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MECHANICAL DEPARTMENT PRESENTS

MECHON

2019

MESSAGE BY DEAN

DR. R.R.SEDAMKAR

It is a moment of pride for me to announce the release of 'MECHON' magazine's fifth issue. The magazine portrays the writers' intellect and enables them to share their innovative ideas. I gladly acknowledge the efforts taken by the students and staff of Mechanical Department who have taken the initiative to promote the writing and publishing skills of students. I'm sure the magazine has helped the students to share and express their thoughts in an articulate manner.

Achievements of students have also been mentioned which will be a motivational factor for other students to achieve the standard of excellence. I am immensely pleased to say that that we have achieved our aim of turning this into reality. I would like to congratulate the students, teachers, alumni and everyone else involved in publishing its fourth edition. I wish everyone loads of success and a bright future.

MESSAGE BY MENTOR

DR. SANJAY KUMAR

I feel esteemed to be a part of the fifth issue of the e-magazine of the Department of Mechanical Engineering.Only 4 batches have passed out and the Department has shown great potential. Our students have shown tremendous potential not only in academics but also in co-curricular activities and extra-curricular activities.

At the International conference, faculties and students have published technical papers in International journals. Some of the papers were also published in Tata McGraw Hill Publication. For the overall personality development of students, apart from academics, participation in co-curricular and extra-curricular activities is the need of the hour. Students are encouraged to participate in National level competitions,and have won 1st prize at hackathon. All these activities help in their holistic development, as a result of which they get admitted into reputed universities and get placed in prestigious companies. I commend all faculties, students and staff members for their hard work in publishing the e-magazine, which represents the insights of the Mechanical Department. I wish them Best of Luck !

MESSAGE BY HEAD OF DEPARTMENT

DR. SIDDHESH SIDAPPA

I am delighted to know that our students have succeeded in publishing the fifth issue of‘MECHON’ for the academic year 2019-2020. ‘MECHON’ the departmental magazine hasthe prime objective of providing aspiring engineers a wide platform to showcase their technical knowledge and to pen down their illustrative and innovative ideas.

This magazine is intended to bring out the hidden literary talents in the students an teachers to inculcate strong technical skills among them. I congratulate and thank all the students and faculty coordinators who have made untiring efforts to bring out this magazine. I wish them all the very best for releasing more such magazines in the future.

MESSAGE BY FACULTY IN-CHARGE

MR. PAWAN TIWARI

It gives me immense pleasure to present the fifth issue of 'MECHON' e-magazine of the Department of Mechanical Engineering. It is the talent and outlook of our students which is portrayed through this magazine. This is one of the best platforms for our students to present multifaceted personalities and innovative ideas. It also enables the students to be aware of their changing surroundings and to consistently learn about new technologies.

I take this opportunity to thank our respected Principal Dr. B. K. Mishra, Dean of Academics Dr. R. R. Sedamkar, Dean Mentor Dr. Sanjay Kumar, Head of Department Dr. Siddesh Siddapa, and all the faculty members for their perpetual inspiration and kind support. I believe that this edition will prove to be a success. I express my heartfelt gratitude to the editorial committee for their relentless efforts, the young writers for their valuable articles and all those who have been a part of 'MECHON'

Contents

FACULTY ARTICLES

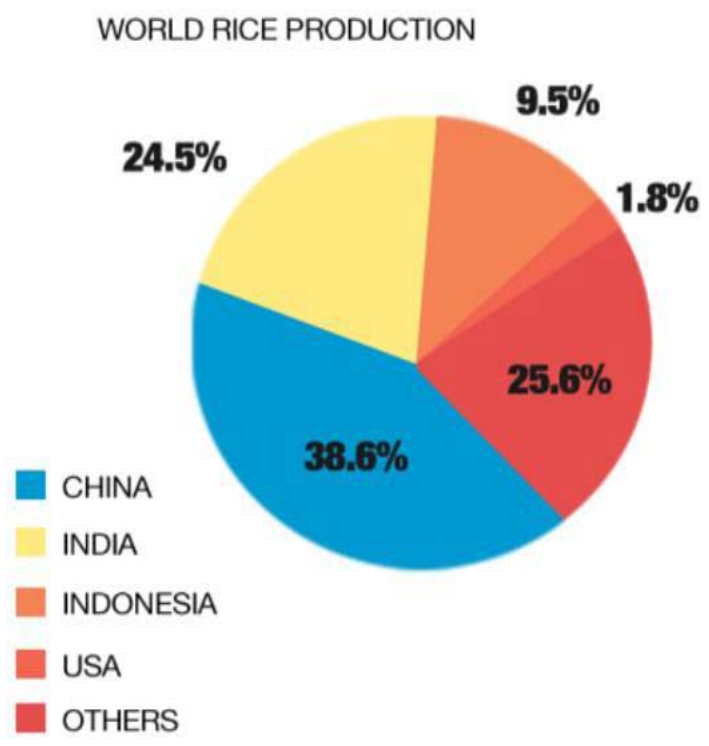
RICE PLANTATION MACHINE

Rice plantation machine : Giving Comfort to Farmers

The most important sector for the Indian Economy is the agriculture sector. Majority of the employment in India is in the agriculture sector. Labour intensive and drudgery are the orthodox way of rice plantation. Mechanized rice plantation machine is cost-effective & operation friendly. For mechanical plantation machine, well puddled and leveled field is required with no standing water on the surface because it creates more floating hills. Considering the growing population, it is a huge challenge to suffice its needs. Mechanization in the paddy sector will have a higher yield and it will release most of the work force to other sectors. This project aims to design a mechanized rice plantation machine to plant rice saplings. Proper time of operations is one of the major parameters to use this machine to its optimum. The two-row paddy rice plantation machine is a quick way of sowing the sapling as well as proper spacing between successive saplings can be maintained. Labour required for the operating machine is reduced, due to which labour cost is reduced.

Rice is majorly consumed and produced in the Asian region. India has the largest area under paddy in the world and ranks first in the production of rice. Average rice production per hectare in India is 2.2 tonnes. Climatic conditions like temperature and humidity play a vital role in rice production. (i) Pre-Planting (ii) Post-production (iii) Growth, these are the steps used in the production of rice. The seven-sister region of India covers 7-8% of the total region of rice cultured in India and in terms of rice produced, accounts to only 5-6% of the total national rice production. However, this region is delayed in terms of rice produced because of a lack of work force.

The factors responsible for cultivation are: (i) Age of the variety (ii) Availability of moisture (iii) Climatic conditions (iv) Availability of inputs and labour. Several attempts have been made to mechanize operation; research is under progress to reduce the production cost with less working load. Machine needs chronic bending down and straighten up for the transplanting process on the other hand mechanical machine requires energy to tug the sapling inside the field. Because of a costlier automated machine, it is unfeasible for a farmer to buy a non-subsidized automated paddy plantation machine.



Objectives :

1. Perfect vertical positioning of a sapling when placed inside the soil.
2. As it is a manually operated machine, experienced workers are not required.
3. Planting seedling evenly without damaging them.
4. Easily transportable and cost effective.
5. Reduce labour charges and the manpower requirement.
6. Prevents backache problem of farmers.
7. Satisfactory working of machine on different soil conditions.

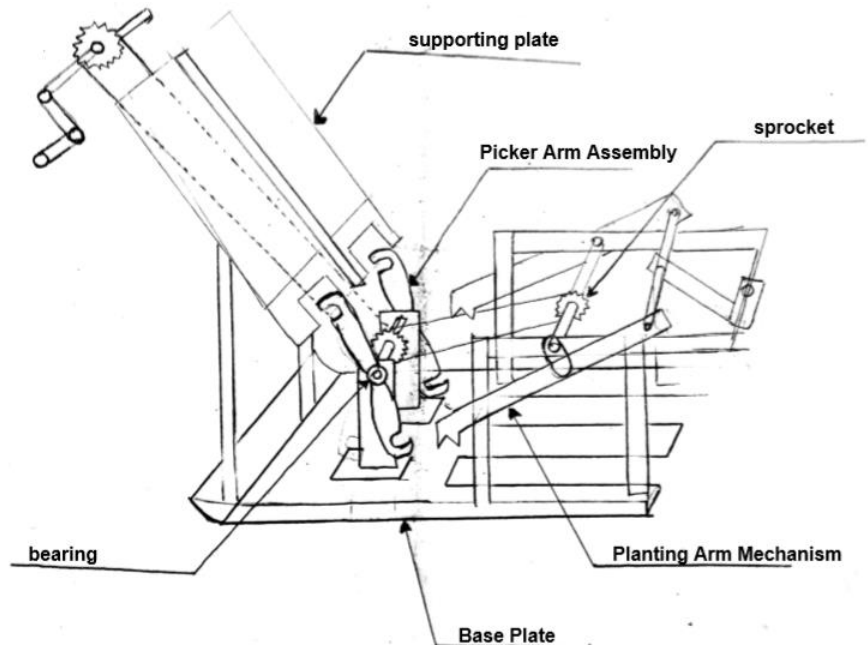
Design :

(A) Terminologies Used :

1. Roller Chain : A roller chain is used for emanation of mechanical power from driving to driven components. Roller chains are widely used in automotive sectors. A roller chain consists of cylindrical rollers held together with other cylindrical rollers with the help of side links. A roller chain is driven by sprocket which is also called toothed wheel. In this machine a chain is used to transmit rotary motion from hand lever to Picker Arm and Plantation arm.

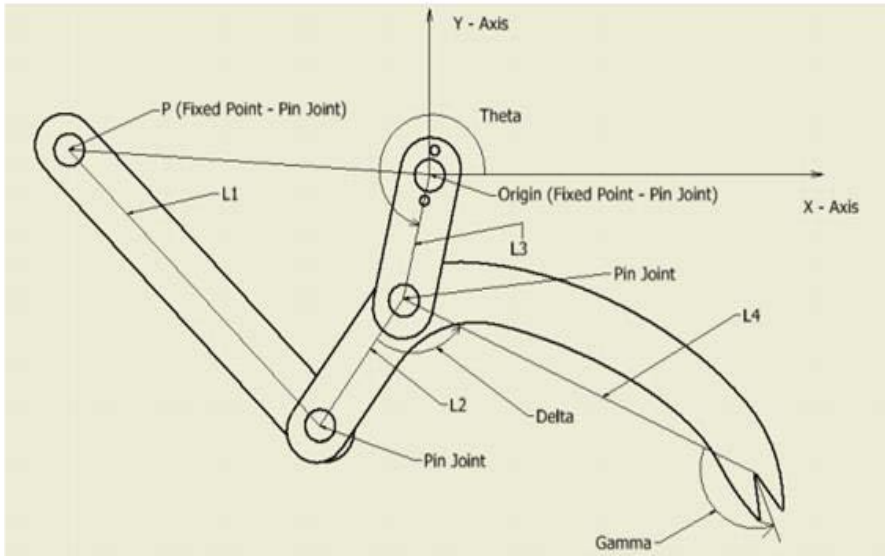
2. Picker-arm mechanism : A Picker arm assembly is fixed on the shaft with sprocket which will get the rotary motion from the chain. A picker arm works both sided. The saplings are arranged on supporting plate and the picker arm picks up the sapling one by one and once the sapling is taken, the sapling above the lower sapling takes place of previous one. And the process continues until the shaft rotates.

3. Planting arm mechanism : A planting arm assembly is mounted with the help of supporting frames on the base plate. The mechanism is such that the motion of assembly will collect the sapling from the picker arm and will plant the sapling into the soil. The process is continuous. This assembly is also fixed on shaft with sprocket.



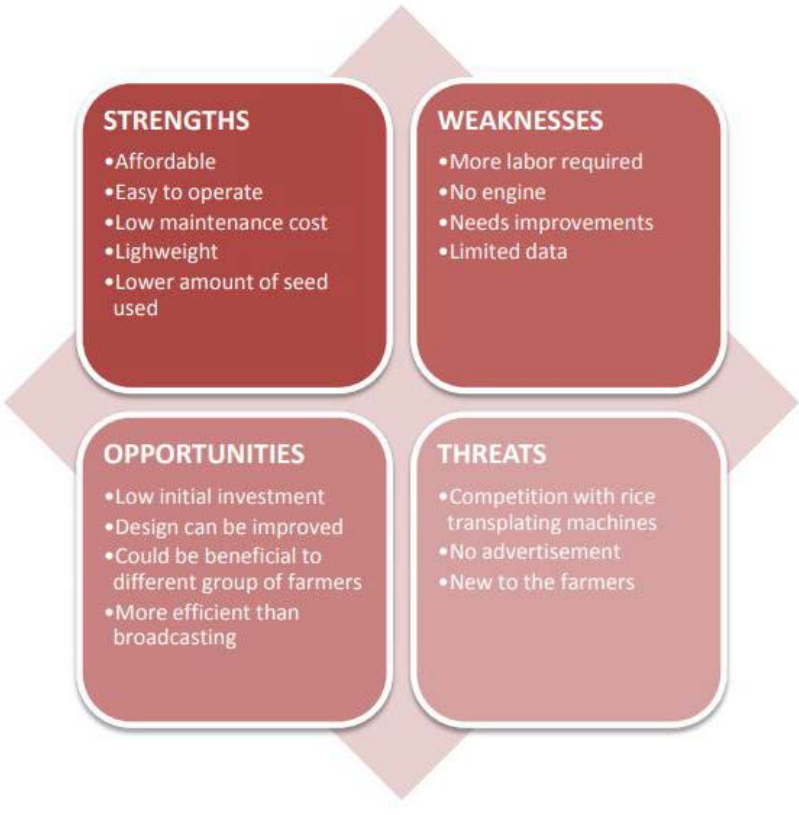
(B) Design of picker arm mechanism :

Grubler's criterion is concerned with the number of links in the mechanism. Kinematic pairs can be used to determine degree of freedom of a mechanism. Four-bar linkage should satisfy Grashof criterion, based on the link lengths. Newton–Raphson method is used to solve non-linear equations for solving the four-bar linkage positioning problem.



Expected outcomes :

1. Farmers can plant the rice saplings in very less time using this machine compared to the manual transplanting process.
2. It will reduce the requirement of the labour.
3. This machine will reduce the backache and other physical problems faced by farmers.
4. The saplings can be planted evenly without damaging them.
5. Sapling plantation will be done in a specific manner.



Future scope :

If successfully implemented, system can be developed further to:

1. The machine can be fully automated using engine which can again reduce the efforts for plantation.
2. The number of rows of plantation at a time can be increased by increasing the number of picker arm and planting arms.
3. Machine could be advanced to plant several rows concurrently.

Conclusion :

- This machine will help in increasing production of the rice.
- The rice sapling plantation machine will work satisfactorily to solve various problems of farmers.
- Automated rice plantation machine, the device is independent of tractor so it is suitable for a poor farmer. It saves time as well as labour cost.

- Mr. Rupesh Deshbhratar
Assistant Professor

TYPES OF DIES IN PRESS WORKING

Press working operations are trending in field of mechanical engineering. They are chipless manufacturing processes by which various parts are made from sheet metal. Press working majorly consists of punches and dies.

Dies and its types :

A die may be defined as a specialized tool used for fabrication processes to shape or cut a material in a press. It is also referred to a complete tool which consists of a pair of conjoining members for producing work in a press.

The dies are classified according to the type of press operation and according to the method of operation.

(A) According to the type of press operation :

As per this criterion, the dies may be differentiated as cutting dies and forming dies.

- **Cutting Dies :**

Cutting dies are used to cut the sheet metal. They utilize the cutting of metal by shearing action. These dies are given specific angles to their edges. The common cutting dies are: perforating dies, blanking dies, trimming, notching, shaving and nibbling dies.

- **Forming Dies :**

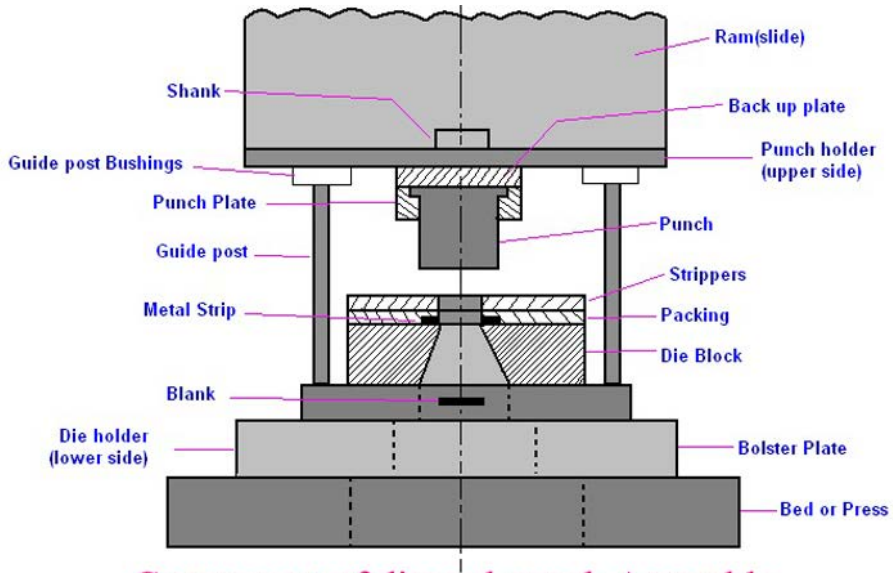
The appearance of the blank is changed without removing any stock by these dies. It alters the shape of the material by deforming action. Cutting action does not take place in this die. These dies include bending, drawing dies etc.

(B) According to the method of operation :

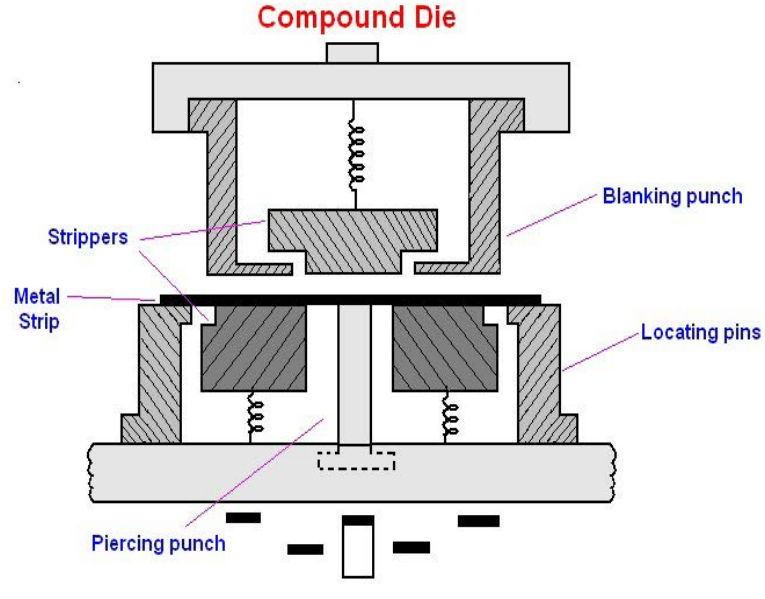
As per this criterion, the dies may be classified as simple, compound, combination, progressive, transfer and multiple dies.

- **Simple Dies :**

Simple dies or single action dies perform single operation for each stroke of the ram.



Component of die and punch Assembly



- **Compound Dies :**

In these dies, two or more operations may be performed at single working point. Only cutting operations are carried out by these dies. The figure illustrates a compound die where a washer is made by one stroke of the ram. Simulation blanking and piercing operations are the prime processes involved. Compound dies are economical in production due to low operating costs as compared to single operation dies. They also provide dimensional accuracy.

- **Combination Dies :**

A combination of two or more press working operations can be carried out in these dies. It is more complicated in comparison to compound dies as a cutting operation is combined with a bending or drawing operation. All of these operations occur in a single stroke of ram.

- **Progressive Dies:**

A progressive die has a series of continuous operations. At each station, an operation is performed on a work piece during a stroke of the press. Between each stroke the metal is transferred to the next station. Each stroke of ram results in a finished product. The piercing punch cuts a hole in the stroke and the blanking punch blanks out a portion of the workpiece in which a hole had been pierced at a previous station. Thus, after the first stroke, being followed by hole punching, each stroke of the ram produces a finished washer.

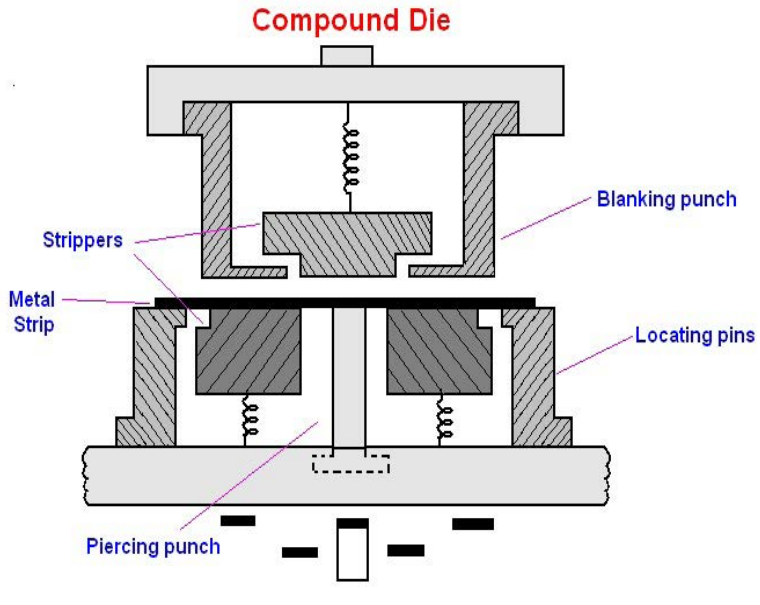
- **Transfer Dies :**

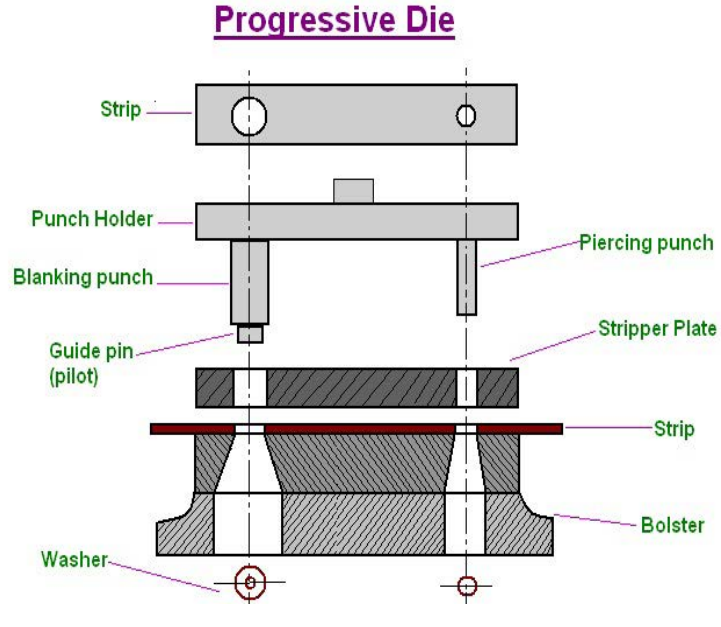
In progressive dies the stroke feed is progressive from one station to another, whereas in transfer dies the pre-cut blanks are fed mechanically from one station to other station with the help of feeding fingers.

