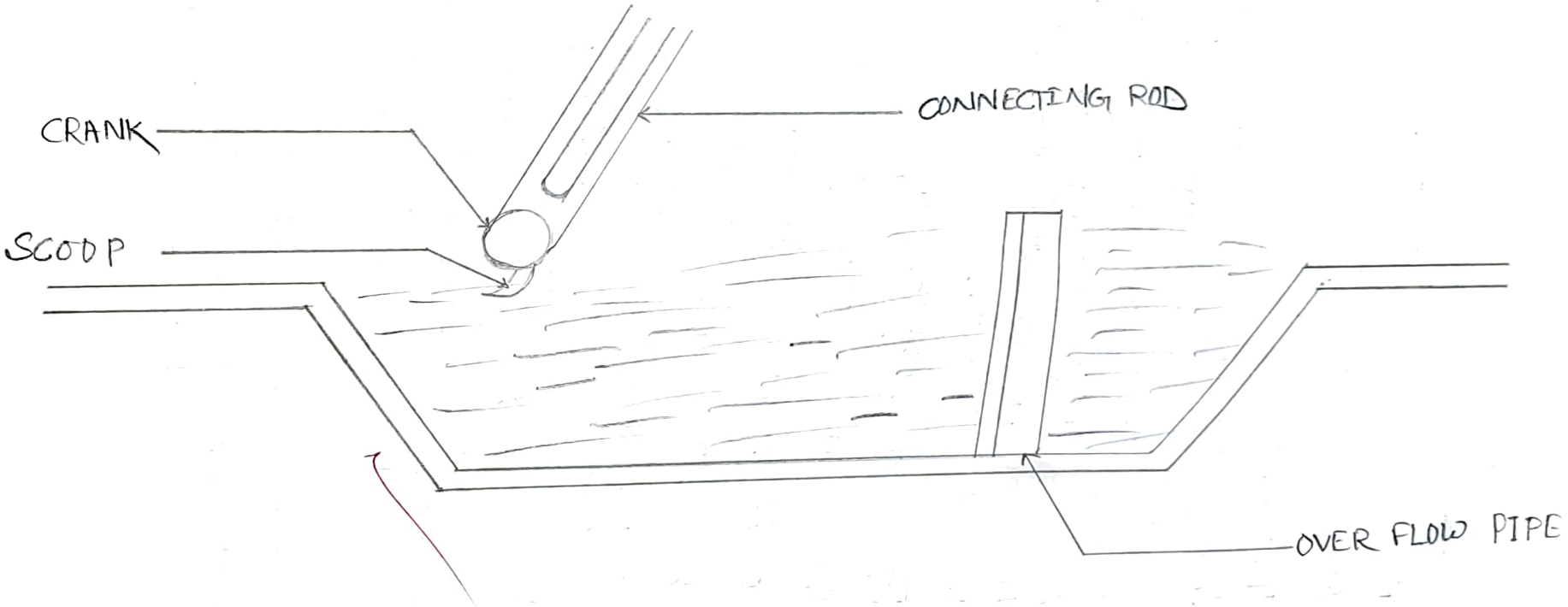
b) Semi Solid - (Greases)

c) Liquid - (Mineral oil, vegetable oil, animal oil)

PROPERTIES OF LUBRICANT :-

A lubricant should be resist corrosion. There is no change in viscosity with change in temperature. It should have high boiling point. It should not develope tome at the time of lubricating. A lubricant should with stand critical operating pressure. It should have a high firing point. Also the flash point & cloud point should be high.

SPLASH SYSTEM



TYPES OF LUBRICATION SYSTEM :-

There are five type of lubrication system as discussed below.

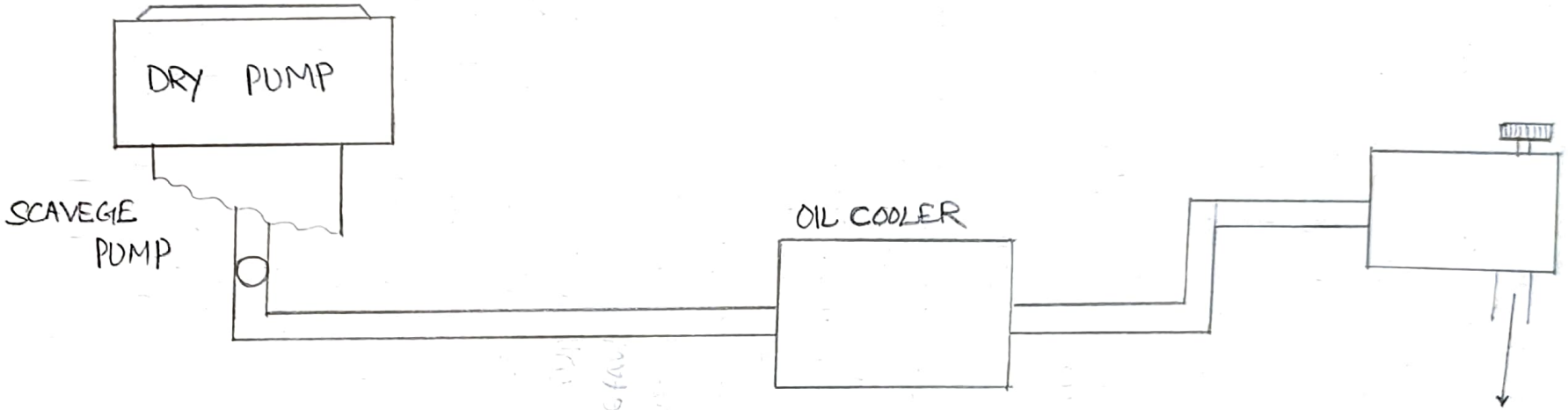
a) Gravity flow system
b) Splash system
c) Pressure system
d) Semi - Pressure system
e) Dry sump system
f) Dual Lubrication system.