- **Multiple Dies :**

Two or more work pieces can be produced with multiple dies. A number of simple dies and punches are grouped together to produce two or more parts at each stoke of the press ram.

- Mr. Vaibhav Gudi
Assistant Professor





ENGINE ANATOMY

JET ENGINES

A machine which exerts force by converting energy rich, liquid fuel into power called thrust is called a jet engine.

This thrust from one or more engines act to push the plane forward and forces air past its scientifically designed wings to create an upward force called lift that powers the plane into the sky.

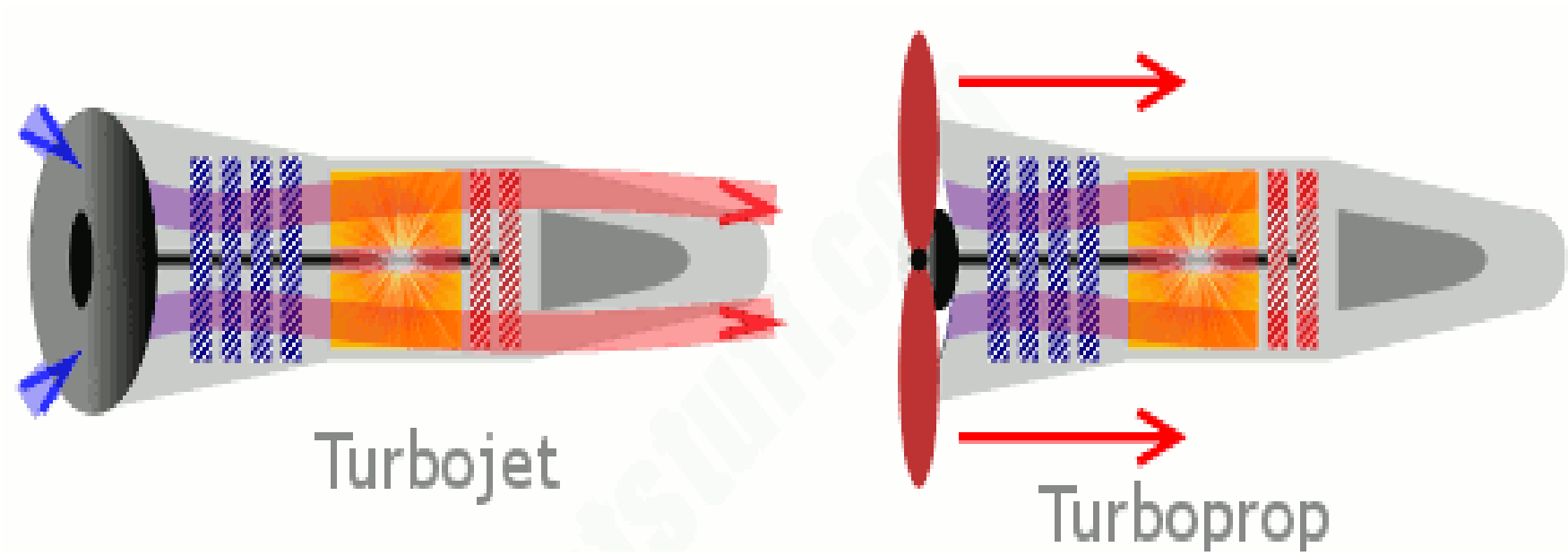
Same scientific principle as the car engines is used by jet engines. It combusts fuel and air to exert energy that, in this case, powers a plane. But this four steps mechanism of intake, compression, combustion, exhaust, which is used in a car engine, is not used here. Jet engines consist of a long metal tube that carries out the same four steps in a straight line to produce thrust. In the simplest type of jet engine, air is taken in, compressed by a fan, mixed with fuel, combusted and then fired out as a hot and fast moving exhaust at the back which helps the plane move forward.

Gas Turbines:

A more technical name for a jet engine is a gas turbine. A jet engine works by combusting fuel in air to release hot exhaust gas. But a car engine uses the explosions of exhaust to push its pistons and a jet engine forces the gas past the blades of a windmill-like spinning wheel- a turbine to making it rotate. So, in a jet engine, turbine is powered by exhaust gas- hence the name gas turbine.

How a jet engine works:

1.The engine takes in air at the front with a fan.
2.That air is then passed through a compressor which is made with many blades attached to a shaft. The blades spin at high speed and compress the air which raises the pressure.
3.The compressed air is then mixed with fuel and an electric spark lights the mixture.
4.The burning gases ignite and then blast out through the nozzle at the back of the engine.

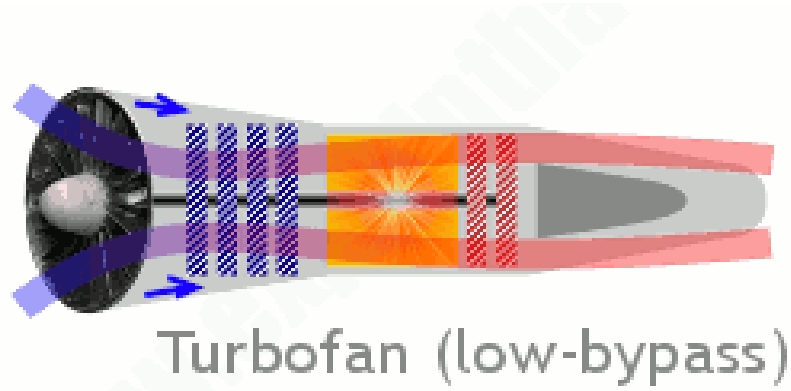


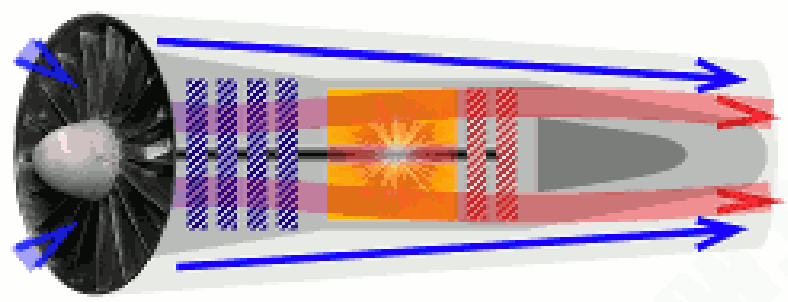
5.As the gas shoots backward, the engine and the aircraft are thrust forward.
6.As the hot air is going to the nozzle, it passes through another group of blades called the turbine.
7.The turbine and the compressor are attached to the same shaft . The turbine spins which makes the compressor spin too.
8.The air goes in the core of the engine as well as around it.
9. Hence, some of the air is very hot and some is cooler. The cooler air then mixes with the very hot air at the engine exit area. This makes the plane propel forward.

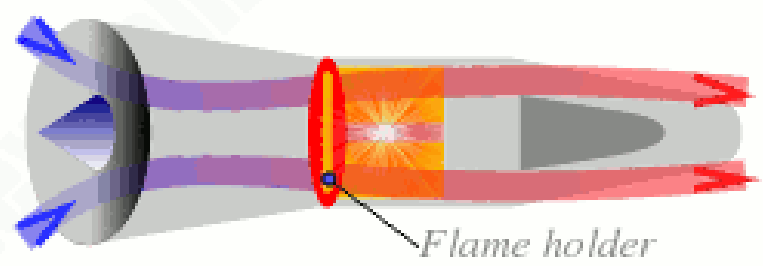
Types of Turbo Jet Engines:

1) Turbojet: The original jet engine is known as the turbojet. It is the simplest type if jet engine based on a gas turbine.
2) Turboprop: in a turboprop jet engine, the turbine inside it spins the propeller mounted on the front that pushes the plane forward.
3) Turbofans: These are used in huge passenger jets. A turbofan produces thrust partly like a turbojet and partly like a turboprop engine. Impressive power and efficiency make turbofans the engines of choice on everything from passenger jets (high-bypass) to jet fighters (low-bypass).
4) Turboshaft: These engines are used in helicopters. There is a huge rotor attached at the top which is powered by one or two gas turbines called the turboshafts.
5) Ramjet: The inlet of a ramjet is designed as a rapidly tapering nozzle without using a compressor or a turbine to power it. These engines are suitable only for supersonic and hypersonic planes.

- Shrutika Kenjale
B.E. MECH A







TURBOPROP ENGINE

A turboprop engine is a turbine engine which is used to drive an aircraft propeller.

Major components of a turboprop engine:

1.Intake
2.Compressor
3.Combustor
4.Turbine
5.Propelling nozzle

How does a turboprop engine work?

1.The air entered through the intake is compressed by the compressor.

2.Fuel is added to the compressed air in the combustor, where the fuel-air mixture then combusts.

3.The gases expand through the turbine.

4.A part of the power generated by the turbine is used to drive the compressor. The remaining power is transmitted through the reduction gearing to the propeller.

5.Similarly, expansion of the gases happens inside the propelling nozzle, where the gases exhaust to atmospheric stress.

6.The propelling nozzle provides a especially small proportion of the thrust generated with the aid of a turboprop..

7.Unlike turbojet, the engine's exhaust gases do not contribute significantly in generating the required thrust, since almost all of the engine's power is used to drive the propeller.

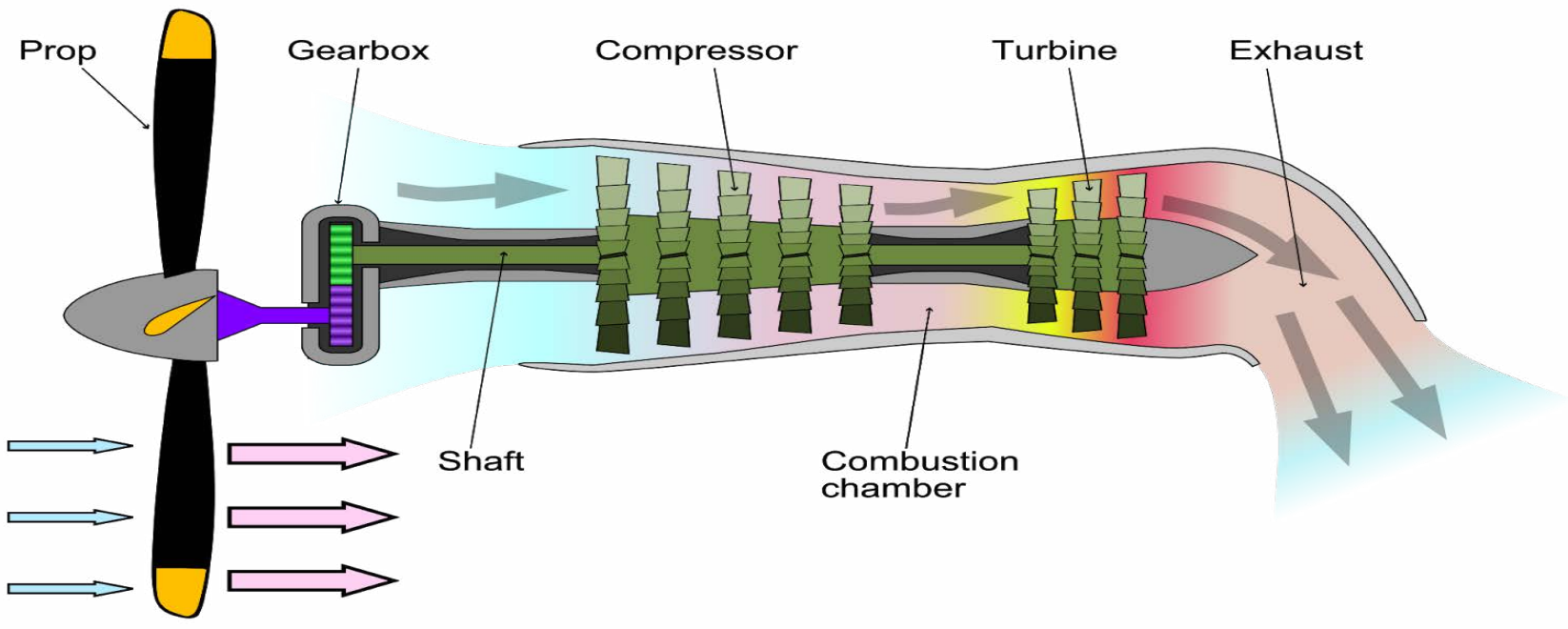
Usage/applications of turboprop engines:

1.Turboprops are most green at flight speeds below 725 km/h (450 mph; 390 knots) because the jet velocity of the propeller (and exhaust) is exceptionally low in Commuter aircraft.

2.Due to the high price of turboprop engines, they are mostly used where high-performance short-takeoff and landing (VTOL) capability and efficiency at modest flight speeds are required.

3.Military and civil aircrafts : In April 2017, there have been 14,311 commercial enterprise turboprops inside the global fleet.

- Jaykumar Deshani
T.E. MECH A



ETHANOL DI ENGINE

Ethanol di engine :

Whilst the race to find the next alternative fuel dominates an awful lot of the green vehicle conversation, there are large efforts being made to enhance present technology. Ethanol direct injection (ethanol di) is one such improvement that could dramatically enhance gas efficiency in traditional internal combustion engines

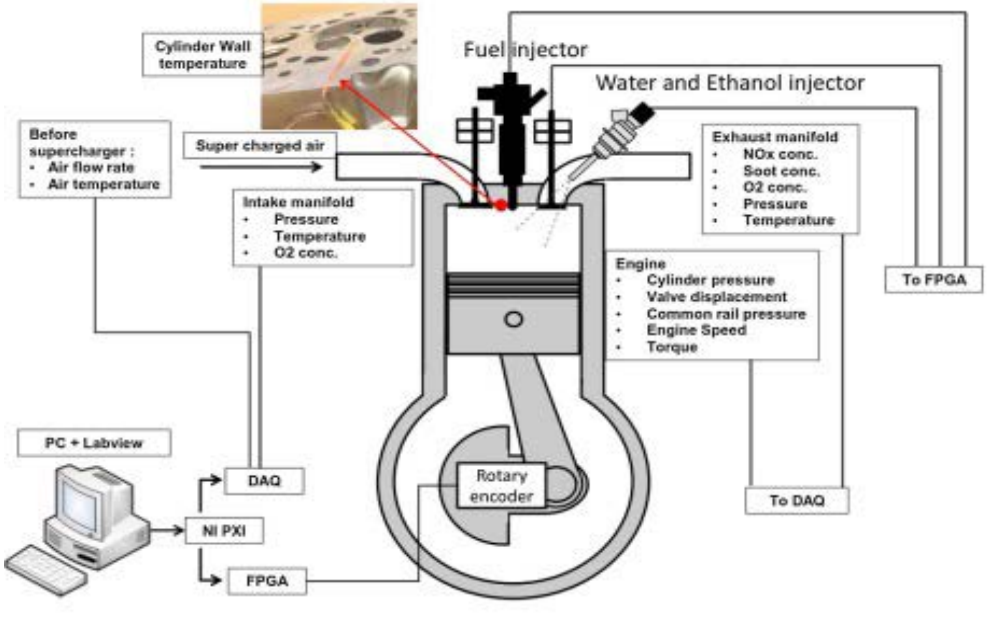
How ethanol di works?

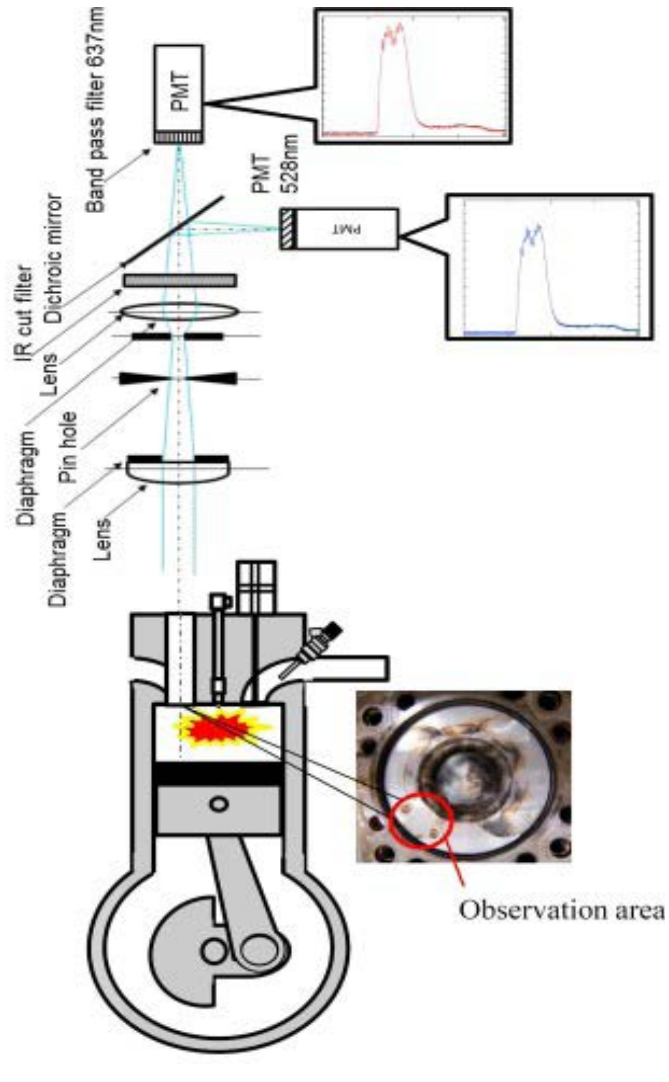
Ethanol direct injection technology refers back to the technique of injecting a small quantity of ethanol alcohol directly into the engine's combustion chamber. The presence of ethanol in the warm combustion chamber lowers the internal temperature, making undesirable spontaneous combustion.

The problem ethanol di solves:

What is engine knock, and why is it crucial to get rid of?

In conventional internal combustion engines, pockets of unburned gasoline can shape inside the combustion chamber. The stress exerted by the pistons at some stage in high-torque operation can produce temperatures excessive enough to reason these pockets of unburned fuel to ignite out of sync with regular combustion. This spontaneous explosion (engine knock) creates a shockwave in the engine that could stress and harm the pistons, combustion cylinder, and engine block. because of this, modern-day internal combustion engines can cope with combustion chamber pressures most effective under a positive factor, a threshold referred to as the "knock restrict."





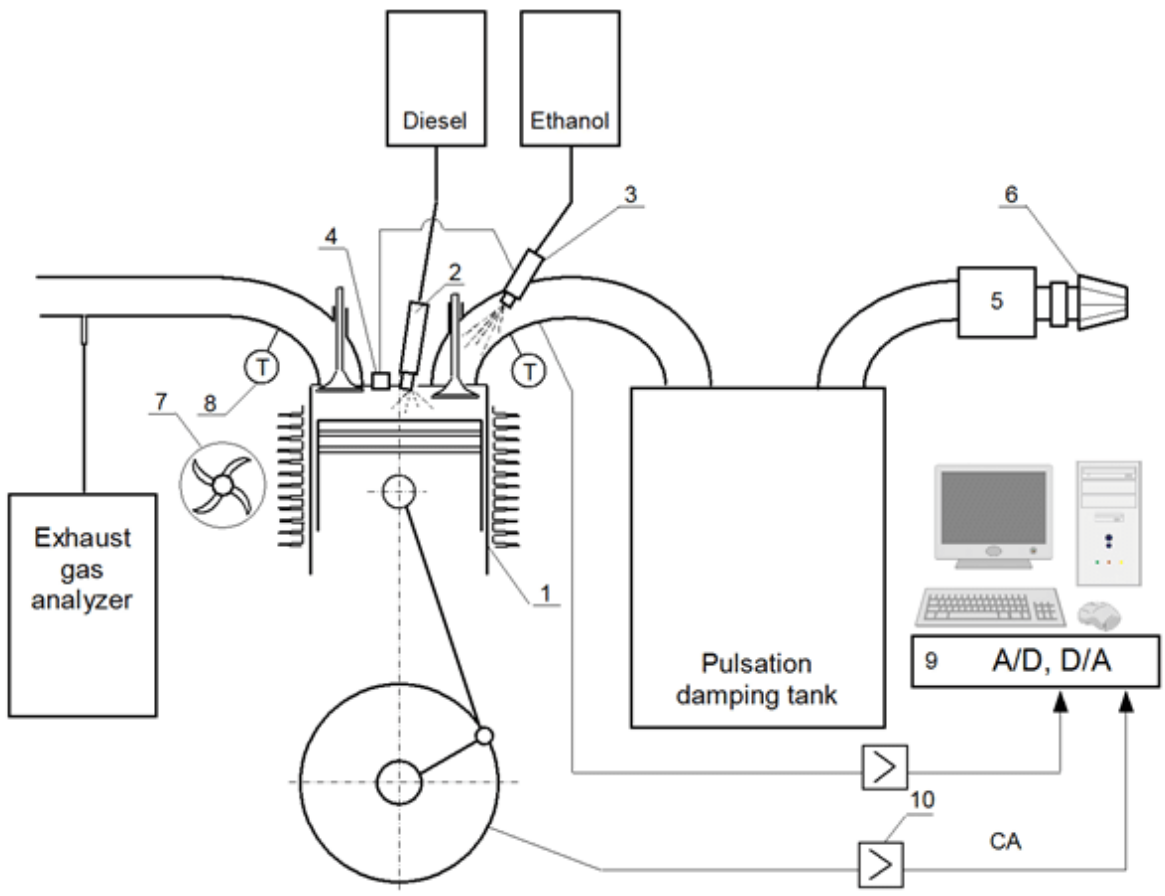
How disposing of engine knock improves gasoline performance:

Eliminating engine knock by itself will now not make an engine greater green. The advantage comes from the possibility of producing engines that may manage pressures that exceed the knock restrict. Whilst the knock restriction is passed, engineers can comprise extra gas green attributes into the engine, consisting of faster charging and better compression ratios. In line with researchers at MIT, an engine which could withstand a better compression ratio will produce the equal peak electricity as a regular engine but at a rate that is 30 percent extra operationally green.