(1) Gravity Flow system :-

This system of lubrication generally developed in two stroke petrol engine, like scooters and motor cycles. It is simplest form of lubricating system. It does not consist of any separate part like oil-pump for the purpose of lubrication. but the lubrication oil is mixed in the petrol itself while filling in the petrol tank of the vehicle in a specified ratio. When the fuel goes into crank chamber during engine operation, the oil particles goes deep into the bearing surface and lubricate them. The piston ring, Cylinder wall, piston pin, etc. are lubricated as in same way.

(2) Splash system :-

The lubricating oil is stored in an oil pan or in a sump. A scoop or dipper is made in the lower part of connecting rod during every revolution



DRY SUMP LUBRICATION

of Crankshaft. The dipper dip in the oil and splashes it. Cylinder wall, piston ring, crankshaft, bearing and big end bearing are lubricated in this way.

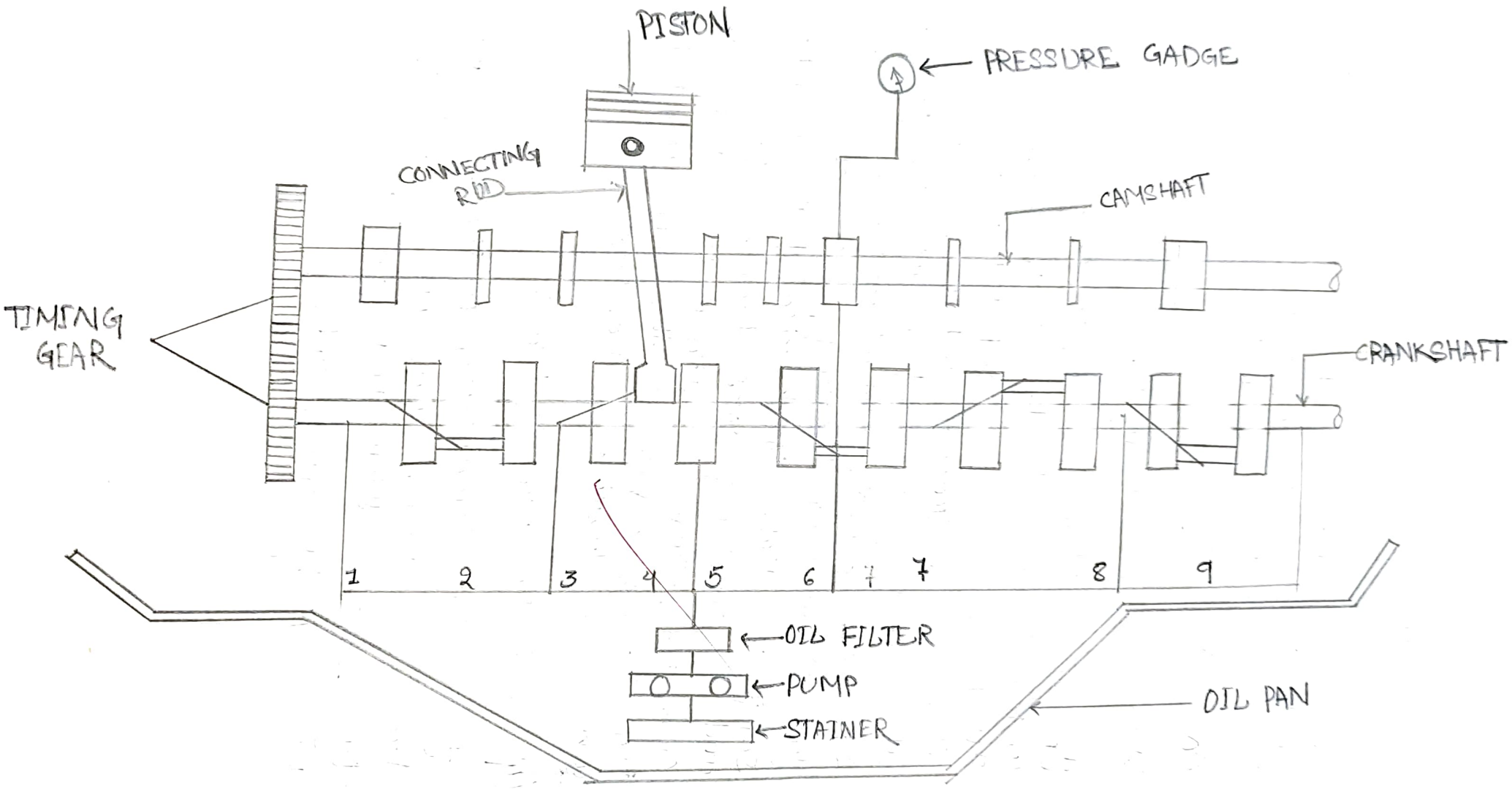
(3) Pressure system :-

In this system the engine parts are lubricated under Pressure feed. The lubricating oil is stored in the sump and and oil pump takes the oil through a strainer and delivers it through a filter to the main oil gallery at a pressure of 2 to 4kg. per cm². From where some of it's lubricant goes to the main bearing, falls back to the sump. Sump is splash to lubricated the cylinder wall and the remaining goes through a hole to the Crankpin. From Crankpin it goes to the piston Pin through a hole in the connecting rod web, where it lubricated the piston.

(4) Semi- Pressure system :-

It is the combination of splash system and Pressure system. Some parts are lubricated by Pressure system and some parts are lubricated by splash system.

PRESSURE SYSTEM



(5) Dry sump system :-

In this system oil is carried in a separate tank from where it is feed to the engine. The oil falls into the sump after lubrication, it is then pumped back to the oil tank by a separate delivery pump. There are two types of pump in this system. one is to feed oil and other to deliver it back to the oil tank.

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EXPERIMENT NO-2

AIM OF THE EXPERIMENT :-

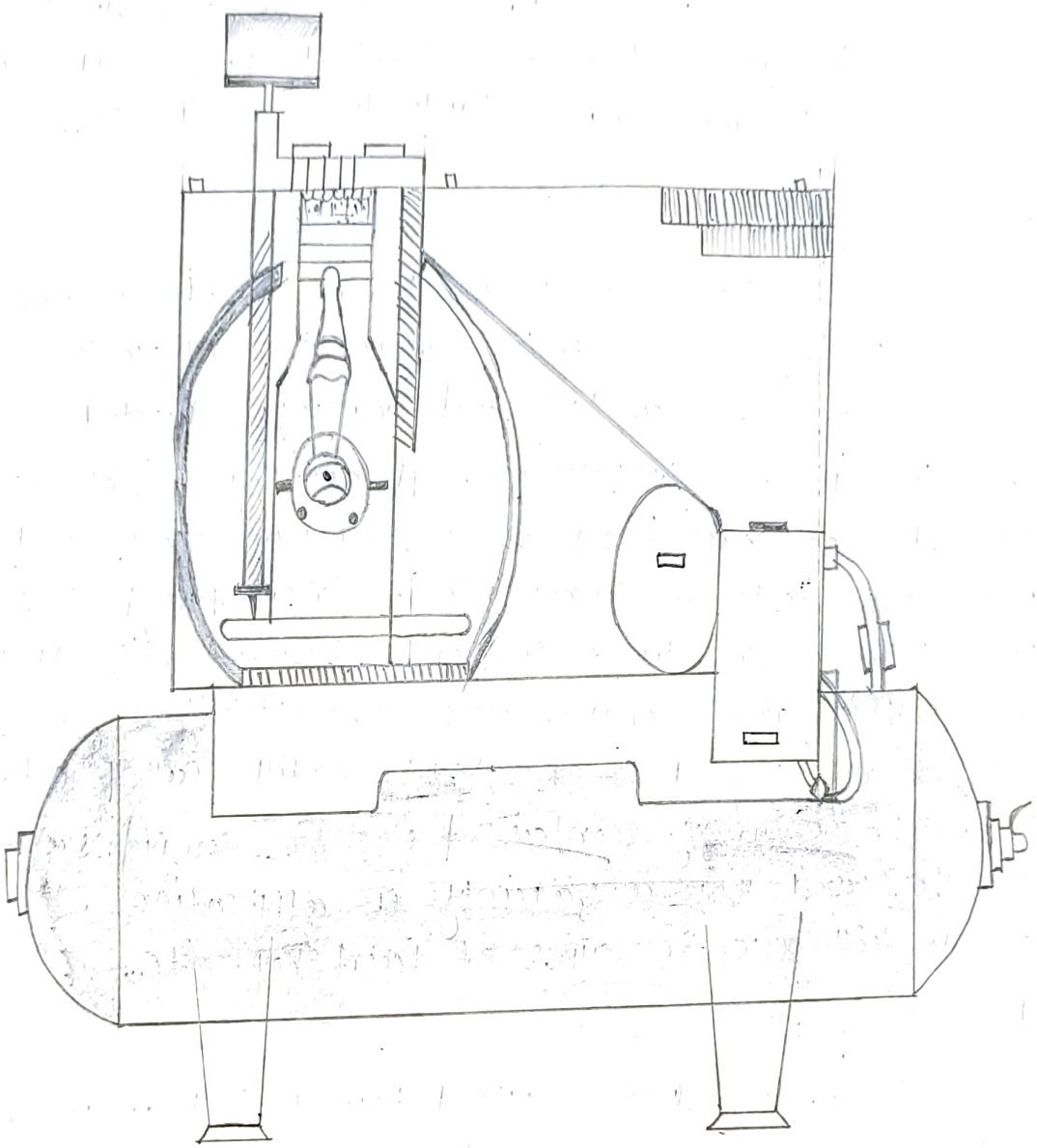
Identification of different machines, equipments & it's operation such as mechanical jack, hydraulic jack, grease gun, oil gun, mechanical press, hydrostatic press air compressure, hydraulic hoist, etc...

AIR COMPRESSURE :-

An air compressure is a device that converts power (using an electric motor, diesel or gasoline engine etc.) in to potential energy stored in pressurized air (i.e compressed air. By one of several methods, an air compressure, forces more and more air into a storage tank increasing the pressure when tank pressure reaches it's upper limit the air compressure shut off. The compressed air then is held in the tank until called into use. The energy contained in the compressed air can be used for a variety of applications. Such as to fill air in types at paint shop etc..

HYDRAULIC HOIST :-

A hoist is a device used for lifting or lowering a load by means of a drum or lift-wheel around which rope or chain winds. It may be manually operated electrically or pneumatically driven and may use chain fibers or wire rope as it's lifting medium. It has a motor or hydraulic system which is lift a load by a little effort by using the pressure of hydraulic oil. It is mainly operated



AIR COMPRESSURE

AIM OF THE EXPERIMENT:-

To study about two stroke and four stroke petrol engine.

APPARATUS REQUIRED:-

Sl.no	Name of the apparatus	Specification	Quantity
01	Model of petrol stroke engine	2-stroke	1
02	Model of petrol stroke engine	4-stroke	1

THEORY:-

2-STROKE PETROL ENGINE:-

- A two stroke cycle petrol engine was devised by Dug lad clerk in 1880.
- In this cycle, the suction, compression, expansion, and exhaust takes place during two strokes of the piston. It means that there is one working stroke after every revolution of the crank shaft.
- A two stroke engine has ports instead of valves . the four stages of a two stroke petrol engine are described below:

1. **SUCTION STAGE:-**

- In this stage, the piston ,while going down towards BDC,uncovers both the transfer port and the exhaust port.
- The fresh fuel-air mixture flows into the engine cylinder from the crank case.