Why ethanol di is a massive deal?

Even as the due emphasis is being positioned on subsequent-technology gasoline technology, incremental advancements which include ethanol di technology will assist propel engine layout to the subsequent degree. The version this is made viable via ethanol di technology uses present engine designs and very small amounts of ethanol alcohol. The ethanol tank in an automobile using this device would have to be refilled 5 to 10 times as once in a while as the fuel tank. And considering an ethanol tank costs an especially cheaper $600, the gasoline savings of ethanol di generation may be earned returned in a good deal less time than with present-day hybrid motors. A 30 percent growth in gas performance with minimal design overhaul is an excellent subsequent step in designing the engine of the next day.

- Bhavika Sakpal
T.E. MECH B

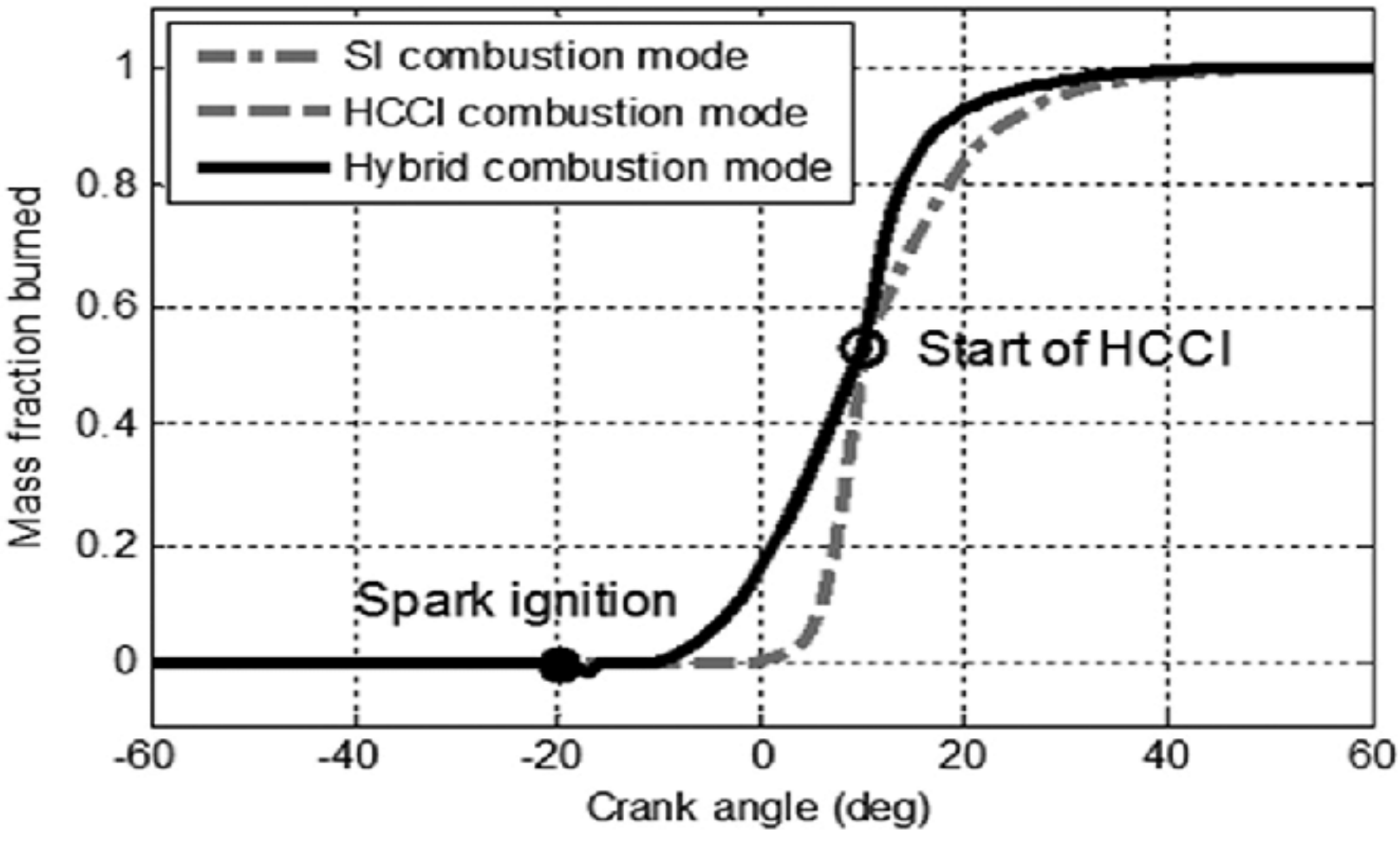


HOMOGENEOUS RATE COMPRESSION IGNITION

Within the quest for ever-enhancing gas performance and emissions discount, a vintage and really promising concept have found new lifestyles. HCCI (Homogeneous rate Compression Ignition) era has been around for a long time but has these days acquired renewed attention and exuberance. whilst the early years noticed many insurmountable (on the time) barriers whose solutions could best come as state-of-the-art laptop controlled electronics have been developed and matured into reliable technologies, development stalled. Time has because it usually does, labor its magic and almost every problem has been solved. HCCI is an idea whose time has to include almost all the parts and portions of era and know-how in the region to make an actual go of it.

What is HCCI?

An HCCI engine is a mixture of both traditional spark-ignition and diesel compression ignition generation. The mixing of those designs offers diesel-like high performance without the tough—and pricey—to deal with NOx and particulate matter emissions. In its most basic shape, it truly the way that fuel (gas or E85) is homogeneously (very well and absolutely) mixed with air inside the combustion chamber (very similar to an ordinary spark-ignited gasoline engine), but with a completely excessive share of air to fuel (lean combination). As the engine's piston reaches its maximum point (pinnacle lifeless middle) on the compression stroke, the air/gasoline mixture automobile-ignites (spontaneously and absolutely combusts and not using a spark plug assist) from compression warmth, much like a diesel



engine. The end result is the first-rate of each world: low fuel usage and coffee emissions.

How HCCI works?

In an HCCI engine (that is based on the four-stroke Otto cycle), gasoline transport control is of paramount importance in controlling the combustion process. On the intake stroke, fuel is injected into every cylinder's combustion chamber through gasoline injectors hooked up immediately in the cylinder head. That is accomplished independently from air induction which takes vicinity via the intake plenum. By way of the stop of the consumption stroke, gasoline and air have been fully added and mixed inside the cylinder's combustion chamber.

As the piston starts to transport returned up in the course of the compression stroke, warmth begins to build in the combustion chamber. Whilst the piston reaches the quiet of this stroke, enough warmth has accumulated to cause the fuel/air mixture to spontaneously combust (no spark is vital) and force the piston down for the energy stroke. In contrast to conventional spark engines (and even diesel); the combustion technique is a lean, low temperature and flameless release of power throughout the complete combustion chamber. The whole gasoline aggregate is burned concurrently producing equal energy, however the use of less fuel and releasing a long way fewer emissions within the technique.

At the end of the strength stroke, the piston reverses course again and initiates the exhaust stroke, however earlier than all the exhaust gases may be evacuated, the exhaust valves near early, trapping a number of the latent combustion warmness. This heat is preserved, and a small quantity of gasoline is injected into the combustion chamber for a pre-charge (to help control combustion temperatures and emissions) earlier than the subsequent intake stroke starts.

Challenges for HCCI:

An ongoing developmental hassle with HCCI engines is controlling the combustion manner. In conventional spark engines, combustion timing is effortlessly adjusted by the engine control manage module changing the spark event and possibly gasoline transport. It’s not nearly so smooth with HCCI's flameless combustion. Combustion chamber temperature and combination composition ought to be tightly controlled within speedy changing and very slim thresholds that include parameters inclusive of cylinder stress, engine load and RPMs and throttle role, ambient air temperature extremes and atmospheric strain modifications. Maximum of those situations are compensated for with sensors and automated modifications to in any other case generally constant moves. Covered are man or woman cylinder strain sensors, variable hydraulic valve raise and electromechanical phasers for camshaft timing. The trick is not so much as getting those systems to paintings as it is getting them to work collectively, very quickly, and over many heaps of miles and years

of damage and tear. Perhaps simply as tough though could be the trouble of preserving these advanced manipulate systems low priced.

Blessings of HCCI:

1.Lean combustion returns 15 percent growth in fuel efficiency over a traditional spark ignition engine.

2.Cleaner combustion and decrease emissions (particularly NOx) than a traditional spark ignition engine.

3.Compatible with gasoline in addition to E85 (ethanol) gas.

4.Gasoline is burned quicker and at decrease temperatures, decreasing warmth energy loss as compared to a traditional spark engine.

5.Throttleless induction device removes frictional pumping losses incurred in traditional (throttle body) spark engines.

Dangers of HCCI:

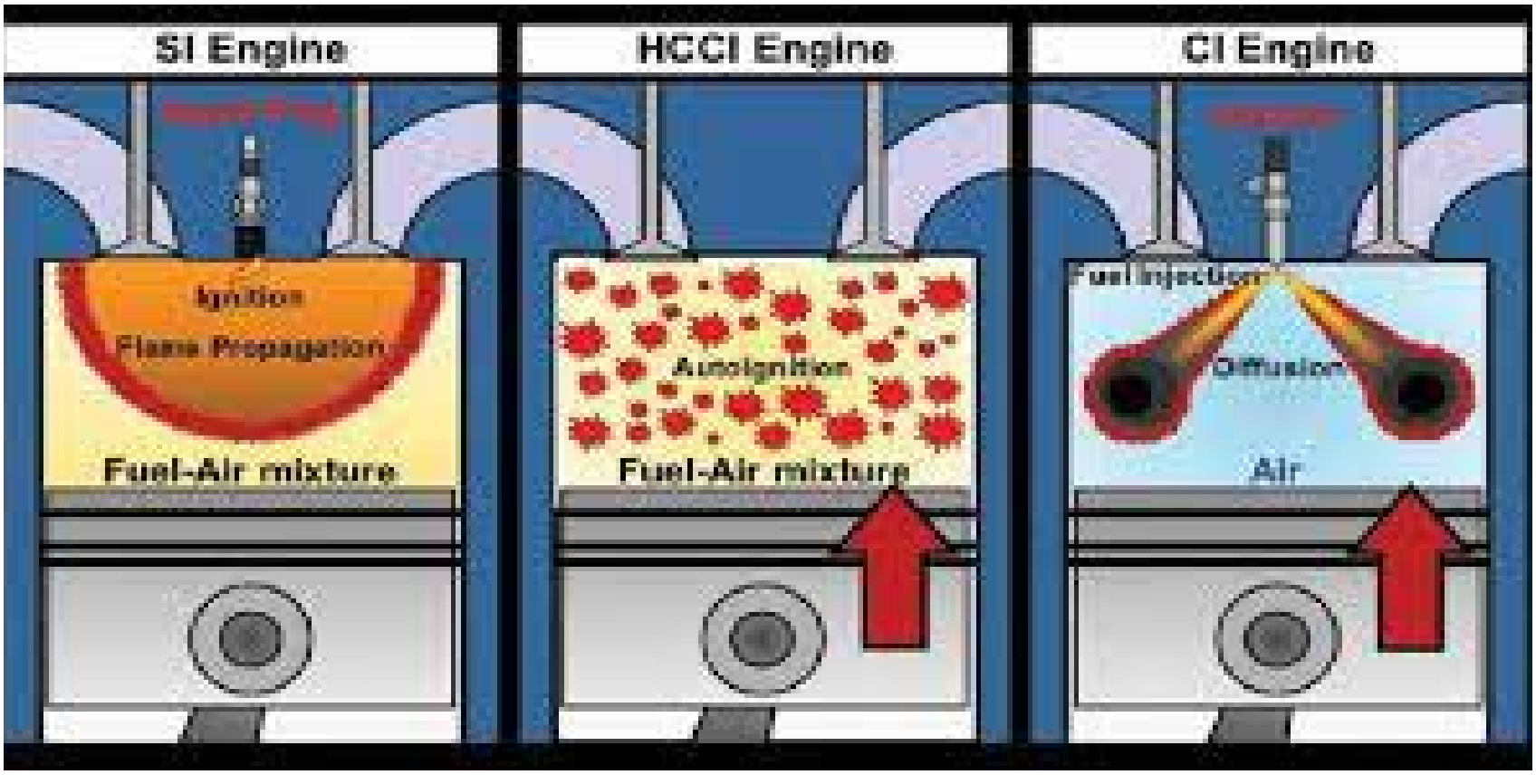
1.High cylinder pressures require stronger (and greater highly-priced) engine construction.

2.Greater confined power variety than a traditional spark engine.

3.The various phases of combustion characteristics are hard (and greater highly-priced) to govern.

It is clean that HCCI era offers advanced gas performance and emissions manipulate in comparison to the conventional tried-and-authentic spark ignition fuel engine. What is now not-so-sure but is the capability of these engines to supply these traits inexpensively, and, likely extra importantly, reliably over the life of the vehicle. Persisted improvements in digital controls have delivered HCCI to the precipice of manageable truth, and further refinements may be essential to push it over the brink into regular production motors.

- Bhavika Sakpal
T.E. MECH B

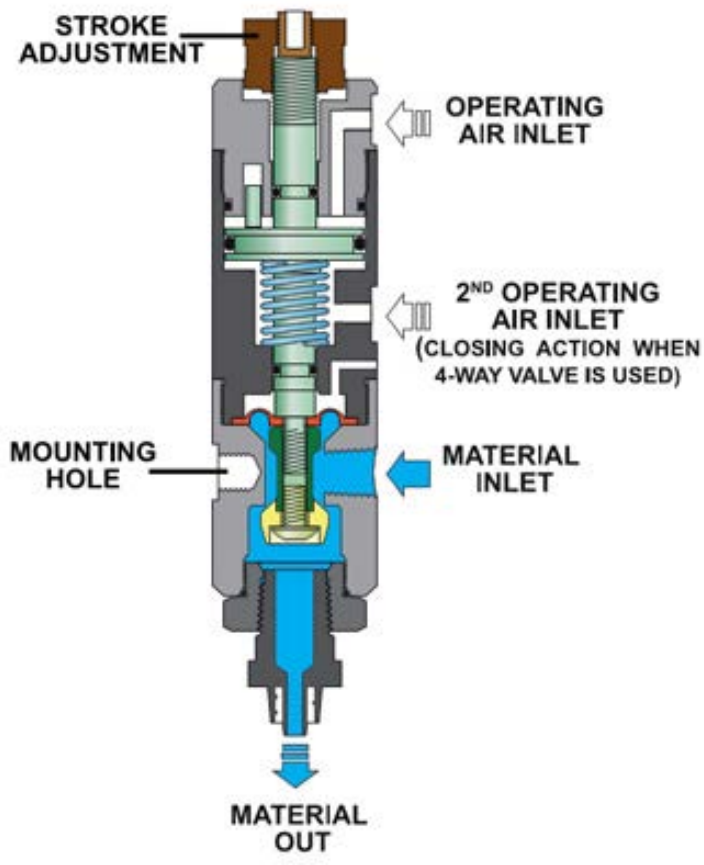


CAMLESS ENGINES

Cam is a piece which rotates or slides in a mechanical linkage and helps in converting the rotary motion into linear motion. Camshafts are rods containing cams which are connected to engines and control the movement of air in and out of the engines. The proper control of the valves is absolutely necessary as the air helps in ignition of the fuel which further creates the up and down movement of the pistons. However sufficient these camshafts could be, they still fail us in various ways. With the increasing speed of engines, it would be better if the valves open a bit earlier for accurate functioning. It is very difficult to adjust the duration of lift and valve in a working engine. To solve this problem, some manufacturers use more than one cam lobe for their systems, but this is still a compromise which further leads to various other issues. So instead of using the cam, why shouldn't we use a computer to open and close the valves at exactly the right time?

Camless engine is an engine which contains valves that can easily control the movement of air in and out of the engines. These valves used in camless engines are known as Poppet valves. These valves are operated by pneumatic, hydraulic or electromagnetic actuators, instead of conventional cams. In a camless engine, the lift and valve timing can be adjusted freely, from valve to valve and from cycle to cycle.

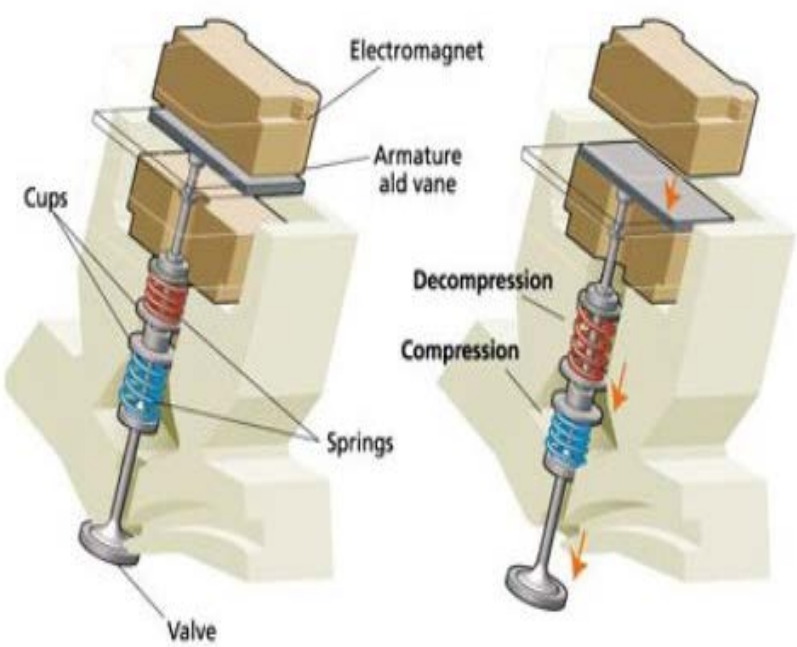
The idea of a camless engine originated in the year 1899, when the designs of variable valve timing surfaced. Theories emerged that independent control of the opening and closing of valves could lead to increased engine power. Various forms of designs were proposed, right from electro-pneumatic form to electro-hydraulic form. The main principle of these designs was the opening and closing of pneumatic valves or hydraulic valves by electronic solenoids. A widespread project



using pneumatic valves was completed in 1991. This project focussed on the development of actuators which are responsible for the controlling the mechanism of opening of valves. There was also a comparative study between a standard Ford engine and a modified camless Ford engine. The results of the study were favourable towards the camless Ford engine.

The three crucial components used by a camless engine include the actuator, the sensors and the electronic control unit. During the operation of a valve, mainly five sensors are used. One is used for sensing the amount of load on the engine. Sensing the speed of the engine is the job of another sensor. Remaining sensors are used for various other purposes; like for sensing the amount of exhaust gas, for sensing the position of the valves, and for sensing the current.

The electronic control unit receives the signals sensed by the sensors. A microprocessor is present inside the electronic control unit. This microprocessor has an in-built software algorithm. It supplies signals to the solid-state circuitry. The foundation of these signals is based on the algorithm. The solid-state circuitry controls the actuator, so that it could function as per the requirements.



Not only does a camless engine provide an independent and variable control of all the aspects of valve motion, it is also capable of controlling the velocity of the valve. The operation of deactivating certain selected valves can also be performed by a camless engine.

It can also vary the activation frequency. In a conventional engine, the engine designers achieve the best possible outcome only at one speed. Whereas, in a camless engine optimum performance can be achieved at any speed suitable for the changing loads.

Another advantage of camless engine is its potential fuel savings. It is estimated that the camless design can provide a fuel economy of about 7-10% as compared to a conventional engine. Camless engines can reduce pollution by about 30% by trapping the harmful gases in the cylinders before they can escape.

Koenigsegg have announced that their next supercar will have a camless engine. Various other applications of the camless engine are being worked upon.

- Anushka Moharir
S.E. MECH A

VIKAS ENGINES

What is the Vikas Engine?

Named after Vikram Ambalal Sarabhai, the Vikas is a family of liquid rocket engines used in space launching vehicles. The engine is the workhorse engine powering the second stage of India's PSLV, the second stage and four strap-on stages of GSLV and twin-engine core liquid stage of GSLV Mk-III.

Who founded it?

ISRO scientist Nambi Narayanan along with French assistance developed India's own version of the Viking engine, called as 'Vikas' in 1980's. Narayanan was in-charge of the cryogenics division. In 1969, he completed his masters in chemical rocket propulsion from Princeton University and returned to India. He introduced the technology of liquid rocket fuelled engines in early 1970's when APJ Abdul Kalam's team was working solid motors. Liquid fuel propulsion was considered ambitious that time and thus Narayanan and his team worked towards domestication of the engine. However, he was falsely accused of espionage in 1994 due to which the development slowed down. Later proven innocent he was awarded the Padma Bhushan for his pivotal role in Indian space programmes.

What is liquid propulsion technology for rockets?

Liquid fuels burn slower than solid fuels and have the capability to generate more energy. However, liquid fuel technology is more complicated. The engine can be throttled, stopped, or restarted by controlling the flow of liquid propellant to the combustion chamber of the engines. All international space-faring nations have shifted to liquid fuels only after using solid fuels in their initial years.

How does it work?

The force required to move any rocket or aircraft through air is known as thrust. The propulsion system of the aircraft develops the necessary amount of thrust. Thrust is generated in variant ways by various propulsion systems, but all thrust is produced through some application of Newton's third law of motion which states that for every action there is an equal and opposite reaction. The mass flow through the engine and the exit velocity of the gas determine the amount of thrust produced. In a liquid propellant rocket, the fuel and oxidizer are stored in disjoint tanks. Pipes, valves, and turbopumps carry the

fuel and oxidizer to a combustion chamber. The combustion chamber combines them and they are burned to produce hot exhaust. The chamber pressure of the Vikas is 58.5 bar. The hot exhaust exits the rocket thus producing thrust and helping it dictate its motion. The Vikas engine is also capable of gimballing i.e. its exhaust nozzle can be swung from side to side. The nozzle movement allows the control of direction of the rocket. Gimballing is a system of thrust vectoring which means that direction of thrust from the engine can be manipulated to control the angular velocity of the aircraft or rocket.

Technical Details :

The initial models of the Vikas engine could generate a thrust of 725 kN. However, the upgraded versions can produce 800 kN of thrust. The chamber pressure of the engine is 58.5 bar. The specific impulse is 2.8 km/s. About 40 metric tons of UDMH (Unsymmetrical Dimethylhydrazine) is used as fuel whereas N_2O_4 (Nitrogen tetroxide) is the oxidizer used. In GSLV Mk-III this propellant loading capacity goes up to 55 metric tons. The liquid fuel engine has a gas generator power cycle. Several variants like Vikas-2, Vikas-2B, Vikas-4, Vikas-4B, Vikas-X to the Vikas engine have been launched. These have differences with respect to their nozzle diameter, chamber pressure and fuel used.

Recent Developments :

The Vikas played a key role in India's Chandrayaan and Mangalyaan missions. In July 2018, a high thrust version of the Vikas engine qualified the ground test at the ISRO Propulsion Complex, Tamilnadu after lasting for 195 seconds. This test was aimed at payload capacity improvement of PSLV, GSLV and GSLV Mk-III. With a 6% increase in thrust to 846kN with respect to the original of 800kN, this successful test opened doors for our space agency to launch heavier satellites and future manned missions. GSLV Mark III used as a launch vehicle for the Chandrayaan II mission on 22nd July 2019 was equipped with a variant of the Vikas Engine.

- Shravani Dighole
S.E. MECH A

V-TYPE ENGINES

The world of automobiles has crossed a milestone since the first vehicle was invented and with the thought of powering the vehicle, the concept of engine came into the limelight. Engines are the devices which can convert heat energy of fuel into mechanical energy. Engines are mainly divided in two types: External combustion engine and Internal combustion engine. In external combustion engine, the fuel gets burnt outside the engine whereas in internal combustion engine fuel gets burnt inside the engine.

Internal Combustion Engines are classified as follows :

1. According to the number of strokes. (Two stroke engine and Four stroke engine)

2. According to the design of machine. (Reciprocating engine and Rotary engine)

3. According to the fuel used. (Petrol engine, Diesel engine, Gas engine, Electric engine)

4. According to method of ignition. (Compression ignition engine and Spark ignition engine)

5. According to the air intake process. (Naturally aspirated, Supercharged engine and Turbocharged engine)

6. According to the arrangement of cylinder. (In-line engine, V-type engine, W-type engine, Opposite cylinder engine, Opposite piston engine and Radial engine)

What is a V-Type engine?

V-TYPE OR VEE TYPE ENGINE is a type of internal combustion engine. In this type of engines, the cylinders and pistons are aligned in two separate planes which when viewed along the axis appears to be in a ‘V’ shape.

Angle between bank of cylinders or between V :

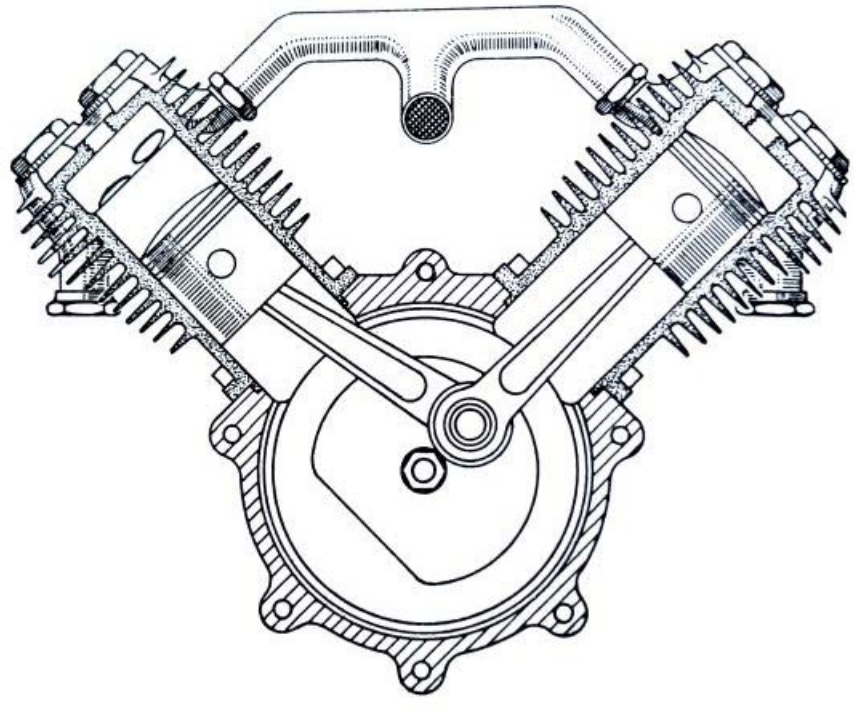
The angle between ‘V’ varies with the number of cylinders. The angle between the banks i.e. the angle of V is a crucial factor for the efficient running of an engine.

Forces produced due to the motion of the piston inside the cylinder are of three types :

1. Rotational mass (offset from the main bearing centerline, mass at each crank throw and counterweight).

2. Firing forces in each cylinder.

3. Reciprocating (up and down forces).



Optimal degrees between firings = 720°/ no. of cylinder

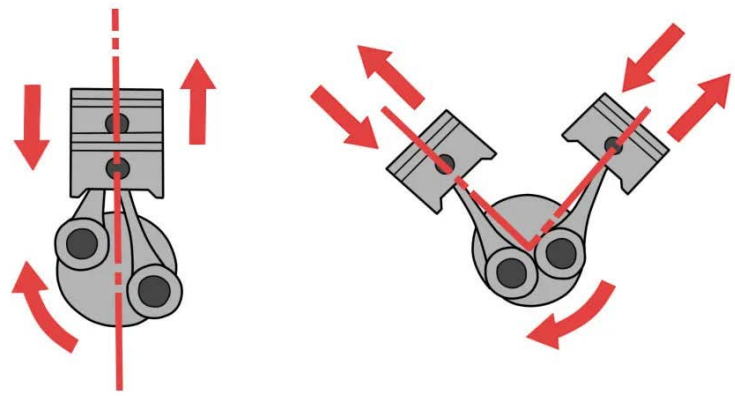
720° is the firing angle of a single-piston.

Different V configurations are :

- V-8 (90 degrees between two cylinders)
- V-6 (60 degrees between two cylinders)
- V-4 (180 degrees flat arrangement)

Advantages over in-line engines :

- Increase in power.
- The decrease in total weight, height and length.
- More torque at low rpm.
- Smallest of all the eight-cylinder engines.
- The low position of bonnet helps in better aerodynamics.
- Increases primary balance and reduces vibrations.
- Smoother operation for high-speed performance.
- Compactness makes it suitable for high-end sports car.



In-line engines V-type engines

V-shaped engines are compact and built for more power than the in-line engine. V type configuration reduces the overall engine length, engine height and weight than the in-line engines. It is a type where two combustion chambers at an angle share same the crankpin on the crankshaft. Due to the compact structure, number of cylinders is increased in the engine which leads to an increase in power. The V engine produces more torque at lower rpm, probably because of the power stroke coming from the 2 sides of the crankshaft.

Disadvantages of V-type :

Major disadvantages of this engine include: Balancing of engine, High cost and Difficult to manufacture

The major complication of the v type is the balancing of engine. If the cylinders are not balanced properly it could lead to mechanical stress and vibrations which will eventually lead to loss of power. Some v type engines are running at low efficiency than their equivalent in-line engine.

Application of V-type engines :

There are various types of v type engine like V2, V3, V4, V6, V8, V10, V12, V14, V16 and V18. The multiple applications of this engine include: Sports car, Sports bike, Tanks and AFVs, Aviation, Railways, Cruisers.

- Suraj Mishra
T.E. MECH A

CYLINDER DEACTIVATION

Cylinder deactivation is a system that aims at reducing the fuel consumption of internal combustion engines by temporarily stopping some of the cylinders in the engines.

Functioning :

In nearly all I.C. engines cylinder deactivation system enables the pistons which are not required. For instance, a vehicle is driving on a highway, once optimum speed is achieved not much energy is required to keep the engine going. So, if it's a V8 engine two or four pistons will shut off, thus saving fuel and reducing exhaust emissions. The remaining pistons continue to generate torque. Maximum efficiency is achieved when the engine is running on a mid-range of speed.

When the intake and exhaust valves for a particular cylinder are closed, cylinder deactivation is achieved. By doing so an 'air spring' is created in the combustion chamber - the trapped exhaust gasses are compressed during the pistons upstroke movement and pushed down during its downstroke motion. The compression and decompression of the trapped exhaust gasses balance out the load on the engine resulting in no-load condition. All of this is controlled by the engine's main brain, known as its engine control unit (ECU) or engine control module (ECM). As soon as more power is generated, the system brings the deactivated cylinders back to work. This transition is very smooth and undetectable.

Two main deactivation mechanisms :

The first mechanism is based on pushrod designs that use solenoids to alter oil pressure delivered to lock pins in the lifters. When lock

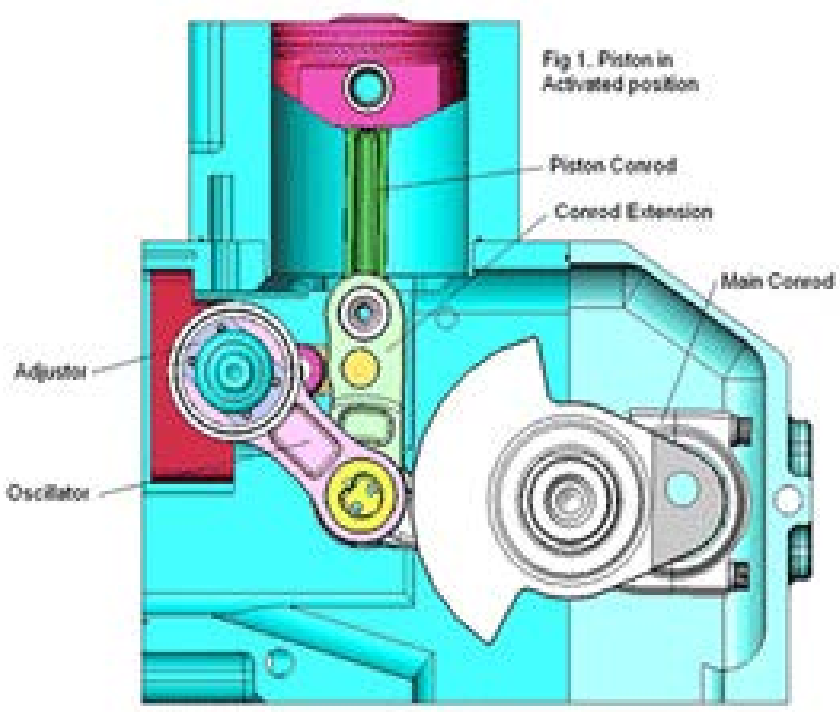


Figure 1

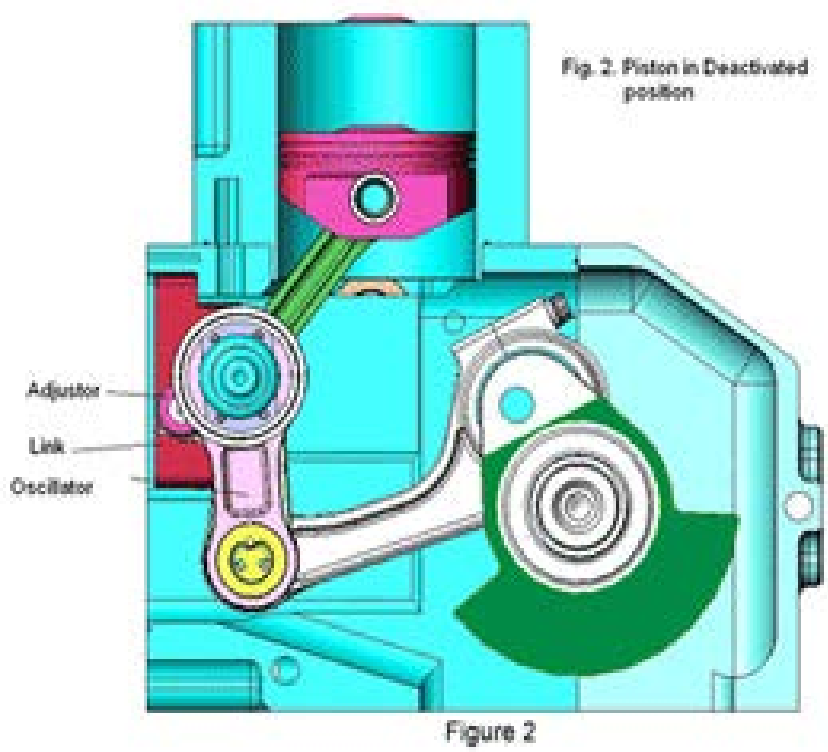


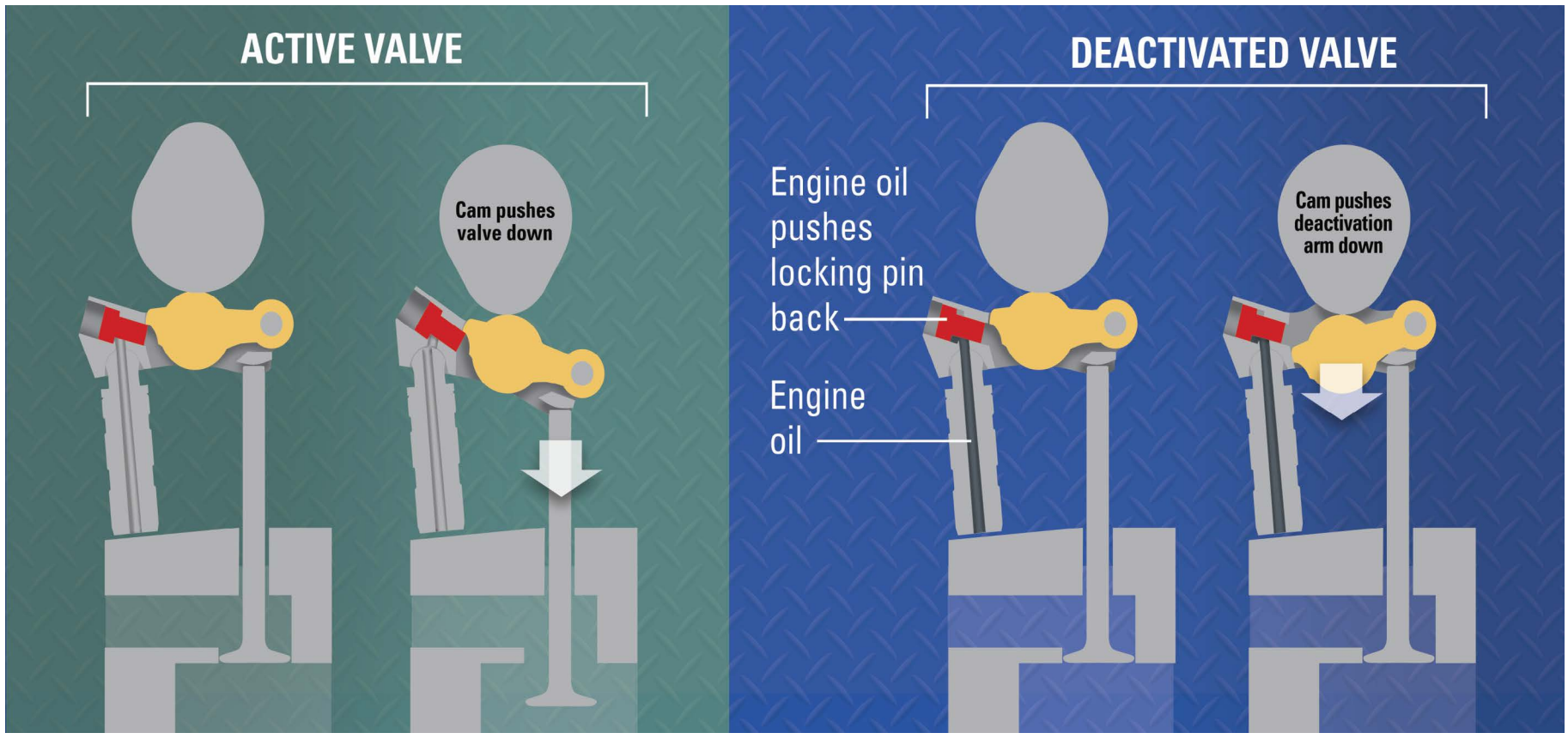
Figure 2

pins are out of place, the lifters collapse and are unable to elevate. The second mechanism is for overhead cam engines which use a pair of locked-together rocker arms that are employed for each valve. While one rocker follows the cam profile, the other actuates the valve. Running on all cylinders is considered a good thing but not all the time. Sometimes, that means burning fuel, which is why Mazda's engineers introduced a new cylinder-deactivation technology for 2018 that can cut down on fuel consumption in certain operating conditions. The new cylinder-deactivation system can be found in the latest SKYACTIVE-G 2.5 litre engine that delivers 187 horsepower and 186 lb-feet of torque. The cylinder deactivation helps eight-cylinder engines to keep running with four-cylinders on. The Variable Cylinder Management system by Honda switches a V6 engine to run on three or four cylinders, depending on the driving conditions. General Motors is all set to introduce the variable system on its pickup trucks which currently run on half cylinder deactivation. The initial experiments with multiple-cylinder engines which were carried out during World War II, were re-attempted in 1981 on Cadillac's V8-6-4 engine. This technology was then a mandatory feature on all Cadillac models except Seville, which had the 350 diesel V-8 engine as a base engine.

Requirements :

The requirements for cylinder deactivation are-

- Torque neutrality
- Emission neutrality
- Good responsiveness
- Optimum speed

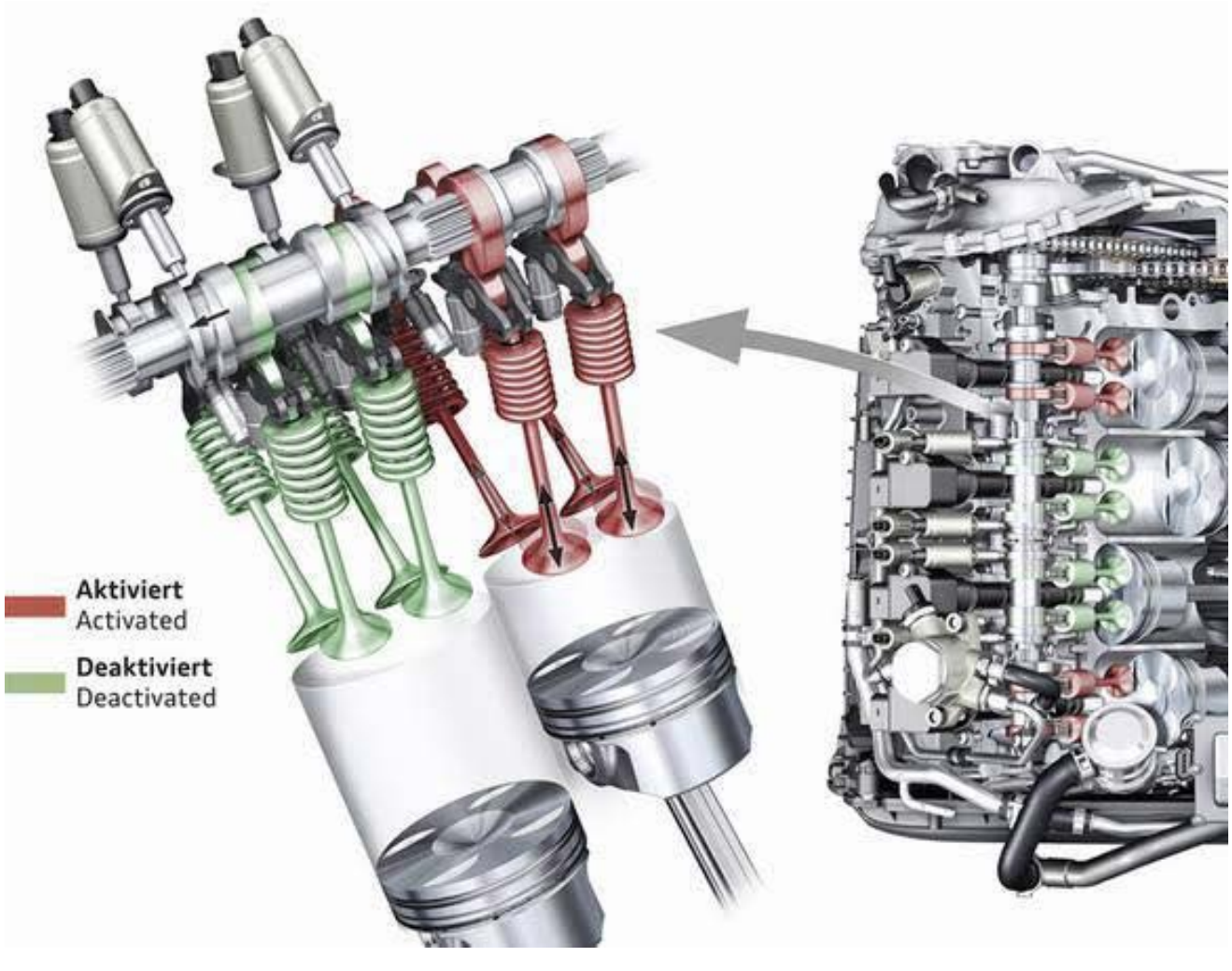


The switch between full engine operation to cylinder deactivation should be seamless, thus optimum conditions are necessary. Cylinder deactivation initiates by first identifying the cylinder to be shut off. When torque reduces, more energy is required and therefore the deactivated pistons are turned back on. The cooling system of the engine undergoes three stages. The first stage involves coolant being circulated along exhaust side of the head, thus absorbing heat. The second and third stages are combined air cooling. When cylinder deactivation comes into picture the first stage can be skipped. As fewer pistons are moving less heat is produced and quality of coolant is maintained for a longer duration thus saving maintenance cost. Cylinder deactivation system is generally used in unison with variable displacement mechanism as they involve control over piston movements.