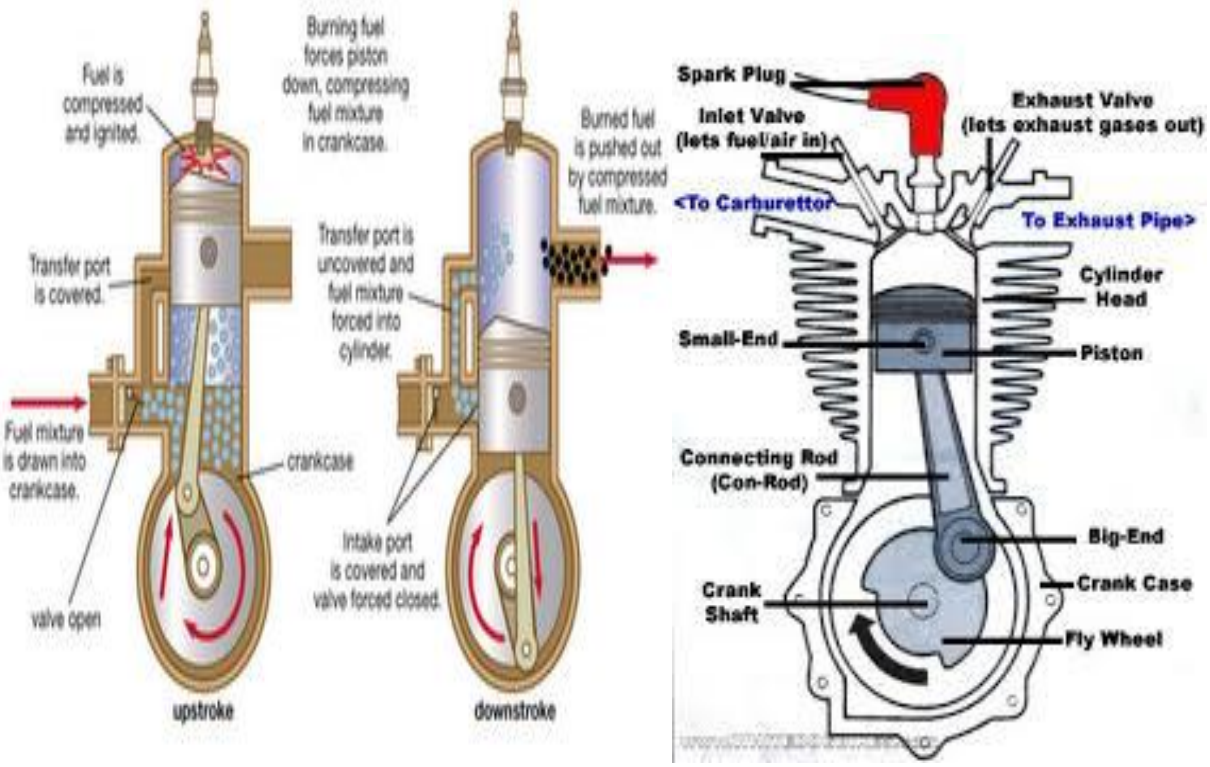
2. COMPRESSION STAGE:-

- In this stage , the piston, while moving up, first covers the transfer port .
- After that the fuel is compressed as the piston moves upwards BDC to TDC.
- In this stage, the inlet port opens and fresh fuel-air mixture enters into the crank case.

3. EXPANSION STROKE:-

- Shortly before the piston reaches the TDC (during compression stroke)the charge is ignited with the help of a spark plug.
- It suddenly increases the pressure and temperature of the product of combustion. But the volume, practically remains constant.
- Due to rise in the pressure, the piston is pushed downwards with a great force.
- The hot burnt gases expand due to high speed of the piston. During this expansion, some of the heat energy produced is transformed into mechanical work.

- **<u>EXHAUST STROKE</u>**:-
  - In this stage, the exhaust port is opened as the piston moves downwards.
  - The product of combustion, from the engine cylinder is exhausted through the exhaust port into the atmosphere.
  - This completes the cycle and the engine cylinders ready to suck the charge again.



4- STROKE PETROL ENGINE:-

Itrequires four strokes of the piston to complete one cycle of operation in the engine cylinder. The four strokes of a petrol engine are described below:

1.SUCTION STROKE:-

- In this stroke, the inlet valve opens and the charge is sucked into the cylinder as the piston moves downward from TDC.
- It continues till the piston reaches its BDC.

2.COMPRESSION STROKE:-

- In this stroke, both the inlet and exhaust valves are closed and the charge is compressed as the piston moves upwards from BDC to TDC.
- As a result of compression, the pressure and temperature of the charge increases considerably.
- This completes one revolution of the crank shaft.

3.EXPANSION STROKE:-

- Shortly before the piston reaches TDC (during compression stroke),the charge is ignited with the help of a spark plug.
- It suddenly increases the pressure and temperature of the products of combustion but the volume,practically remains constant.
- Due to the rise in pressure, the piston is pushed down with a great force. The hot burnt gases expand due to high speed of the piston.
- During this expansion,some of the heat energy produced is transformed into mechanical work.