Conclusion :

Developing an efficient controller with cylinder deactivation requires careful modification of the base controller functionality and development of a mode selection and transition feature. The overall mechanism focuses mainly on the key intermediate control parameters to allow efficient control. Thus, with a view of environment protection, the cylinder deactivation mechanism saves fuel and reduces exhaust emission of gases (CO_2, CO, etc). In future, the cars we drive will undergo great changes and the dynamic piston cylinders being controlled by the cylinder deactivation mechanism would be one of them.

- Tanay Sambrani
S.E. MECH B

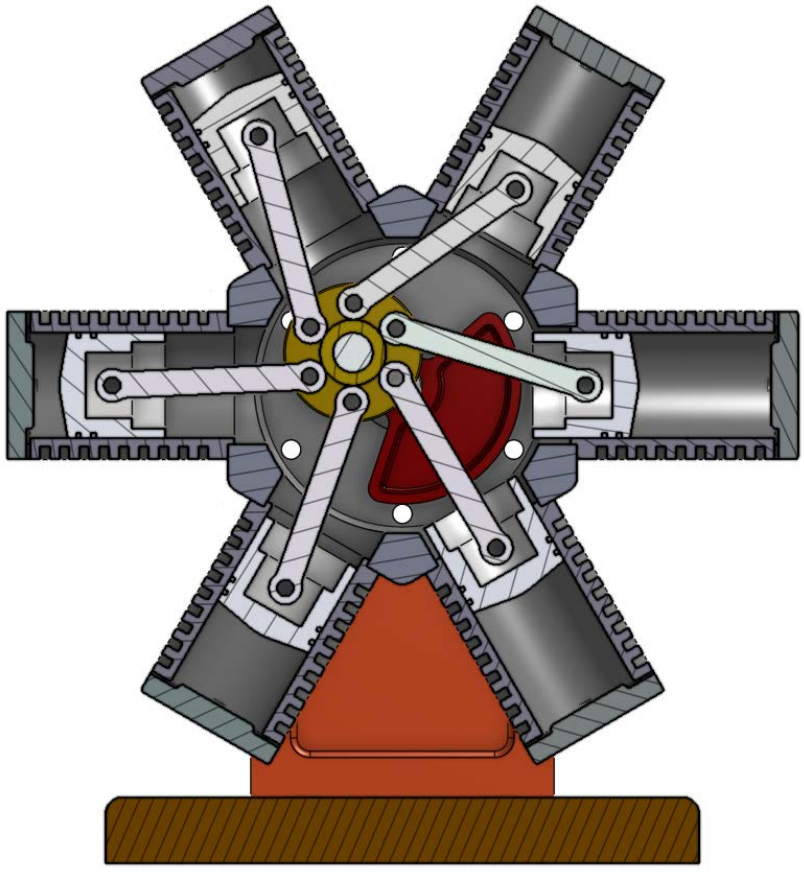


RADIAL ENGINE

Introduction:

Radial engine is a special type of a four stroke internal combustion engine. It consists of cylindrical pistons arranged in a fashion like the spokes of a wheel. Radial engine is also known as ‘star engine’ due to its resemblance of a star when number of cylindrical pistons is odd. There are two types of radial engines: 1) Stationary radial engine, 2) Rotary radial engine.

The stationary radial engine is fixed along with the aircraft and rotates only its shaft or propeller. Whereas a rotary engine of the radial type rotates along with the propeller with a fixed crankshaft. The power generation in the radial engine follows the same 4-strokes i.e. Suction, Compression, Power and Exhaust. Its power is used to rotate the propeller of an aircraft. Companies like BMW, Bristol, Fiat, Mitsubishi, Nakajima etc. used to produce various radial engines. Radial engines are still used in small aircrafts and in some bikes of Harley Davidson. It was a thing of great technology in engines with unique vision and appearance. Radial engines were not only famous for their design but also the fact that they provide uniform force and mass distribution produced by cylinders around the centered crankshaft. However it was later replaced by gas turbines which were lighter than radial engine in comparison of the power they produced.



History:

Radial engines came into the picture around 1901 when Charles Manly had his first design and built a five cylinder water cooled radial engine. During the time Manly invented his engine, internal combustion engine were not widely in use or were not much known. This leaded to problems of construction and lack of manufacturing methods. Manly’s engine developed 52.4 brake horsepower along with a speed of 950 rpm. It would weigh 1.09 kg per horsepower which came with a total weight of approximately 60 kg after the addition of ignition system, fuel tank etc. Water cooling in radial engines had problems of its own. They had a complex structure and were expensive too. Hence in 1903-04 Jacob Ellehammer build the first air cooled three cylinder radial engine. Using the experience of this engine he later developed a more powerful five cylinder radial engine in 1907. Cooling problems

occurring to the stationary radial engine was solved by rotary radial engine which provided its own flow of air cooling to the engine.

Another early contribution to radial engines was made by Alessandro Anzani. Anzani engine was used in Bleriot XI, a French aircraft by Louis Bleriot to cross the English Channel. Radial engines took at least a decade to get approved by the U.S. Navy to fly for them. In 1921 U.S. Navy announced the same with a demand of an air cooled system and certain modification under the Naval Air Arms Set. Radial Engines were also used in World War 1 and World War 2. Radial Engine ruled the skies for nearly five decades before the gas turbines. Gas turbines had the ability to self-cool and thus radial engines were replaced from aircrafts.

Construction and working:

Radial engine consist of several parts like pistons, cylinders, crankshaft, cam ring, articulating rods, master rod, intake and exhaust valves etc. Pistons are used in many engines which move along the axis of the cylinder in which it is fitted. Master rod is the main component behind the radial engine mechanism. One piston is directly connected to the master rod and the rest are connected using the articulating rods which are fastened to the master rod using knuckle pins. Master rod converts the reciprocating motion of the piston into rotational motion and thereby rotates the camshaft which rotates the propeller. Reciprocating motion of the pistons is brought by the 4-stroke mechanism of engines. 1) Suction/Intake stroke: A gaseous mixture of fuel is injected inside the cylinder. The piston is at the bottom of the cylinder during this intake. 2) Compression stroke: The gaseous fuel mixture is now compressed to its least volume using the piston. Compression leads to a rise in temperature of the mixture. 3) Power stroke: At the end of the compression stroke a spark plug develops a spark inside the cylinder which ignites the fuel mixture and the piston is forced downwards. 4) Exhaust Stroke: After ignition the smoke formed is removed by opening the exhaust valve. In this way the reciprocating motion of the pistons is obtained. The opening and closing operations of the valves are obtained by the cam ring. Cam ring consist of two circular disks, one for intake valve and other for exhaust valve. Each of these circular disks has four lobes each 90 degrees apart. Cam ring rotates in an opposite direction and $1/8^{th}$ speed of the crankshaft. This is obtained by some specific gear reduction mechanism. Cam ring is fitted in such a manner that it would sequentially open and close the intake and exhaust valves during suction and exhaust strokes respectively. Radial engines usually consist of odd number of pistons to enable a proper timing and smooth flow of firing order. Like for a five cylinder radial engine the firing order would be 1-3-5-2 and 4. During the working of the engine, a lot of heat is developed which lead to damage of the internal parts of the engine and also raises the chances of engine oil burning. Hence a proper cooling system is implemented in the engine.

- Parth Sankhe
S.E. MECH B

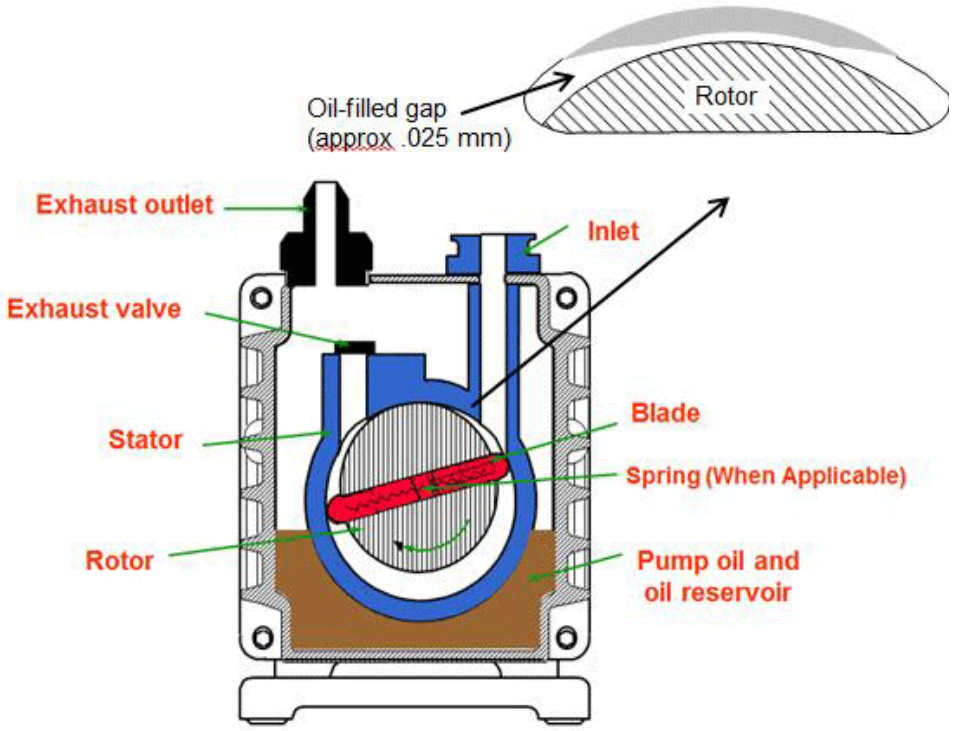
VACUUM PUMPS

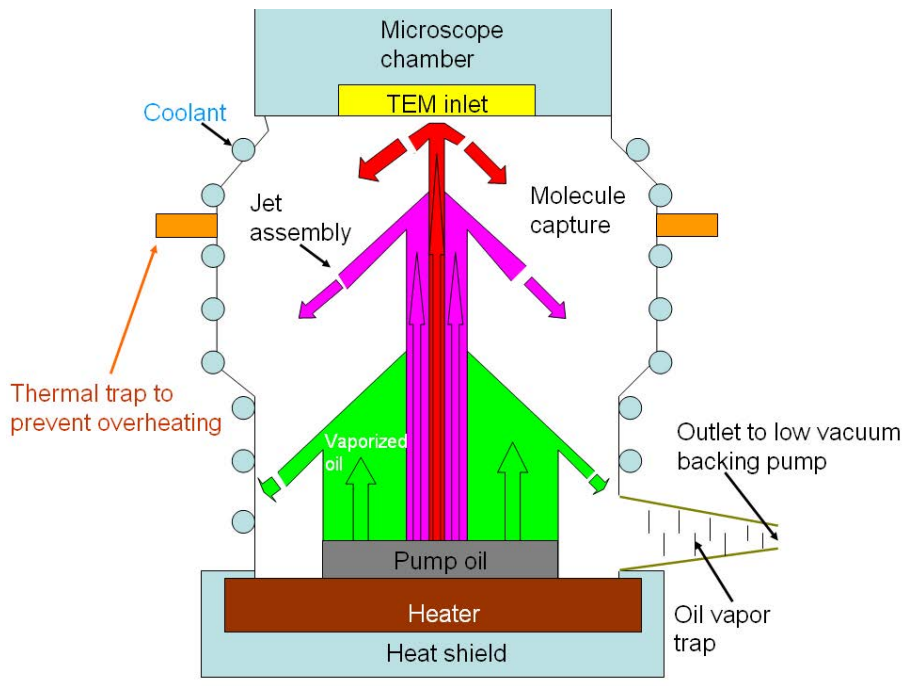
Rotary vane vaccum pump :

An oil-sealed rotary displacement pump is called a rotary vane vacuum pump. The pumping system includes a housing, an eccentrically hooked up rotor, vanes that move radially under spring pressure and the inlet and outlet. The outlet valve is oil-sealed. The inlet valve is designed as a vacuum protection valve that is constantly open throughout the operation. The running chamber is positioned inside the housing. Rotor and vanes divide the running chamber into separate areas having variable volumes. As the rotor turns, gas flows into the enlarging suction chamber until it is far sealed off by the second vane. The enclosed gasoline is compressed until the whole valve opens towards atmospheric pressure. When a gas ballast operation takes place there is an opening, which empties into the sealed suction chamber on the front side. A motor attached to the rotor helps it move.

Oil diffusion vaccum pump :

A low vapor pressure oil helps in the functioning of an oil diffusion vacuum pump. The vapor generated by boiling the oil is directed at a high speed through the jet assembly. The flow is modified from laminar to supersonic and then to molecular in the nozzles. Numerous jets are used in series to enhance the pumping motion. Air flow or water line cools down the outside of diffusion pump. The working fluid condenses when the vapor jet hits the outer cooled shell of the diffusion pump and is thus recovered and directed back to the boiler. The pumped gases carry on flowing to the bottom of the pump at elevated stress, flowing out via the diffusion pump outlet, wherein they are compressed to ambient pressure by the secondary mechanical fore pump and exhausted. Diffusion pumps can't discharge directly into the surroundings, so a mechanical fore pump is normally used

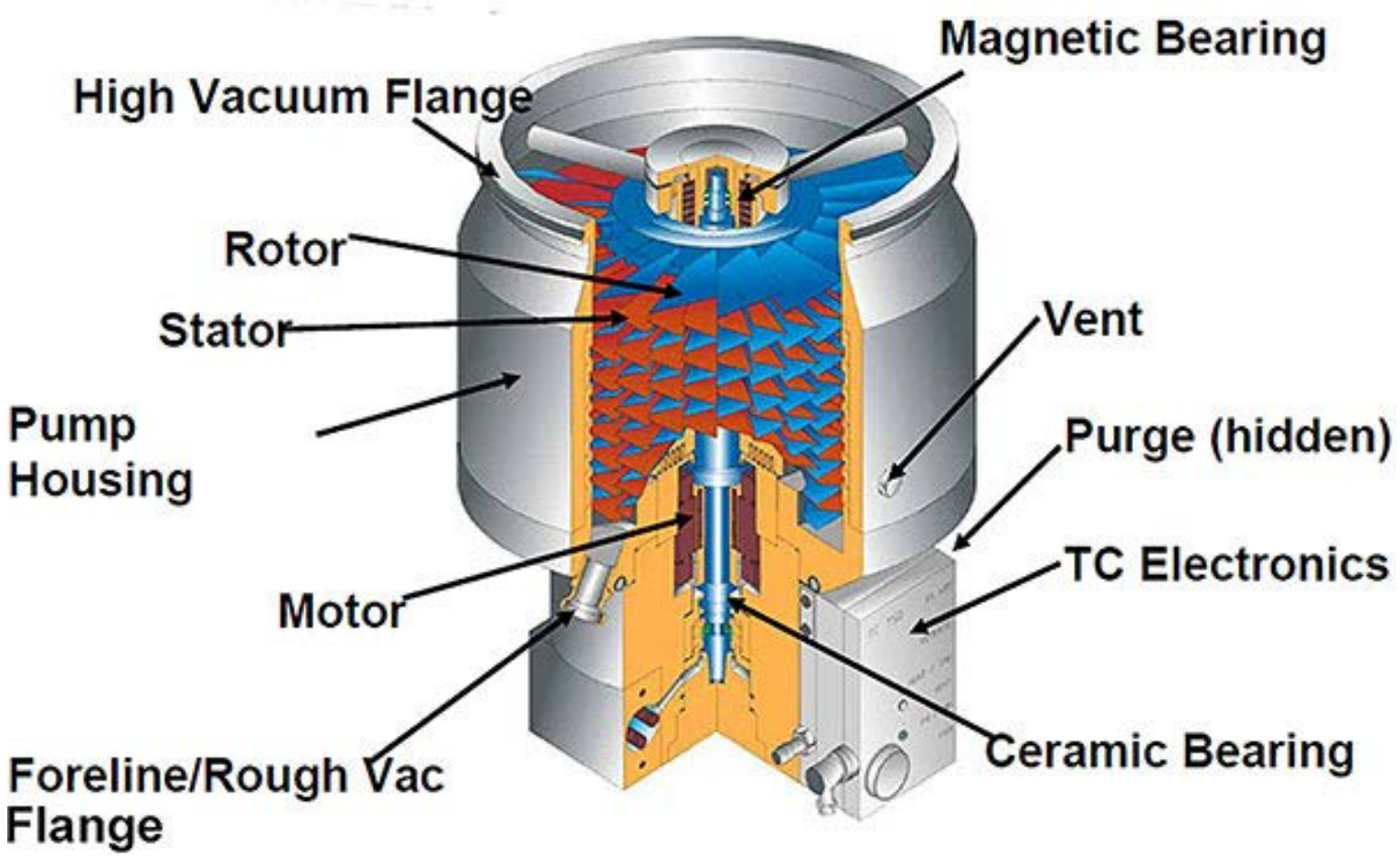




to maintain the pressure around 0.1 mbar. Diffusion pumps don't have any moving components and as a result are quite durable and reliable. These pumps operate between a pressure range of 10-10 to 10-2 mbar. They're driven using convection and accordingly, have a very low electricity performance. Also, the cost per unit pumping speed is quite low compared to other pumps used in the same vacuum range. One principal downside of diffusion pumps is the tendency to back stream oil into the chamber being evacuated. This oil can contaminate surfaces within the chamber or its contact with hot filaments or electrical discharges may additionally bring about carbonaceous or siliceous deposits. Usually, cold traps and baffles are utilized between the chamber and the diffusion pump to reduce back streaming, despite the fact that this results in a few losses of pumping ability. The oil of an expansion pump can't be exposed to the atmosphere while warm and if this happens it needs a replacement.

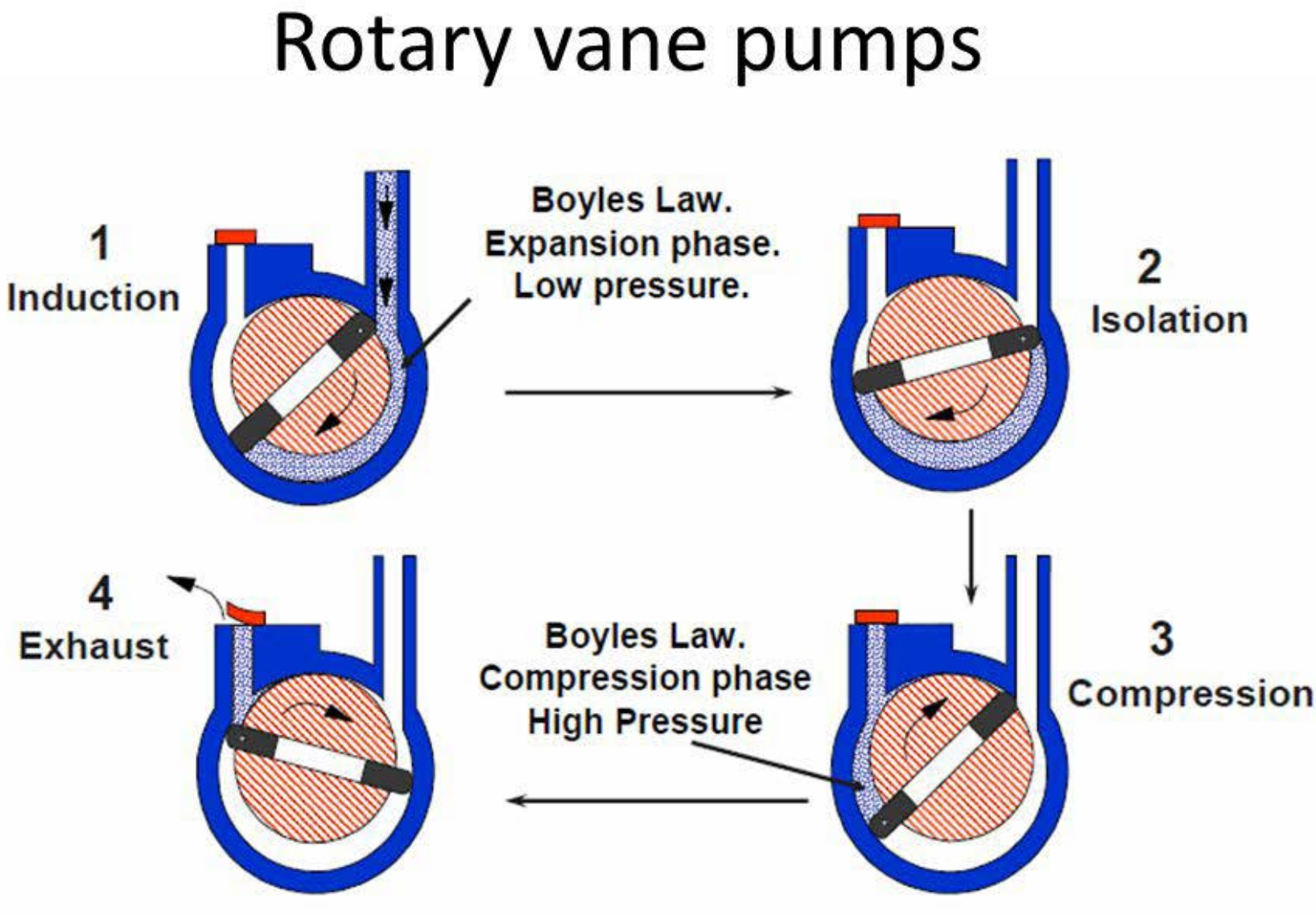
Turbo-molecular vaccum pump :

A turbo-molecular pump (TMP) reduces the chamber pressure to which it is connected from 10-2 Torr to about 10-8 Torr. A TMP includes a stack of rotors with blades, or slots, relying on the particular pump. In between rotor disks are stators, fixed discs that include the equal blades, or slots, as the rotors, but orientated in the opposite manner. The rotor spins about the axis due to motor action. The stators are fixed disks in between rotors, and the vent is a hole through which we will let gas pass if we desire to bring the pump back to a better pressure. The massive arrows display the flow of pumped molecules from the connected chamber. While the blades, spinning at 20000 rpm (about 2100 rad/s), hit the molecules, momentum is imparted. Due to the angle of the orientation of the blades of the rotor and the stator, the molecules circulate all the way down to the following rotor. This succession of rotor-stator pairs drives the molecules toward the exhaust,



wherein they are gathered by a backing pump. When the chamber is at atmospheric pressure, the gas flow is defined as ‘viscous glide’, where the molecules circulate in bulk and engage with each other different more than they do with the partitions of the container. Maximum turbopumps cannot operate in this regime. The reason is the pressure exerted through a blade on a molecule is insignificant in comparison with the collisions among the molecules, and so the overall flow remains unaffected. Because of this, a rotary pump has to cast off the fuel molecules prior to the turbopump being turned on, right down to about 10-2 Torr. At this pressure, the glide is referred to as ‘molecular flow’, meaning that molecules are fairly free and, to a good approximation, do not have interaction with each other. In this regime, the turbopump imparts momentum to the fuel molecules independently to decently move downwards towards the alternative end of the pump. Once on, the turbopump will work for quite a long term decreasing the chamber pressure until in some unspecified time in the future the pressure will no longer go down considerably to any extent further. This happens between 10-6 and 10-8 Torr.

- Amresh Tiwari
B.E. MECH B



EMERGING TECHNOLOGIES

SOLAR POWERED FLIGHT

Solar energy is an abundant and imperishable source of energy and using it to power aircrafts didn't seem quite possible until some decades ago. But with immense research done by developers and the ever-growing technological knowledge, solar-powered aircraft has now become a viable plan.

Solar flights and their working :

Photovoltaic solar panels are employed for the transmutation of light energy to electrical energy. A photovoltaic cell comprises of a layer of a semiconducting material, typically silicon that exhibits photoelectric effect by absorbing photons of light and releasing electrons. These captured electrons generate electric current.

An array is formed by connecting several cells together; the greater the area of the array, the more electricity is produced. The electricity developed by these modules is direct current electricity, modifications in the electrical arrangements (series and parallel configuration) to achieve the required voltage and current meld. Recently, solar energy has proved to have enormous importance in the aviation industry.

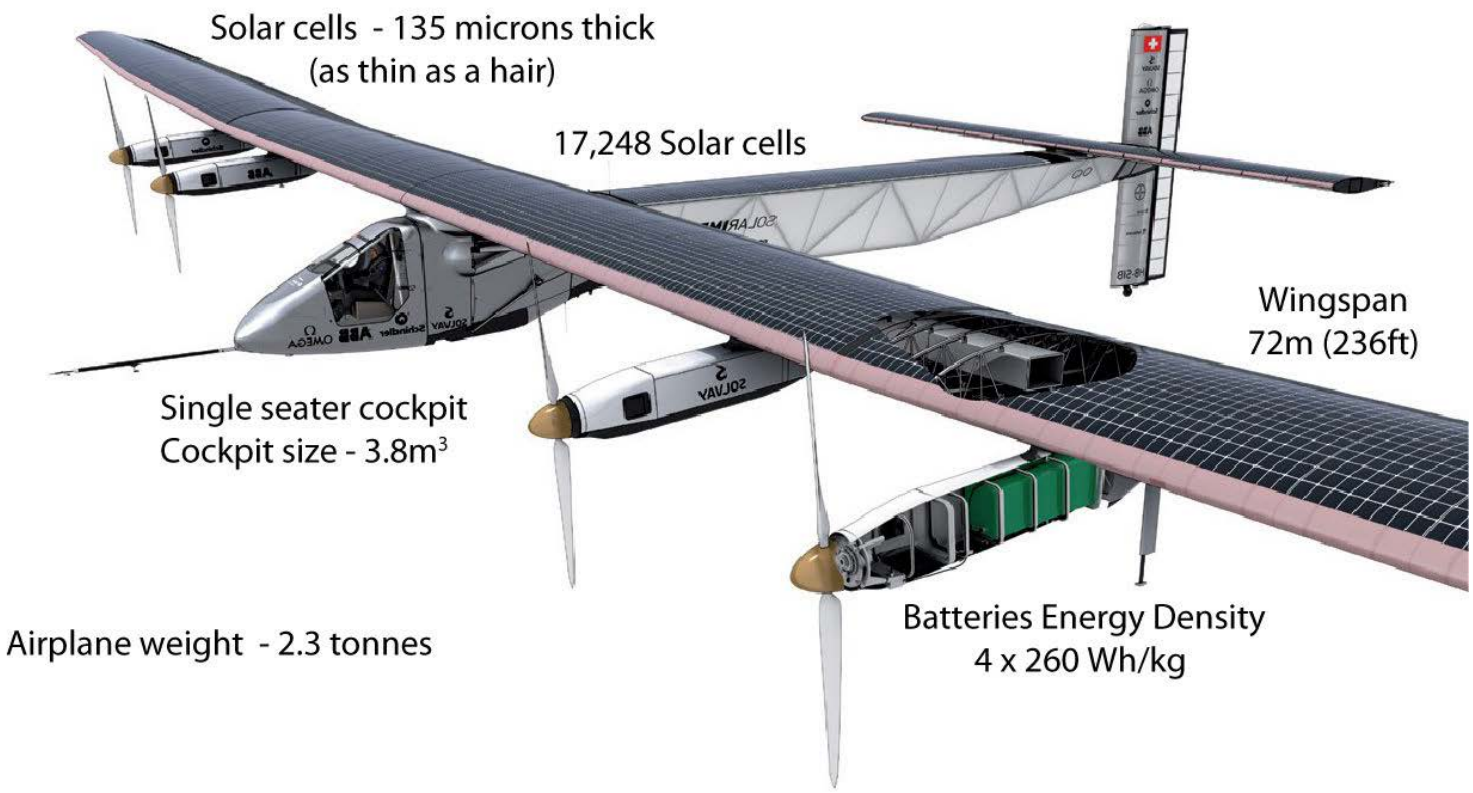
Many plans have been proffered that suggest using solar energy in place of conventional fuels to propel the aircraft. These aircrafts' have solar panels positioned on their wings, which absorb the energy from the sun using the photovoltaic cell. The aircraft stores the energy that it absorbs, in its batteries for operating the engines during the nighttime, as the availability of light energy is quite low compared to the broad daylight.

The energy produced by these panels is used to drive the motor for powering the aircraft, which reaches the motor as soon as the engine is turned on. When the engine is switched off, the remaining energy gets converted to chemical energy that is accumulated in the batteries for further use. The body of these aircraft usually is made of extremely lightweight materials like carbon fiber and alveolate foam joined together in the form of a honeycomb.

The carbon fiber and honeycomb structure make up the airframe of the aircraft. Encapsulated solar cells from a blanket on the upper face of the wing, while the lower wing has a flexible skin. Rigid polyurethane foam for protection of cockpits and motors, high-performance polycarbonate sheets protect the window and an ultrathin polymer film to protect the cells from water and UV radiation. These materials help in making the aircraft body resistant to wind, water, mold, and high-temperature variations.

Solar impulse :

The year 2010, was a breakthrough in the scientific and aeronautical industry as Solar impulse: the first of its kind, a single seater flight had successfully completed a 26-hour course of flight which included 9 hours of flying during the night using the energy from the sun. The weather conditions also impacted the flying of this aircraft as it was solely dependent on the availability of sun rays falling on the solar panels. Plans to increase the efficiency of these planes have been proposed to use them for commutation purposes. In the year 2014, Solar Impulse 2; an improvised version with better load capacity and higher efficiency flew across the world to test out its capability to withstand long duration flights and unsuitable weather conditions. Solar impulse 2 had been lodged with new batteries that that the ability to store more energy. The highest altitude achieved by this flight was 8,500m. Solar impulse 2 faces a big problem as it is still not able to reach altitudes at which conventional airplanes cruise.



Design :

An aircraft consists of a fuselage, the hollow tube that makes up most of the aircraft body. Wings provide a source of lift to the aircraft. Empennage comprises the horizontal and vertical stabilator, which plays an important role in providing steadiness to the aircraft. The Solar impulse is an aircraft which is compatible to seat only one person in the cockpit. Engines, propeller, and electrical system make up the power plant, that drives the aircraft. The landing gear contains wheels and struts that aid in the landing purposes of the aircraft. For a solar-powered aircraft, solar panels are equipped on the wings of the aircraft that convert all the light energy absorbed by them to electrical energy, which is reserved in the batteries as chemical energy to provide the engines and motors with energy through the course of the flight. For an aircraft to move at a constant velocity, the four primary forces that are weight, thrust, lift and drag of the aircraft must be balanced. If equilibrium is not maintained between these forces, the aircraft accelerates in the direction where the force is larger.

Advantages :

The cost of building and launching a solar-powered flight is quite less compared to conventional flights, which will benefit both the companies and customers. One major benefit of these airplanes is that they do not emit exhaust, making them pollution free. With the depletion of resources becoming a more and more serious issue, the use of solar emission to power an aircraft is considered to be a very unconventional plan because no scarce resources are used for providing fuel for the aircraft. Solar powered aircraft are not only considered to be fuel-efficient but also cost-efficient, as they have a low maintenance cost.

Disadvantages :

One crucial disadvantage of the solar-powered aircraft designed is that they cannot bear heavy load. They are not yet suitable for long distance journey. Temperature and weather changes will cause immense problems to the operation of these flights, as they are solely dependent on the sun's energy for their fuel. The output produced by the solar panels equipped on the wings is very low to power the aircraft.

Future Scope :

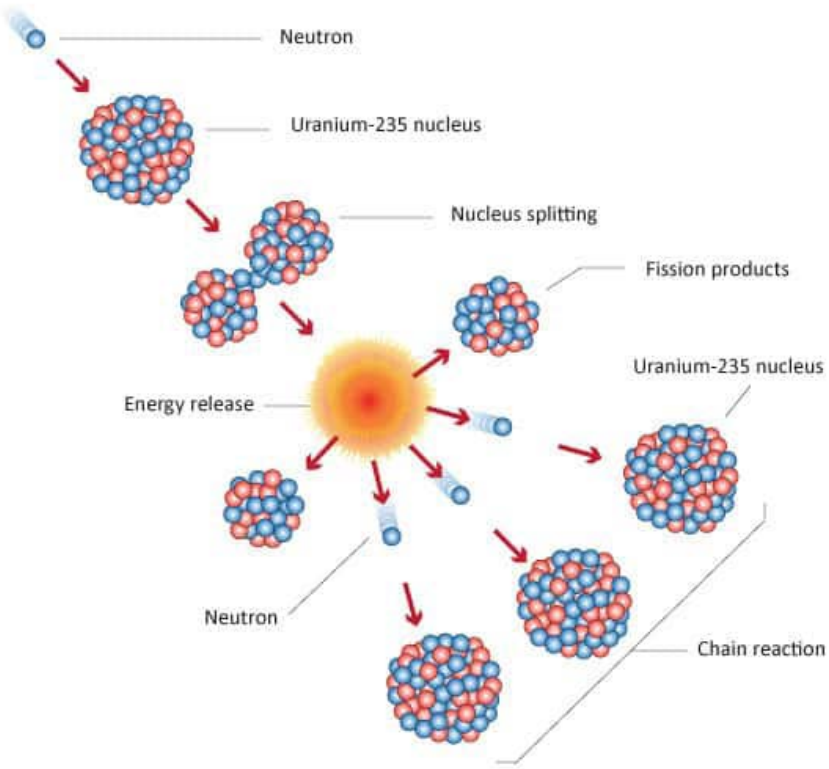
Working on ideas to minimize the drag on the aircraft has been a primary research area. Research on more efficient engines and lightweight planes and new body designs has been performed. The Spector project that is being led by Clarke, is working to make a smaller design to supply energy that generates lift on the plane by making it more aerodynamic and efficient by equipping it with electric motors. With the technological world never finding a stop, soon solar-powered aircraft will find their way in the aviation industry as they prove to be more cost and fuel efficient.

- Dolcee Jain
S.E. MECH A

NUCLEAR FISSION POWERED ROCKETS

The rockets we see flying in deep space are all chemical powered where the mixture of liquid hydrogen and oxygen is burnt to give the thrust. But have you ever heard of nuclear fission rockets? Yes, well they are already under research and test. The plan for the nuclear rockets is to provide propulsions using nuclear fission.

Liquid hydrogen is used as a fuel and the nuclear fission is carried out by using Uranium 235 which heats up the hydrogen gas to a very high temperature which then expands and is made to pass through nozzle which gives very high thrust to the rocket as compared to the chemical fueled rocket. The problem with these rockets is that the byproduct is steam which has high weight and hence for a given temperature the velocity of rocket is less. Whereas, the nuclear thermal rockets byproduct is hydrogen which is the lightest element and hence for a given temperature the velocity is high.



The idea of nuclear thermal rockets was initiated in the back 1970s and 1980s but later the project was aborted. Now again the idea got a boost when NASA used nuclear propulsion for Voyager 3. The ongoing project of NASA is the Kilopower project for which they got the funding of 125 million dollars from the US government.

The chemical rockets require almost 8 to 9 months and such long time can be crucial for astronauts as well as space administration to carry the food and necessary things required during the period. So, if the plans of nuclear fission powered rockets are executed, they will require almost half the time required to reach Mars. Also, the heavy weight of liquid oxygen will be eliminated which will allow faster speed or more payloads. This could be the key step, if successful, in establishing the Mars colony as proposed by NASA. But there are many crucial problems that the designers are facing. If the rocket blasts during the launch blast off or after launching then the radiation would pollute the atmosphere or if it falls in the sea it would cause a big threat to marine life and humans and there could be major consequences. The ongoing research is so sped up that the researchers at the Princeton University have even proposed a nuclear fusion rocket project which uses the hydrogen isotopes for fusion. The fusion powered engines shows a promising future.

- Lance D'Silva
S.E. MECH A

ZIP CHAIN LIFTERS

Abstract : Conventional method of lifting include lifting the weight by the help of cranes, forklift or by any type of lifting mechanism. A major problem in lifting and lowering applications is moving loads at a linear rate while maintaining steady and level positioning on vertical and horizontal plane. Zip chain lifter employs a lifting mechanism that uses zip chain to directly transmit upward and downward thrust, thus lifting the object. The zip chain lifter consists of chain and sprockets mechanism for transmission of motion and force from one part to another.

Introduction :

A lifting operation is concerned with the lifting and lowering of load. Zip chain lifter uses zip chain and sprocket mechanism to lift and lower the load accordingly. It is named so because it consists of two chains that interlock in zip-like fashion to form a single, strong column. Ordinary chain is used for pulling purpose; it is not capable of transferring power when pushed, while zip chain can be used for both the pushing and pulling application. The zip chain lifter has simple structure, better stability and reliability.

Chain and Sprocket Mechanism :

The yield from power sources such as wind generators, turbine and electric car is rotary motion of drive shaft. The out-turn rotary movement and force must be transmitted from power source to a machine by the help of mechanism that will use the energy in some way. For this purpose, different type of mechanism is used out of which one is the chain and sprocket type mechanism. A Sprocket has projected teeth that fit into recesses of chain which is used to pass the motion and torque from one shaft to another. A chain is made up of series of link with the link held together steel pin. Together chain and sprocket work as a mechanism for power transmission. The number of teeth between the driven and driver sprocket determine the speed and torque of the chain and sprocket mechanism. Power is transmitted through a single strand chain when the driver sprocket rotates and the teeth interlock the chain, pulling the chain around it causing it to rotate. The chain drive uses the engagement of sprocket teeth and chain to drive it.

Design of zip chain lifters :

Zip chains are two strands of chain that interlocks in a zipper like fashion to form a single, strong column that enables push/pull operations over long stroke. The design of zip chain lifter consists of zip chain, sprockets and bearings and rollers. Zip chain lifter is an innovative lifter that directly transmits lift thrust through zip chain. The material used for the manufacturing of chain and sprocket depends upon the torque and power need to be transmitted, generally the metals used for manufacturing are alloy steel and cast iron with suitable alloy properties followed by the heat treatment for tempering and case hardening the equipment. Zip chain follows mechanism that transmits drive force more efficiently than electric/hydraulic lifters.

Working of zip chain lifter :

The zip chain lifter is a new lift table that maximizes the zip chain and sprocket mechanism to move it forward and backward. This Ground-breaking, electrically driven lifting mechanism gives multiple time the energy efficiency as compared to conventional hydraulic lifter. The working of zip chain lifter is basically dependent on the chain and sprocket mechanism, the zip chain is mounted over sprocket which rotates both anticlockwise and clockwise direction to provide forward and backward motion. The sprocket rotates and Zip chain interlock to form a strong column support which is used for upward motion or lifting of the object. This continuous rotating motion of sprocket moves zip chain upward and backward. The zip chain is provided with scissor metal lifter and roller bearings to provide the required support for the lifting or lowering of load. Zip Chain lifter is used to lift or lower the load by the application of Zip chain, sprocket and electrically driven mechanism. Once the motor is supplied with power, it start rotating the sprocket and the chain from the housing get locked in the space of sprocket thus lifting up the slab along with the zip chain .The roller support at the end provide the required support for the base (on which load is kept) to lift or lower the load, also it act as a compact spacing henceforth providing a better stability and reliability.

Features :

- **Excellent Speed and Position Control**

Zip chain uses the simple multi stage control mechanism. In zip chain lifter the speed is same throughout the stroke range hence it follows a constant path of speed. The positional accuracy of zip chain lifter varies within +/- 1. Arranging multiple stops and multilevel positioning can be easily done. High repeatable stopping accuracy at many points.

- **High speed and high frequency operation**

The zip chain lifter operates multiple times faster than hydraulic lifter. The mechanism provides greater stability thereby enhancing the rate of frequency of lifters. In hydraulic lifters due to increase in oil temperature it needs to be hold down for few minutes or second to

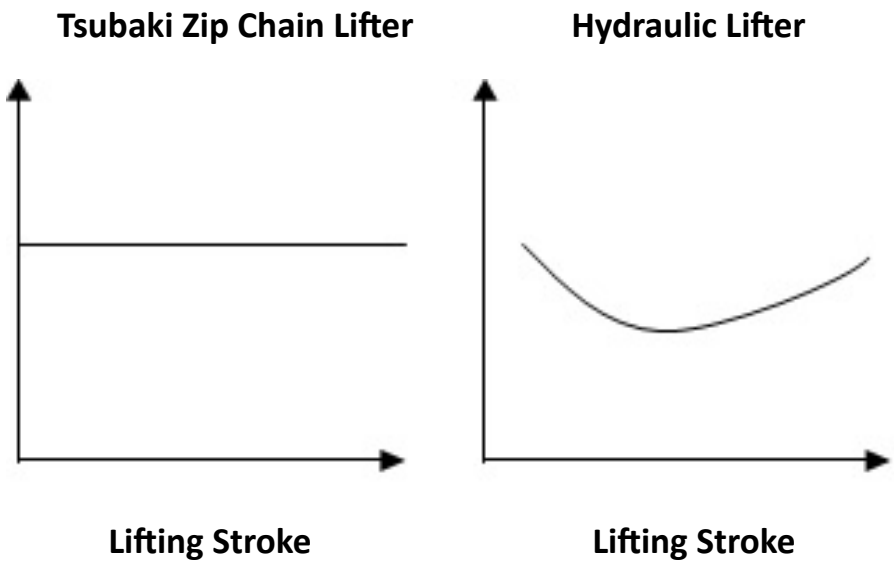
get the oil cool, thus limiting the frequency operation. While in case of zip chain lifter no such obstruction is observed.

• Greater thrust efficiency

Driving force is transferred directly since the zip chain mechanism pushes up the platform instantly. A minimal load is placed on the roller bearing and hinges. While in case of hydraulic lifter a large amount of thrust is needed at starting as the cylinder pushes the bar in oblique direction. Zip chain instantly pushes the platform so that motor toque can be transmitted without any losses.

• Energy efficiency

As compared to conventional lifting method zip chain lifter are more efficient. In a way it can provide much higher speed and hip operational frequency limiting the losses. It also features a regeneration unit that returns some amount of energy produced when the platform is lowered to the primary power system, allowing the lifter to recover 30 percent of electricity consumption. The Zip chain lifters are more energy efficient in terms of transmission efficiency as it uses the diagonal push of hinges to support the platform carrying load.



Limitation :

The chain drives need accurate mounting and maintenance, particularly lubrication and slack adjustment. Also, in an extreme condition the chain might get break due to certain expansion or contraction in drive. It cannot work without electricity supply, since the rotation movement to sprocket is provided by motors. The size of zip chain and sprocket limit the application as for varying loads, size of zip chain and sprocket will vary accordingly.

Application :

Zip chain lifter can be installed on an automated guided vehicle with small footprints. It can be used for lateral pushing and lifting of components, in operator lifter. With the high durability and ease of application it can be used in any machinery for lifting or pushing the load. Its application also consists of lifting or lowering the loads. With increase in number of chains and sprocket extra support can be provided for lifting or lowering of loads.