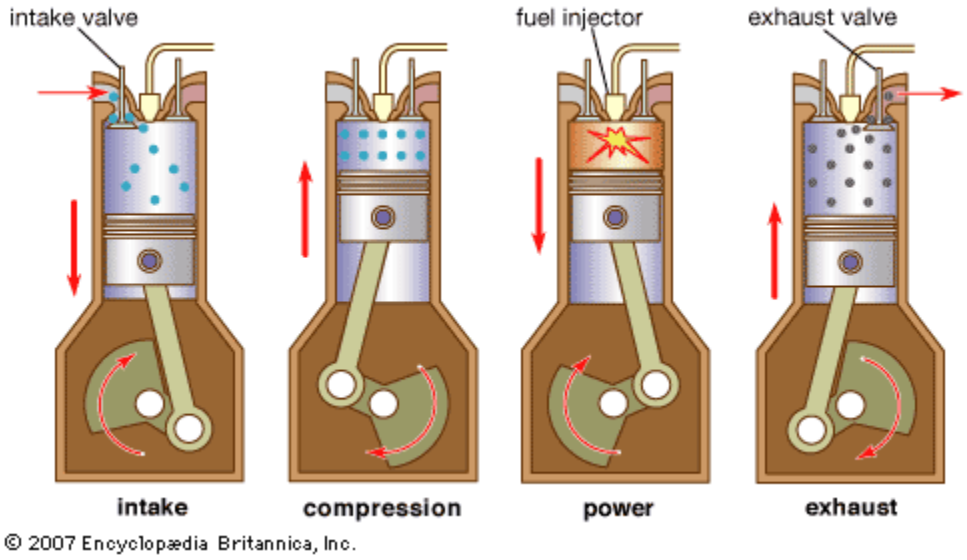
4. EXHAUST STROKE:-

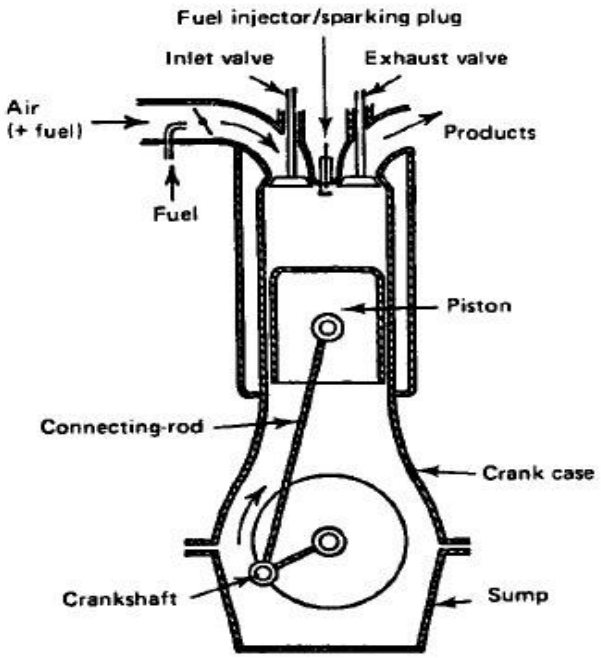
- In this stroke,the exhaust valve is open as piston moves from BDC to TDC.

- This movement of the piston pushes out the products of combustion, from the engine cylinder and is exhausted through the exhaust valve into the atmosphere.
- This completes the cycle, and the engine cylinder is ready to suck the chargeagain.

CONCLUSION:-

From the above experiment we have successfully studied about 2-stroke and 4-stroke petrol engine.





4- STROKE PETROL ENGINE

AIM OF THE EXPERIMENT:-

To study about twostroke and four stroke diesel engine.

Sl.no	Name of the apparatus	specification	Quantity
01	Model of diesel engine	2-stroke01	01
02	Model of di0esel engine	4-stroke	02

THEORY:-

2-STROKE DIESEL ENGINE:-

A two stroke cycle diesel engine also has one working stroke after revolution of the crank shaft.All the four stages of a two stroke cycle diesel engine are described below:

1.SUCTION STAGE:-

- In this stage,the piston while going down towards BDC uncovers the transfer port and the exhaust port.
- The fresh air flows into the engine cylinder from the crank case.

2.COMPRESSION STAGE:-

- In this stage,the piston while moving up, first covers the transfer port and then exhausts post.
- After that the air is compressed as the piston moves upward.
- In this stage, the inlet port opens and the fresh air enters in to the crank case.

3.EXPANSION STAGE:-

- Shortly before the piston reaches the TDC (during compression stroke),the fuel oil is injected in the form of very fine spray into the engine cylinder through the nozzle known as fuel injection valve.
- At this moment, temperature of the compressed air is sufficiently high to ignite the fuel. It suddenly increases the pressure and temperature of the products of combustion.
- Due to increase in pressure,the piston is pushed with a great force .The hot burnt gases expand due to high speed of the piston.
- During the expansion,some of the heat energy produced is transformed into mechanical work.

4. EXHAUST STAGE:-

- In this stage, the exhaust port is opened and the piston moves downwards.
- The product of combustion from the engine cylinder is exhausted through the exhaust port into the atmosphere.
- This completes the cycle,and the engine cylinder is ready to suck the air again.

4-STROKE DIESEL ENGINE:-

It is also known compression ignition engine.Because the ignition takes place due to the heat produced in the engine cylinder at the end of compression stroke.The four stokes of the diesel engine are described below:

1.SUCTION STROKE:-

- In this stroke,the inlet valve opens and the pure air is sucked into the cylinder as the piston moves downwards from TDC.
- It continues till the piston reaches in the BDC.

2.COMPRESSION STROKE:-

- In this stroke,both the valves are closed and the air is compressed as the piston moves upwards from BDC to TDC.
- As result of compression,pressure and temperature of the air increases considerably.
- This completes the revolution of the crank shaft.