Conclusion :

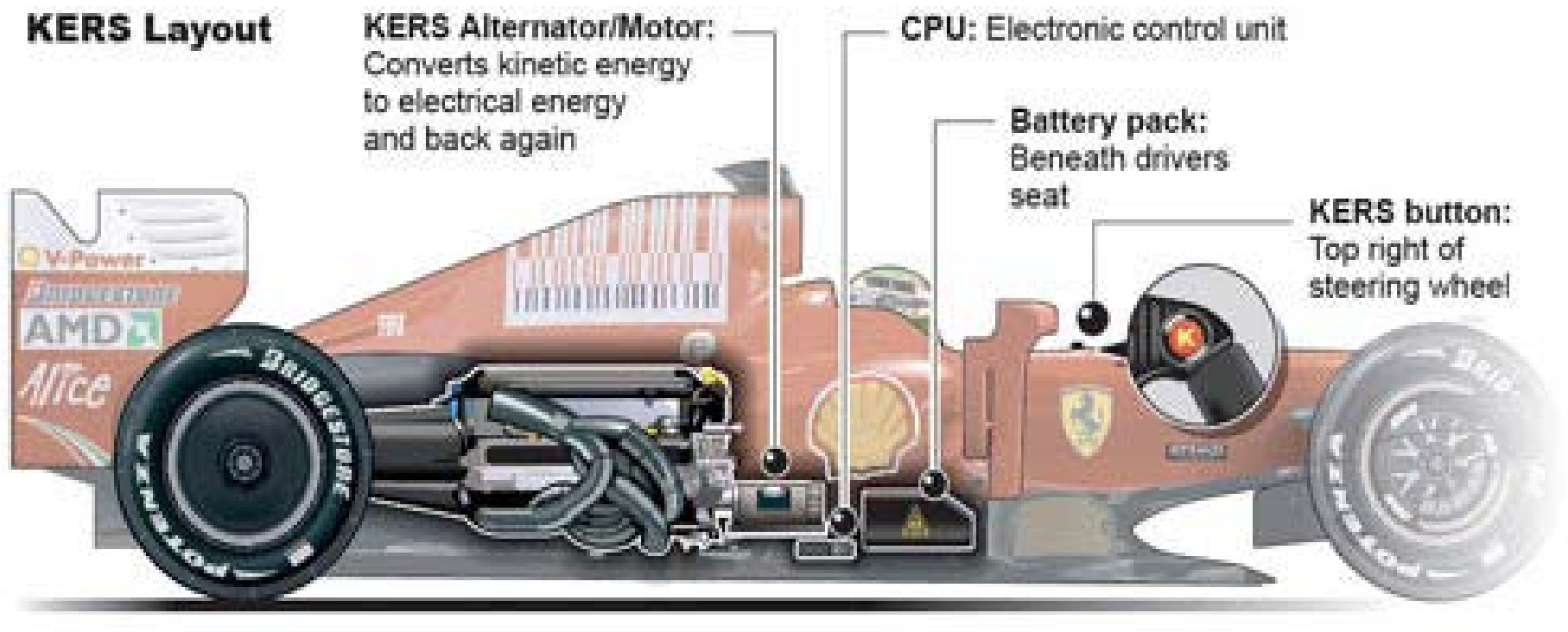
The zip chain lifter follows the most convenient and simplistic approach compared to other lifters used in industries. The compact ability and high durability with ease of application maximize the application of zip chain lifters.

- Pradeep Kapri
B.E. MECH A

KERS TECHNOLOGY

The law of conservation of energy expresses that energy cannot be created nor destroyed however rather can be constantly changed over to various forms. To a Formula 1 vehicle, that implies that all the energy that the vehicle has while achieving rates of 200 mph must be exchanged to different types of energy when the vehicle plans to go slower. At the point when the vehicle brakes, this energy is normally exchanged to warmth and sound energy that, for the motivations behind the vehicle and its driver, is lost. The activity of KERS is to collect a bit of this energy and redeploy it into the vehicle as additional pull, giving an execution preferred standpoint to its driver.

The activity for Formula 1 groups to actualize KERS into their vehicles was led by the leader of the FIA, the administering body for Formula One hustling. His motivating force was to improve the open picture of Formula 1's association with the earth. The game has regularly been related with a negative commitment to the earth and the presentation of KERS was an endeavor to dishonor that notoriety. At the season of presentation, numerous street vehicle makers were starting to offer half and half autos which utilized a comparative guideline to collect and reuse energy thus the idea of KERS was one that the public could rapidly comprehend and appreciate.



To the groups contending be that as it may, actualizing KERS gave the drivers the chance of extra increasing speed at the occasions where they need it most.

Actually, groups were so persuaded of the benefit of KERS that a considerable lot of the groups vying for the constructors title changed their autos mid-season to remain focused in the title race.

How It Works :

There are two primary executions of the KERS framework and they vary in how the energy is put away. The electrical KERS utilizes an electromagnet to exchange the motor energy to electric potential energy that is inevitably changed over to substance energy that is put away in a battery. It then redelivers the put away energy to the drive train by fueling an engine.

The electric KERS was what numerous groups begun off attempting to actualize into their vehicles. Be that as it may, the battery used to store the energy is exceptionally inclined to battery fires and can cause electric stuns. After an episode with the BMW Sauber group, where a designer chipping away at the KERS was scorched while testing the framework after a training run, numerous groups esteemed the electric KERS to be dangerous. Along with different factors, for example, being heavier than different executions, the electric KERS usage isn't found inside the present Formula 1 vehicles. The mechanical execution was at first created by Flybrid Systems. To gather the energy after braking, the framework utilizes the braking energy to turn a flywheel which goes about as the repository of this energy. Whenever required, the redelivery of the energy is like that of the electric KERS usage, the pivoting flywheel is associated with the wheels of the vehicle and when called upon gives a power help. The mechanical execution of KERS is known to be more effective than the electric comparable because of the less changes of the energy that are occurring. The executions are like that what are utilized by half breed traveler autos. The principle contrast is that in a cross breed vehicle, the redelivered energy replaces the reason for the motor and powers the vehicle totally. In Formula 1, this would be infeasible. Rather the energy is utilized notwithstanding the present motor. This isn't basic and is accomplished utilizing by interfacing a Continuously Variable Transmission (CVT) to the drivetrain. The CVT in this way handles the proportion of the torque given by the engine associated with the motor and the torque from the flywheel.

How F1 Drivers Use KERS:

The undeniable advantage of KERS is the lift given. The KERS lift can give drivers an extra 80 bhp for as long as 7 seconds a lap. This means all the more dominant increasing speed which can have a significant effect to a Formula 1 race. Drivers have been utilizing it out of moderate corners to help achieve their best speed sooner just as on straights to really go past what might for the most part be their best speed. Since its beginning KERS has been utilized in a few race changing minutes and in 2009, Kimi Raikkonen utilized

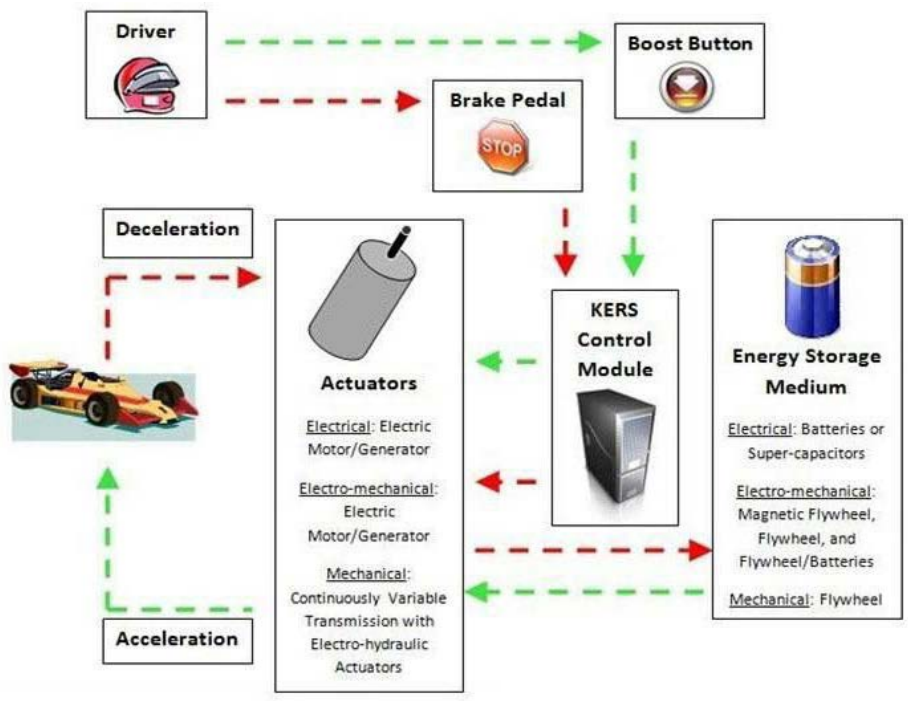
KERS to overwhelm Giancarlo Fisichella in the end phases of the race to win it.

Restrictions of KERS:

While KERS could at present give significantly more capacity to longer to Formula 1 cars, there are a few reasons why the present frameworks are not achieving their maximum capacity. One of these is the heaviness of the frameworks. Formula 1 cars have a greatest weight limit, and the parts can weigh as much as 45 kilograms. Bigger flywheels can store and in this way convey more power however that comes at the cost of extra weight.

There have additionally been worries about the wellbeing of the frameworks. In the event that the flywheel, pivoting at a great many cycles for each second, is liberated from its compels, it could deliver overwhelming harm on anything it crashes into.

Frequently that would be the driver. Notwithstanding when controlled, the flywheel will set aside some effort to quit turning thus architects and any other individual managing the vehicle would should be mindful so as to avoid it. In case of an accident, this could obstruct therapeutic staff from rescuing for a driver still in the vehicle.



The Future of KERS:

With respect to motorsport, as Formula 1 is endeavoring to accomplish a cleaner, greener open picture, the game will actualize more guidelines to advance the utilization of KERS. The building test lies in giving groups the biggest conceivable preferred standpoint while as yet remaining inside the principles of the administering body.

Some traveler vehicle producers have discussed utilizing a KERS usage in their autos. Volvo, typically an industry head in advancement, has effectively fabricated an improvement donkey of their lead S60 with a mechanical keys execution. The KER usage is really lighter and littler than the parts expected to make a gas-electric mixture framework and tests recommend they would show comparative fuel utilizations. Architects at MIT have likewise executed an electric bike which makes utilization of KERS which costs less to create than a commonplace electric bike and henceforth could prompt lower costs.

- Bhavika Sakpal
T.E. MECH B

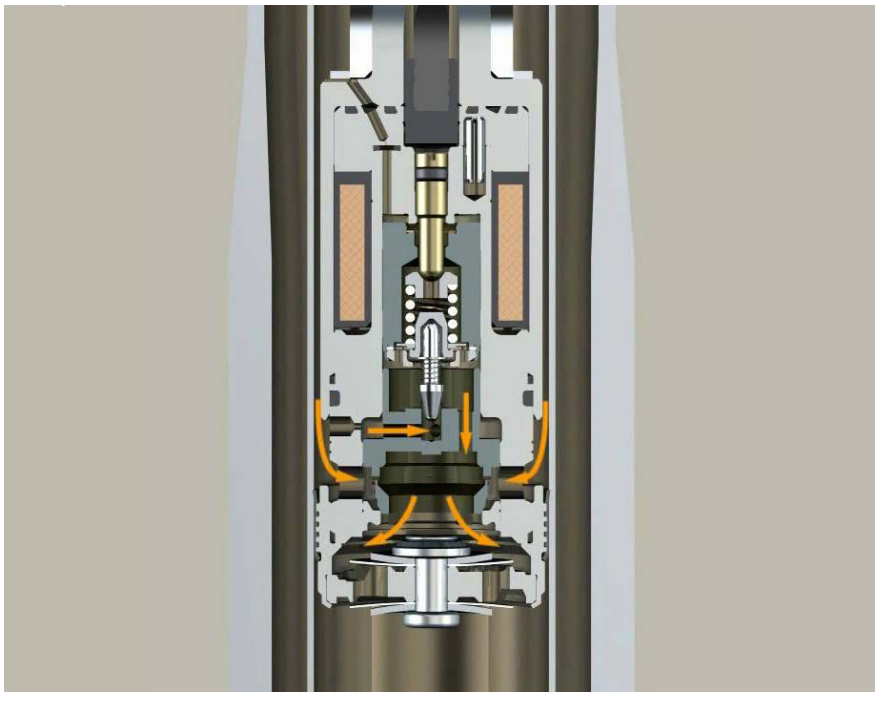
CONTINUOUS DAMPING CONTROL

Introduction :

Over recent decades, electronic systems have substantially enhanced the operation of vehicle mechanical functions and the field of damping is no exception. Active and semi active damping system have become major area of focus for next generation vehicle. One of such developing active damping systems is Continuous Damping Control system.

Continuous Damping Control :

Continuous Damping Control (CDC) is an active suspension system which increases driving safety, comfort and dynamics by adjusting damping forces optimally for each individual wheel. Active suspension systems are those systems that control the vertical movement of the wheels relative to the chassis by using separate actuators which can exert independent force on the suspension to improve the riding characteristics.



Principle :

Continuous damping control system is based on Skyhook theory. The ideal suspension lets the vehicle retain a stable position as if it was suspended by an imaginary hook in the sky. This suspension should be unaffected by the condition of the roads. This is the Skyhook theory. In real this skyhook theory is achieved by actuator operations.

Construction :

The CDC system technology is formed by linking together the sensors, actuators, software and hardware.

Sensors at each wheel that detect relative wheel to body position.

Electronic Control Unit (ECU) with integrated sensors detect heave, pitch and body roll motion.

Active Dampers (Actuator) with electronically controlled valves that are individually controlled to provide continuous range of damping.

Working :

Vehicle sensors monitor values such as body, wheel and feeds them to the Vehicle Electronic Unit (ECU). Serving as the central repository of the data, the ECU evaluates the data to determine the ideal damping force for every individual wheel on continuous basis. ECU electromagnetically regulates a proportional

valve which is the core of CDC damping system. The proportional valve determines the flow rate of the oil in the damper. A higher voltage present at the valve leads to a smaller opening in the damper and thus the oil flows more slowly and the damping is harder. The system calculates and regulates the damping force every few milliseconds and thus constantly captures the entire driving situation.

Advantages :

Continuous Damping Control offers the following benefits over a traditional damping system :

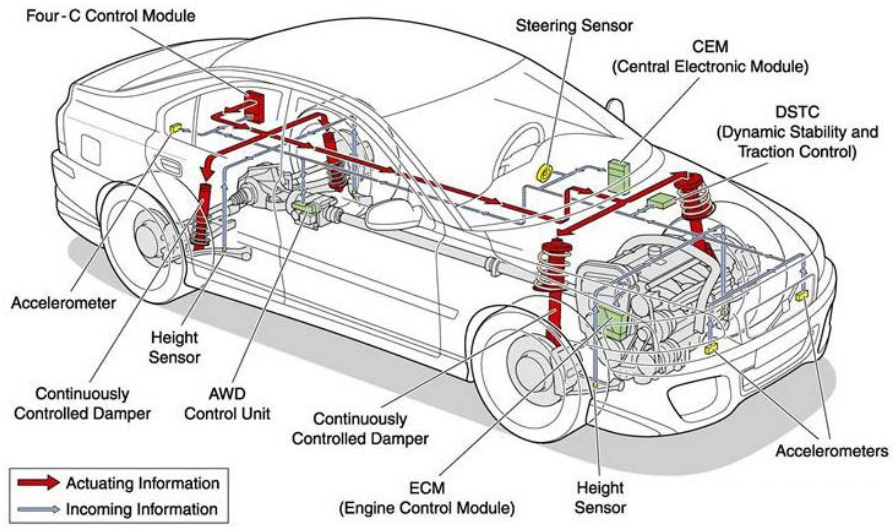
- Greater safety thanks to optimized wheel damping
- Enhanced driving comfort and dynamics, e.g. during lane-change
- Reduced roll, pitch and vertical motion
- Precise tracking during acceleration
- Superior handling
- Improved cornering stability
- Shorter breaking distances thanks to better road contact
- Continuous adjustment in real time

Drawbacks :

The drawbacks of this design are high cost, added complication and mass of the apparatus, and the need for frequent maintenance on some implementations. There can be requirement of specialised tools for maintenance and some problems can be difficult to diagnose.

Conclusion :

Continuous Damping Control solves the conflict between driving safety and ride with comfort by setting the damper. Although Continuous Damping Control system has been installed in few cars like Cadillac XT4, developments are being made to increase the adjustments of wheels per second. The 2018 Buick Regal introduced the second-generation Continuous Damping Control system that's capable of 500 adjustments per second. The future of vehicles lies in active suspension systems like Continuous Damping control system which takes the comfort and ride quality to whole other level.



- Harsh Chaurasia
T.E. MECH A

COMPETITIONS

ISNEE QUAD-TORC 2019

Quad is an all terrain vehicle (a four wheeler bike), which was initially developed as a farm-to-town vehicle in isolated and mountainous areas.

“Indian Society of New Era Engineers” is an organization focusing on the technical and managerial development of future engineers. The organising committee gives opportunity to the undergraduate and diploma engineers to research and develop innovative projects. Design challenges organised by ISNEE provide students a panorama to work as a team and allows them to commit and dedicate to demonstrate and prove their creativity to resolve real life problems.

Quad-Torc is a four day competition which involves many events which are planned each day. The competition embarks with drop test event which is mandatory for all the teams to surpass, where the vehicle is dropped from a height of 7 feet. Many other events such as the DisAsm, Suspension test, Manoeuvrability, Kill the Hill and other documentation events such as the Design Validation, Evaluation and Business plan presentation are planned accordingly.

Team Technocrats is the particular team from Thakur College of Engineering & Technology to participate in ISNEE QUAD-TORC national level competition. The Quad-Torc 2019 was held at Bijnor, Uttar Pradesh from 6th-10th September 2019. The team participated and showcased their skills in 2019 with a total of 42 team members.

Reasons to participate in this competition :

- To showcase our skills at a national level.
- To build a bridge between imagination and the real engineering through designing and manufacturing.
- To create a change in the society with our knowledge of engineering.

Our experience while :

1. **Deciding the material, budget, design :** The most significant and challenging part as a team is to build a vehicle with high quality components and also to maintain the budget. The work initiated with hundreds of iterations for suspension and steering mechanism to choose the best design and reliability for our vehicle. While participating for the first time the team was a bit confused about the material to be used and finalised on Carbon Steel (AISI 1018) but participating for the third time the team is more focused on weight reduction and is willing to choose Alloy Steel (AISI 4130) as it gives twice more strength as compared to its weight.

2. **Planning and manufacturing the vehicle :** As we finalised our material and design, it was the time to have an efficient schedule for manufacturing. As we were new to this competition and also due to lack of knowledge we decided to attend the workshop which was organised by ISNEE committee. It was a 2 day workshop at Pune which gave a brief insight to different plans of approach and manufacturing techniques. The engine was a 250cc LIFAN engine provided by SD Motors. Bombay talkies, Malad (west) was the apt location for manufacturing where we had a place to work and a massive ground to test dynamically the vehicle at each stage.

Experience of the competition :

Fifty teams from all over the nation participated in this competition. Every team and their vehicle were unique in its own way and surprised everyone with their skills. The technical inspectors helped and guided each team throughout the competition. The competition was well organised and the members from other teams also helped each other with any spares or fabrication if needed hence showcased sportsman spirit. Being the first team from our college we managed to gain some good numbers in terms of ranking and achievements.

ACHIEVEMENTS

- 1. Won **First prize** in **Cost Plan.**
- 2. Secured **First place** in **DisAsm** event **(49.16min)**
- 3. Judgers choice Award (Best female participant: **Ms. Ruchi Pourana**)
- 4. Secured **Second place** in **Business Plan** presentation.
- 5. Secured **Third place** in **Traction Test.**
- 6. Secured **Third place** in **Fuel Economy Test.**
- 7. Finished **sixth** in the **endurance race.**
- 8. **AIR position 5th** among **50** registered teams.

Team Captain	Team Mentor
Pradeep Kapri	**Sachin Oak**

HYBRID VEHICLE CHALLENGE

FORMULA IMPERIAL 2019

The event was conducted in the first two weeks of February 2019. It was held at Buddh International Circuit in Noida, UP. Various teams from all over the country participated in the event with a total count of 60+ registrations. Out of which only sixteen teams made it to the final round.

Team MAVERICKS RACING of our college also participated in this competition bagging 6th rank in the Hybrid Category. The achievement was massive for the team. This team consisted of more than 25 members lead by captain Manas Ghumare and Vice Captain Akash Yadav.

It was the effort of all the team members that made it possible to make a Hybrid type formula vehicle from scratch. Almost all the parts were designed and manufactured by the team members with minimal outside help. The manufacturing process took around two months while the major focus was given to the designing process.

The team got a few sponsorships in the form of kinds. A major portion of the funds was contributed by the team members itself.

Technical Specification of Vehicle –

1.Engine: 306cc single cylinder 10HP (Briggs and Stratton).

2.Motor: BLDC, 2kW.

3.Chassis: Made of Hollow pipes (AISI 1018).

4.Suspension: KTM Coil overs (Front and Rear).

5.Brakes: Disc, 200mm (Front and Rear).