3.EXPANSION STROKE:-

- Shortly before the piston reaches the TDC, fuel is injected in the form of very fine spray in to the engine cylinder through the nozzle known as fuel injector or fuel injection valve.
- At this moment, temperature of the compressed air is sufficiently high to ignite the fuel.It suddenly increases the pressure and temperature of product of combustion.
- Due to increased pressure, the piston is pushed down with a great force.The hot burnt gases expand due to high speed of the piston.
- During the expansion,some of heat energy is transformed into mechanical work.

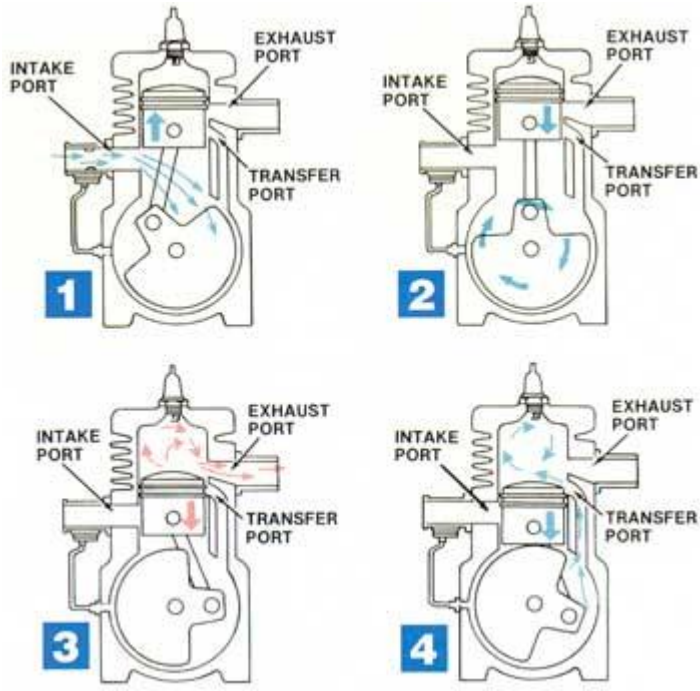
4.EXHAUST STROKE:-

- In this stroke the exhaust valve is open as the piston moves from BDC to TDC.
- This movement of the piston pushes out the product of combustion from the engine cylinder through the exhaust valve into the atmosphere.

- This completes the cycle and the engine cylinder is ready to suck the fresh air again.

CONCLUSION:-

From the above experiment we have successfully studied about the 2-stroke and 4-stroke diesel engine.



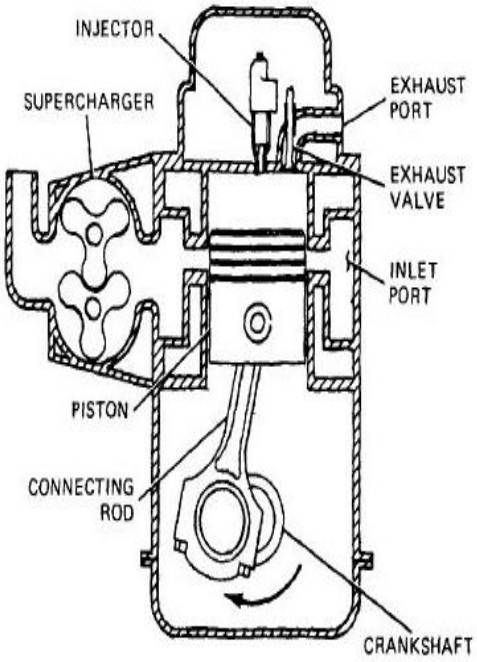
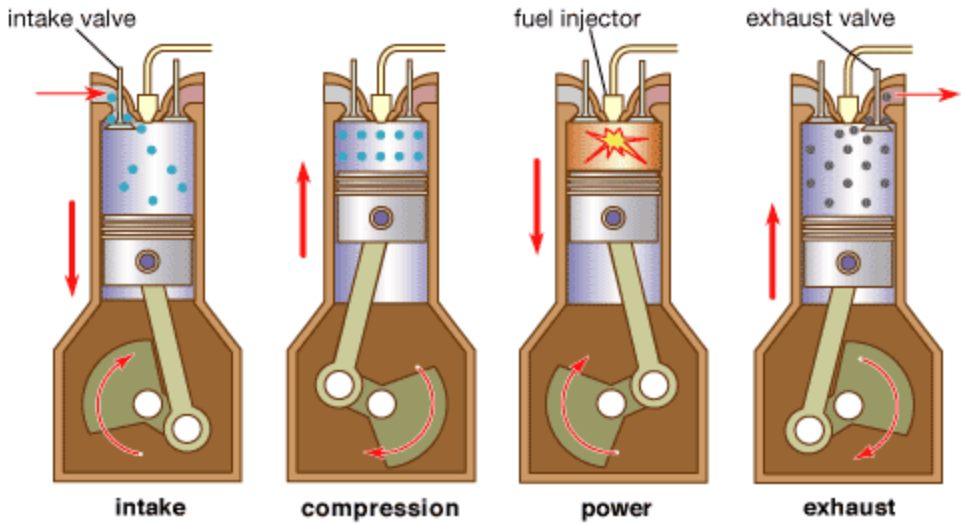
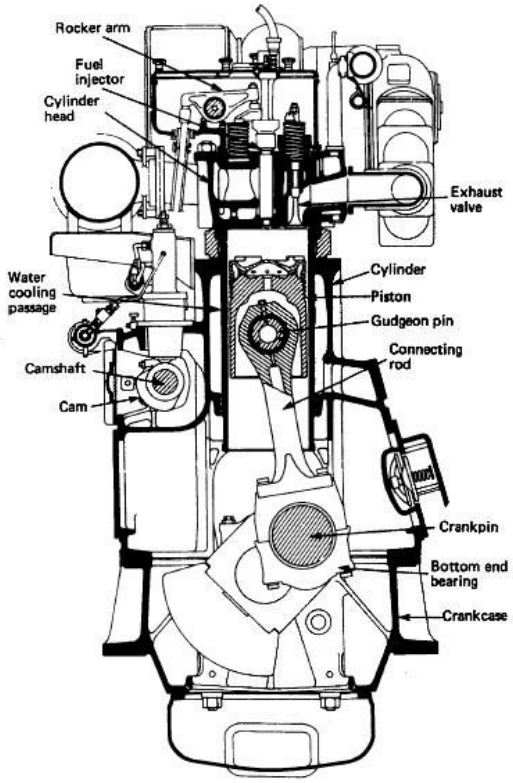


Figure 2-21. The Two Stroke Cycle Diesel Engine





4-STROKE DIESEL ENGINE

EXPERIMENT-2

I.C.ENGINES PERFORMANCE TEST (4 – STROKE DIESEL ENGINES)

Aim:- To conduct load test on single cylinder, vertical, water –cooled diesel engine and hence to determine frictional power and draw the performance characteristic curves.

Apparatus:- Single cylinder diesel engine test rig coupled with rope brake dynamometer, stop watch.
Engine Specification:-

TYPE : 4-STROKE DIESEL ENGINE (water cooled)

MAKE : KIRLOSKAR

BORE : 85 mm

STROKE : 110 mm

SPEED : 1500 rpm

OUTPUT : 5HP

COMPRESSION RATIO : 16.5 : 1

BRAKE DRUM RADIUS : 0.185 m

ORFICE DIAMETER : 15 mm

SPECIFIC GRAVITY OF H.S.D.OIL : 0.85 gm/ml

CALORIFIC VALUE : 10,000 K cal/kg

Description:- The water-cooled single cylinder diesel engine is coupled with a rope brake dynamometer. Separate cooling lines are provided for the drum and the engine. Thermocouples are arranged for sensing the temperature of cooling water consisting of fuel tank mounted on stand, burette with 3-way cock arrangement is provided.

Theory:-

Load test is conducted to study the performance characteristics of the engine. The single cylinder diesel engine is run at a constant speed of 1500 rpm. The engine is loaded in steps of constant interval loads i.e . 0kg, 2kgs, 4kgs ----etc. At each load fuel consumed is determined. The output of the engine is calculated as follow.

$BP = \frac{\Pi\ WDN \times 9.81}{}$ ……KW W=(W1 –W2) Kgf

60000.

A graph with BP on X- axis and Fuel consumed per hour (FCH) on Y-axis is plotted. The line joining the all data points when extended back, it intercepts the – ve X-axis. The negative intercept magnitude gives the Frictional Power of the engine. The line connecting the data points is known as the WILAN'S LINE.

The other performance parameters like Brake Mean Effective Pressure (Bmep), bth), Mechanical efficiencyηith), Brake thermal efficiency (ηindicated thermal efficiency (mech), Specific Fuel Consumption (SFC) are determined and graphs are plotted.η(

Maximum load on the engine (Wmax) can be calculated as follows

Wmax = 3.68 x 60000

ΠDN x 9.81

Procedure :- 1. The fuel level in the tank is checked.

2. Lubricating oil level is checked.

3. The engine is started at no load condition and the time taken for 10 ml fuel consumption is noted.

4. A load of 2 kg s is applied on the engine, the spring balance reading w2 , applied load w1 , time taken for 10 cc of fuel consumption are noted down.

5. The above procedure is repeated at different loads like 4kgs, 6kgs, ----- 15 kgs.

6. Frictional Power is obtained from the WILAN'S LINE graph. mech , are calculated.ηbth, η ith, η

7. The other parameters like SFC, Bmep, IP,

8. Graphs are plotted as given below.

i) BP Vs FCH

ii) BP VS SFC BP VS Bmep mechη

iii) BP VS bthη

iv) BP VS ithη

v) BP VS

Observations:-

Model Calculations:-

1. BP = Π WDN x 9.81 ……..KW 60000

2. Fuel consumption per hour (FCH): FCH = 10 x 3600 x 0.85 ……Kg/hr t x 1000

3. SFC = FCH .....Kg/kwhr BP

1. Indicated Power (IP) IP = BP + FP (FP is obtained from WILAN'S LINE graph) mech)η

2. Mechanical Efficiency (mech = BP/IPη

3. Bmep = 60000 x BP bar w

LA nk x 10

4.ith = IP x 3600 x 100 ……..%η7.

FCH x CV

5. bth = BP x 3600 x 100 ……%η8.

FCHXCV

Where

i) IP and BP are in kilo watts

ii) ii) CV- calorific value of the fuel in kj/kg

Precautions:-

i) The engine should be started and stopped at No Load condition.

ii) Cooling water supply must be ensured throughout the experiment.

iii) The readings should be noted without Parallax error.

iv) Lubricant oil level to be checked.

Review Questions:_-

1. Define mean effective pressure?

2. Briefly discuss the various efficiency terms associated with an engine?

3. Mention the basic aspects covered by the engine performance?

4. What are the methods available for improving the performance of an engine?

5. List the types of exhaust temperatures measured?

Trouble Shooting:-

1. Engine will not start due to air lock in the fuel system- i)Open the bleed- off valve and release the air lock.

2. Engine will not start due to diesel filter choked – i) Remove the filter and clean it.

3. Engine will not start if the holding bolts are loose – i) Tighten the bolts so that required injecting pressure occurs.

4. Abnormal noise - i) Check the engine Jacket cooling system. ii) Check the bearings condition. iii) Check the level and condition of lubricating oil / lubricating filter.

Inference:- Brake Thermal efficiency around 25%

Indicated Thermal efficiency around 35%

Friction Power loss around 16%

Mechanical efficiency around 75%

Specific Fuel Consumption for diesel engine is around

Applications: - Understanding of speed Vs Load Diesel consumption Vs Load per unit time

Aim: To conduct Morse Test on 4-stroke petrol engine and hence to determine the FRICTIONAL mech) of the engine.ηPOWER (FP) and MECHANICAL EFFICIENCY (

Apparatus: Petrol engine test rig coupled with hydraulic dynamometer, stop watch and tachometer.
Engine Specifications:-

Type : 4-cylinder, 4-stroke petrol engine.

Make : HM—1 sz

Rated Power : 75 HP at 5000 RPM

Compression Ratio : 8.5:1

Bore x Stroke : 84mm x 82mm

Clutch : Diaphragm type

Loading : By Hydraulic Dynamometer

Description: A medium capacity 4-stroke vertical water-cooled petrol engine is selected. The engine is coupled with a hydraulic dynamometer. This consists of two half castings and a rotor assembly or rotor shaft and coupling running on ball bearings. The principle of operation of the unit is similar to the fluid coupling. The reaction at the casting is measured by a load cell. The load is read from the digital indicator.

Theory: Morse test conducted on multi cylinder engines to determine the frictional power, indicated power and mechanical efficiency of the engine. The power available at the shaft (Brake Power) is always less than the indicated power of the engine. These two parameters are related as follows.

IP=BP+FP …….(1)

Where IP= Indicated Power

BP= Brake Power

FP= Frictional Power

In this experiment the engine is run at a constant speed of 1500 rpm, to keep the FP of the engine constant. To calculate the IP of a particular cylinder, say nth cylinder, the spark plug is short circuited to that cylinder and speed is kept constant at 1500 rpm. Then IP of that nth cylinder is given by

(IP)n = (BP)- (BP)n off ……..(2)

Where BP= Brake Power of the engine with all cylinders working

=_W x N / 2720 ----------(3)

(BP)n off = Brake power of the engine with fuel supply cut-off to nth cylinder.

The hydraulic dynamometer works at an operating pressure of 1 kg/ cm2 The maximum load on the engine is calculated as follows

. 55 Kw= Wmax x 5000/2720 ……..(4)

Wmax = 30 kgs

Procedure:

1. The Fuel level and lubricating oil level are checked.

2. The Engine is started and the load is adjusted to 8 kg at an engine speed of 1500 rpm.

3. The engine is allowed to run for some time at this condition. Then first cylinder is cutoff by operating the lever , So that spark plug is short circuited.

4. The engine speed is adjusted to 1500 rpm by decreasing the load on the engine. The load at which speed becomes 1500 rpm is noted. In no case the accelerator be touched while adjusting the speed.

5. The first cylinder is put on to working condition by operating the lever and the engine is allowed to run for some time at this state

. 6. The second cylinder is cut-off and the load at which speed is maintained at 1500 rpm is noted.

6. The above procedure is repeated for the third and fourth cylinders.

OBSERVATION TABLE :

SL NO	Cylinder status	Speed (rpm)	Load (kg)
1	All cylinders on	1500	1500
2	First cylinder cut-off	1500	
3	Second cylinder cut-off	1500	
4	Third cylinder cut-off	1500	
5	Third cylinder cut-	1500	

	off		

Model Calculations :

1. Brake Power (BP): BP= $\frac{W \times N}{2720}$.....KW

2. Brake power of the engine when nth cylinder cut-off,(BP)n off (BP)n-off =Wn-off x N / 2720……KW

3. Indicated Power of nth cylinder (IP)n (IP)n = (BP) - (BP)n-off ……..KW

4. Indicated power (IP) of the engine: IP = (IP)1 + (IP)2 + (IP)3 + (IP)4 .....KW

5. Frictional Power of the engine (FP) : FP = IP - BP ……KW mech) :η

6. Mechanical Efficiency (mech) = BP x 100/IP

SL NO	CYLINDER NO	IP(KW)
1	1	
2	2	
3	3	
4	4	

Review Questions:-

2. Briefly discuss the various efficiency terms associated with an engine?

3. What are the methods available for improving the performance of an engine?

4. List various methods available for finding frictional power of an engine?

5. Why morse test is not suitable for single cylinders engine?

6. Explain the principle involved in the measurement of brake power?

Trouble Shooting :-

4. Engine will not start due to air lock in the fuel system-open the bleed - off volve.

5. Engine refuses to start---- Petrol tap shut off.

No petrol in the tank

Throttle disconnected, too much air through carburetor.

Pilot jet blocked.

Checked petrol filter

. Fuel pump not operating

7. Engine Started & stopped after few minutes of running – Controls out of order Stripper timing gear Valve sticking Broken valve No valve tappet clearance. Insufficient lubrication

Applications:- Performance data of engine obtained from theoretical analysis is compared with experimental results and approved for validation.

Inference:- Friction looses as in the case of pistons , bearings , gears, valve mechanisms, these losses are usually limited from 7 to 9 percent of the indicated out put. Power observed by engine axillaries such a fuel pump, lubricating oil pump, water collecting pump, radiator, magneto & distributor, electric generator for battery charging etc. These losses may account for 3 to 8 percent of the indicated out put. Ventilating losses are usually below 4 percent of indicated out put.

Pumping losses and power observed by the scavenging pump are account 2 to 6 percent of the indicated out put. Excusing all, the mechanical efficiency of engine varies from 65 to 85 %.
Precautions:-

1. Only one cylinder should be cut-off at a time.

2. The engine should not be operated with a cut-off cylinder for a long time

. 3. The engine should be started and stopped at no load condition.

. 4. The load applied on the engine should not exceed the maximum load that can be applied

5. The lubricating oil level should be maintained sufficiently.

6. Cooling water supply must ensured throughout the experiment.