6.Top Speed : 65km/h (Engine only),

20km/h (Motor only)

VEHICLE NUMBER	CATEGORY	TEAM NAME
2	HYBRID	TEAM ARVANS
17	ELECTRIC	FALCON RACERS
15	HYBRID	HYBRUTOS RACING
6	ELECTRIC	TEAM VANQUISHERS
8	HYBRID	SPECTRA XTREME
12	HYBRID	ALACRITY
1	HYBRID	HAYAGRIVA 3.0
4	HYBRID	MAVERICKS RACING
18	HYBRID	DRAVIDIAN THURIDRA
3	HYBRID	TEAM MODTOS
5	HYBRID	TEAM SPITFIRE
9	HYBRID	TEAM ENIGMA
7	HYBRID	VARCHASVA

MAVERICKS RACING TEAM

HUMAN POWERED VEHICLE CHALLENGE

Introduction :

Human Powered Vehicle Challenge (HPVC) is a competition organized by the American Society of Mechanical Engineers (ASME). The main objective of this competition is to enable engineering students to expand their knowledge, test and showcase new skills, inspire innovation and simultaneously develop eco-friendly means of transport.

What is an HPV?

Human Powered Vehicle or HPV is any vehicle which uses human muscle power to move. An HPV comes in many variants including upright bicycle, semi-recumbent, recumbent, delta, tadpole, front wheel drive, rear wheel drive, etc. the upright being the most well-known and commonly used among them.

About the competition :

HPVC- 2019 was a three-day competition held at Vellore Institute of Technology (VIT), Vellore from 1st to 3rd of February 2019 wherein 40 teams from all over India took part. The Design Event was held on the first day of the competition. Various tests were conducted on the vehicle which encompassed Safety Test, Braking Test, Turning Radius Test and Slow Speed Stability Test. The Drag Race was scheduled on the second day wherein the competitors had to race against the time to qualify and then compete with one another to win the race. The drag race aimed at testing the vehicle's transmission efficiency. The Endurance Race was held on the final day in which the participants had to cover maximum laps while traversing various obstacles within a stipulated time of two and a half hours.

About Team Photon and vehicle Philip :

Team Photon from Thakur College of Engineering and Technology participated in this event. The team consisted of 26 members under the mentorship of Prof. Mahendra Shelar (Faculty), Kalpesh Maurya (Captain), Ashfaq Khan (Vice Captain). The team was founded in 2016. This was the third time Team Photon participated in the competition and therefore the team had the advantage of the insight gained in the previous years. The vehicle was named as 'Philip', as a homage to Philippiddes who is the central figure in the story that inspired a modern sporting event, the marathon race. Philip was a front wheel drive semi-recumbent bicycle.

The Journey…

● Team Building :

Just as the saying goes "Talent wins games, but teamwork and intelligence win the championship." The preparations for the competition started off by bringing in new team members. The candidates were carefully interviewed for the required qualities and a strong and proficient team of 26 members was formed.

● Initiation :

Several meetings were conducted, various aspects were deliberated amongst the old and the new members, experiences and mistakes from the past competitions were discussed in detail and various design reports from the winning teams were reviewed. It was made sure that the ideas conceived by new members were considered and discussed. This process brought the entire team on the same page and any contention was resolved with deliberation and discussion.

● Planning and Strategy :

Various responsibilities were distributed among the team members, namely designing, transmission, seat fabrication, inventory, RPS (roll-over protection system), etc. Backward calculations were made and plotted on Gantt chart. The objective was that everyone has some experience in each domain.

● Designing :

The designing stage started soon after an outline was ready. The experience of the past two years was utilized to the fullest extent. Various meetings were held for deciding the type of variant and after vigorous brainstorming sessions, the team decided to go with a semi-recumbent front wheel drive bicycle. The material for chassis was selected after weighing the pros and cons of each material. Software like Solid Works workbench and ANSYS were used for designing and load analysis respectively.

● Procurement :

Not a single stone was left unturned in pursuit of the required raw materials and to find the best prices in order to keep the project within the budget. This activity trained the members to negotiate properly and taught them to do whatever is needed in order to get the job done.

● **Fabrication :**

Fabrication started from scratch just after the designing process with the resources at hand. Required trails were conducted on the prototype of the vehicle to weed out any shortcomings. Some processes like gas cutting, laser cutting, sheet metal bending, etc. were out-sourced as it was not feasible to set them up at the workshop. Soon after the success of the prototype, the team started the fabrication of the final vehicle.

● **The Culmination :**

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Overview & Key Learnings :

This year, the team excelled at every aspect of the competition. The event gave the team an immense exposure at the national level. The members got practical experience at operating power tools. Apart from the technical aspects, they also got a semblance of Project Management, Time Management and Resource Management skills. Members also leaned on complementary abilities of each other and won. The team secured 1st position in the competition which is the most coveted award in the whole competition. The enormous improvements that the team has made over previous years show its resilience and diligence is an indication of a glorious and promising future.

Achievements :

- 1 st place in Design Event
- 4 th place in Men’s Drag Race
- 5 th place in Women’s Drag Race
- 17 th place in Endurance Race

SUPRA SAEINDIA

Supra SAEINDIA, India's biggest formula student competition, was held between 15th to 20th July 2019. The decision of participating taken by Eclipse Racing - The Official Formula Student Team of TCET was a big one. With no foundation whatsoever, the journey for Team Eclipse Racing was tough. Starting with the recruitments, members from every branch and year were invited and the tests, interviews were conducted. In the month of November, the team comprising of 13 passionate and innovative minds, led by Captain Mr. Nrutesh Haldankar and Industry Representative Mr. Ankit Gupta, was finalized and the first official step was completed- Registration for Supra SAEINDIA 2019.

With only 8 months in hand, priority was given for research and development. The next 4 months were spent understanding the event, gathering knowledge for the design spectrum, debates on 'One's better than the other', compromise between 'Design Complexity, Cost Benefit Analysis and Manufacturability' and in the end completing the Phase 1 by freezing the design. The Final Design of the vehicle was reiterated to perfection. With all things set, raw materials were ordered, CAD drawings were printed and with the association of the Title Sponsor M/s Laxmi Air Control, the Phase 2 the Manufacturing Phase was started . Knowledge gained from the college workshop was utilized to build parts which were designed and analysed. Various processes like cutting, grinding, welding, nibbling, painting were used. Jigs and fixtures were used for utmost accuracy.

With all the production, assembly and partial testing done, the car left for Buddh International Circuit, Greater Noida on 9th July 2019, with the help of the Co-Sponsor M/s Kosmos Developers. As the team reached the event venue on Day 0, registration was done, pit was set and every other preparation were finalized. The vehicle showed up a day late on Day 1, which tensed the team. Day 1 was utilised for preparing the vehicle for Technical Inspection. Day 2 was the judgement day. The team was scattered around participating in Static Events. With the statics done, the team took their first chance at the Technical Inspection. With all the events done, it was learnt that the vehicle wasn't fit to participate in the event as it didn't clear the Technical inspection at the second attempt. Team Eclipse racing Stood 97th out of 127 Teams at Supra SAEINDIA 2019.

The Senior faculty advisor Dr. Sanjay Kumar and faculty advisor Mr. Sachin Oak left no stones unturned to ignite motivation within the team and to guide them. The constructive criticism motivated the team and helped them focus on achieving the best.

Technical Specification of Vehicle –

1. Tires and Wheels: 175/70 R13 Bridgestone Wet Tires, R13 x 5.5J ET40 Steel Rims
2. Chassis: AISI 1018 Carbon Steel Space Frame Chassis
3. Torsional Rigidity: 2300 N/m2
4. Suspension: Double Wishbone Pull Rod System (Front), Direct Actuating System (Rear)
5. Steering: Customized Rack and Pinion Setup made of 7075 T6 Aluminum.
6. Brakes: Brembo P32G Dual Piston Fixed Caliper (Front), Bybre T28GF Dual Piston Floating Calipers (Rear)
7. Powertrain: Royal Enfield 500 EFI Twin Spark Engine (27 BHP, 41 Nm of Torque), Alto Open Differential, Customized Half Shafts.

PROJECTS

PLASTIC PYROLYSIS

Plastic is a material that has revolutionized the material industry and we find it in every industrial sector we see around us. The demand for plastics is increasing exponentially with the growing population. Plastics are an indispensable material as there is no other alternative which offers the same versatility, flexibility and manufacturability at a much lower cost. Having said that, plastics are essentially very long chain hydrocarbons which are synthesized from petroleum products. As every coin has two sides, plastic has its own shortcomings and has been criticized by scholars and environmentalists due its non-biodegradability which can't be overlooked for its advantages. Due to this inherent property, their disposal is becoming an ever-increasing threat to the environment. The accumulation of discarded plastics in landfills affects the quality of the soil making it infertile. Its collection in the oceans and water bodies harms the aquatic life and thus causing unbalance in the ecosystem. Also, being synthesized from petroleum products, the fossil fuels are depleting with the increasing plastic production. Due to this alarming situation, all around the globe, measures are being implemented to counter this malice. Methods like incineration and mechanical recycling have not proven to be effective due to the magnitude of the problem. Mechanical recycling demands an intensive work force to segregate the plastic on basis of their grade, colour and type. In incineration plastics are burned as secondary fuels which generate toxic gases which poses a threat to the environment as well as human health.

Introduction :

Pyrolysis is the process of heating any organic matter in the absence of oxygen. Hence when the plastics are pyrolyzed, it causes the breakdown of the long chain hydrocarbons into smaller chains of fuel range without any toxic by-products. Out of the current plastic management techniques, pyrolysis is the most effective method that can be implemented to tackle the problem of plastic waste which has been accumulated over the years.

Waste plastics have created a very serious environmental challenge because of their huge quantities and their disposal problems. Waste plastic pyrolysis in liquid fuel (gasoline, diesel oil, etc.) or chemical raw materials can not only effectively solve the problem of pollution, but also can alleviate the energy shortage to a certain extent. Waste plastics recycling, regenerating, and utilizing have become a hot spot of research at home and abroad and gradually, has formed a new industry.

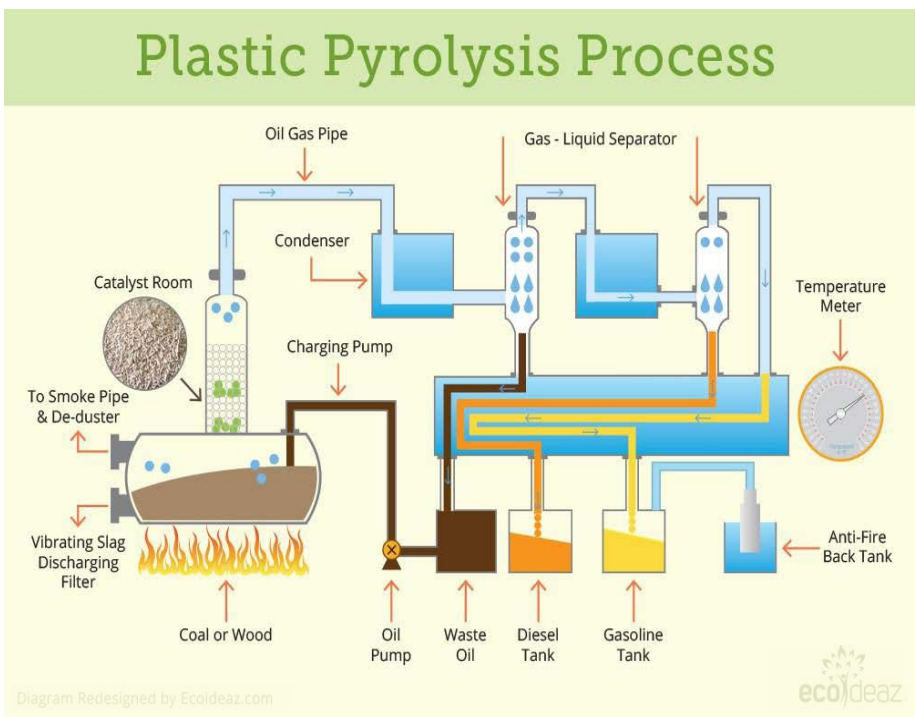
Working :

Our project deals with the extraction of OIL/DIESEL from waste plastics termed as PLASTIC PYROLYZED OIL, which can be marketed at much cheaper rates compared to that present in the market. As we know that both plastics are derived hydrocarbons, pyrolysis process becomes an option of waste-to-energy technology to deliver bio-

fuel and substitute fossil fuels. The advantage of the pyrolysis process is its ability to handle unsorted and dirty plastic. The pre-treatment of the material is easy. Plastic is needed to be sorted and dried. Pyrolysis is also nontoxic or non-environmental harmful emission unlike incineration. The objective of this project is to commercialize plastic pyrolysis process by obtaining fuel-oils which do not require further processing and by improving the process efficiency; thus, reducing the overall process operating costs. Pyrolysis is parameter-oriented process.

Methodology :

Plastics are basically hydrocarbon polymers of chain length ranging from C>50000 and C<1000000, chemically synthesized from petroleum. So, they inherently possess significant energy content which could be harnessed. Pyrolysis is the thermo-chemical process of decomposing long-chain organic matter into simpler chemical compounds in the absence of oxygen. When plastics are pyrolyzed, they crack down from long hydrocarbon chains to smaller chain lengths of fuel range which can be condensed, distilled and processed to be utilized for numerous industrial and domestic applications. A proportion of the plastic vapours of very short chain length (<C4) remain uncondensed at the end of the process. This gaseous fuel can be used for secondary heating in various industrial applications.



It is very difficult to find out alternatives of plastic. The demand for plastic is increasing every day and so is the waste. We have observed the use of waste plastics, factory planning and its feasibility in Metropolitan City. The implementation of this project can create numerous opportunities in the city and provide a fuel substitute for the country. Bangladesh has implemented this technology and it has shown promise there, though the plastic pyrolysis oil offers lower engine performance, the plastic waste amount is enormous and it is needed to be processed, to reduce the environmental problems. Moreover, the engine can be modified to efficiently use plastic pyrolysis oil. The waste plastic used in the process must be PE or PP or LDPE in order to protect the contamination of chlorine in the oil.

Increase in energy demand due to urbanization, population growth, industrialization and increased price of fuel makes this technology even more significant. Waste plastics fuel is eco-friendly due to low content of pollutants, good performance characteristics without any additives such as lubricants and economical.

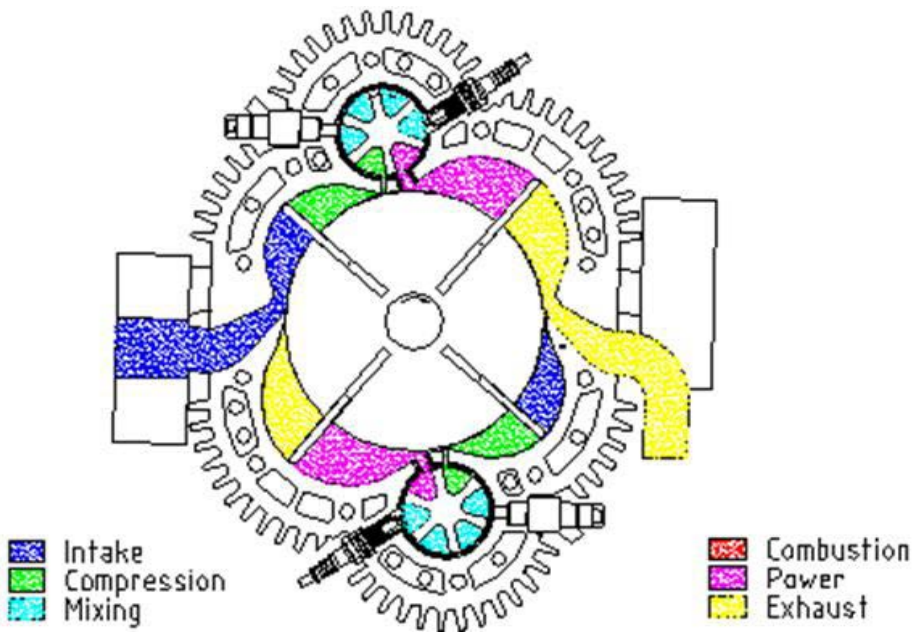
- Mihir Naik

GREEN ENGINE

The green engine is a six section engine, which has a very low exhaust emission, better performance, low vibrations and many other advantages. Other than those functions its forte is to evolve to any fuel which is also properly burnt. It is fair enough to say, if applied, this engine will serve the reason to a huge quantity.

Technical features :

As compared to conventional piston engines which are operated on 4 phases, the green engine is an actual six segment inner combustion engine with a higher expansion ratio. It has six impartial or separate working processes: consumption, compression, mixing, combustion, power and exhaust. These processes result in excellent air-gasoline mixing, entire burning, high combustion performance and complete enlargement. The most essential function is the growth ratio being a good deal larger than the compression ratio. Also, the different main functions are the innovative improvements of the sequential variable compression ratio, steady volume combustion and self-adapting sealing system. Therefore, an engine having extremely high thermal performance, close to zero emissions, less noise emissions, light and small, lower fee with the capability of the burning of various fuels has come into being.



1. Direct Air Intake :

Direct air consumption is in such a way that there aren't any air inlet pipes, throttles and inlet valves at the air intake device. An air filter is directly linked to the intake port of the engine and collectively, with the less heating impact of air intake manner, benefited from lower temperature consumption chamber, the highest volumetric performance which makes the engine produce an excessive torque of output on all velocity range is executed. The pump loss which consumes the component of engine power is removed. Additionally, gasoline measuring centers are built-in and elements are saved.

2. Strong Swirling :

Due to a tangential air duct in between combustion chamber and compression chamber, a swirling which can be misplaced till fuel port is opened, can be formed whilst air is pumped into the combustion chamber. Therefore, the air-gas mixing and the combustion manner will have a fulfilling working situation.

3. Sequential Variable Compression Ratio :

This significant innovation can provide the

most appropriate compression ratio for the engine. It really works with a burning form of fuels. Therefore, an outstanding combustion overall performance is attained.

4. Constant Volume Combustion :

The fuels can generate more strength while the combustion takes place at the constant volume. Additionally, when the lean burning is controlled, the regular extent combustion era can permit the engine to have strong combustion. Furthermore, greater water may be brought in for better operating pressure and drop down combustion temperature; so strength is introduced. Hence, heat losses and NO_2 emissions are reduced.

5. Vibration Free :

As main moving elements, vanes are counted in little mass and operated symmetrically. Therefore, the performance of the engine is very clean and thus, the vibrations are eliminated.

Advantages :

As obvious from the technical capabilities which consist of efficiency improvements, there are many blessings of the green engine over the contemporary piston engines.

1. Small Size and Light Weight :

As an inexperienced engine could be very compact with multi-strength pulses, the dimensions and weight be 1/5-1/10 to those of traditional piston engines on equal output. Its energy to weight ratio could be greater than 2 hp according to pound without supercharging or faster charge.

2. High Efficiency :

Because many fantastic innovations are being included inside the engine design such as: direct air intake, sequential variable compression ratio, great blending method, steady volume combustion, controllable combustion time, excessive working temperature of the burner, high expansion ratio and self adapting sealing device and so forth , the thermal efficiency of the inexperienced engine may be probably as high as 65% or even more, if various other technologies are to be taken into consideration.

3. Highly Reliable :

As there are fewer transferring components operating smoothly, no crankshaft, valves, connecting rods, cams and timing chains and consumption and exhaust movements are performed directly with the aid of the movement of the vanes. For this reason, it's exceptionally reliable.

Conclusion :

This inexperienced engine's prototypes were currently modified and also because of the particular layout, barriers have no longer been determined to any quantity. However, even if there are any barriers, the inexperienced engine is positive to serve the cause to a massive extent.

- Saif Samnani
B.E. MECH B

INTERVIEW

ALUMNI INTERVIEW

Pratiksha Das, 24, is all set to break gender stereotypes by becoming the first female to obtain a license for driving BEST buses. Graduated in mechanical engineering from TCET, she began her racing journey at an age of 14 and has been unstoppable since then. With over 51K followers on her social media, her passion for driving and love for vehicles, this bike blogger is on a riding spree.

1. How was your experience at TCET?

Firstly, I am a direct second-year student. When I joined TCET I started with my racing journey and I had doubts regarding attendance because it's mandatory to have 75% attendance in college. I used to go for races due to which my attendance was very low. Other students who were into sports, were granted attendance. But my situation was completely different as I was into motorsports and it is time-consuming. In spite of that, I got support from the HOD, the class in-charges and the faculty and they never took any strict action against me. TCET always encouraged me to pursue my passion by providing all the support required.

2. How did you stumble upon and get hooked on to biking?

I was 14 when I started riding bikes. I remember learning to ride my uncle's bike in two days. Eventually, I got into racing. In 2016, I was part of India's First Female Racing Team and since then there was no turning back. I was and continue to be a part of many races and have won a few trophies too. I had many goals in my life regarding biking. I always wanted to go to Khardung La pass, the world's highest motorable pass at 18000 ft. It was always on my checklist and I completed that last month. That was the most adventurous and memorable experience I had. It's the passion and love for riding that helps me keep going.

3. What role did mechanical engineering play in your journey?

In the racing world, I have noticed that most of the girls are from commerce background. I am the only one in my team who is a mechanical engineer. I was interested in learning the mechanics of a vehicle as it was an area of interest. It assisted me in understanding the technical aspects that others are not familiar with. Mechanical engineering has helped me to learn more about cars, bikes and machines. When I am invited for a bike launch or even when I write and review about bikes, the technical knowledge I have helps me go beyond the aesthetics of the vehicle.

4. How is the riding scene in India different for women than men, if at all?

Previously the ratio in India for bike riding was not that great, it was 99 men to 1 woman. Even now if there are 100 riders, only 10 to 15 are female. Like I said I was part of India's First Female Racing team, racing for women started from 2016 only. Since then the government noticed women being inclined towards racing and started taking initiatives to encourage female participation. For example, if for a race the registration fees for a male participant is Rs.5000 then its cutdown to half for females. Slowly but surely the face of Indian bike racing is changing progressively and we will see a lot more female involvement.

5. If there was one thing you could change about people's perception of riding, what would it be?

People consider riding to be risky. In my experience, I came across two types of bikers – one who follows the safety norms and wear proper gears like helmets, suits, boots, etc. and then there are ruffians because of whom riding is considered unsafe. These people rash drive, break basic traffic rules and perform stunts without any guidance. They put their lives in peril and advertise danger. I always ensure all my team members have put on the safety gear before any ride. With proper safety precautions taken, any profession can be enjoyable.

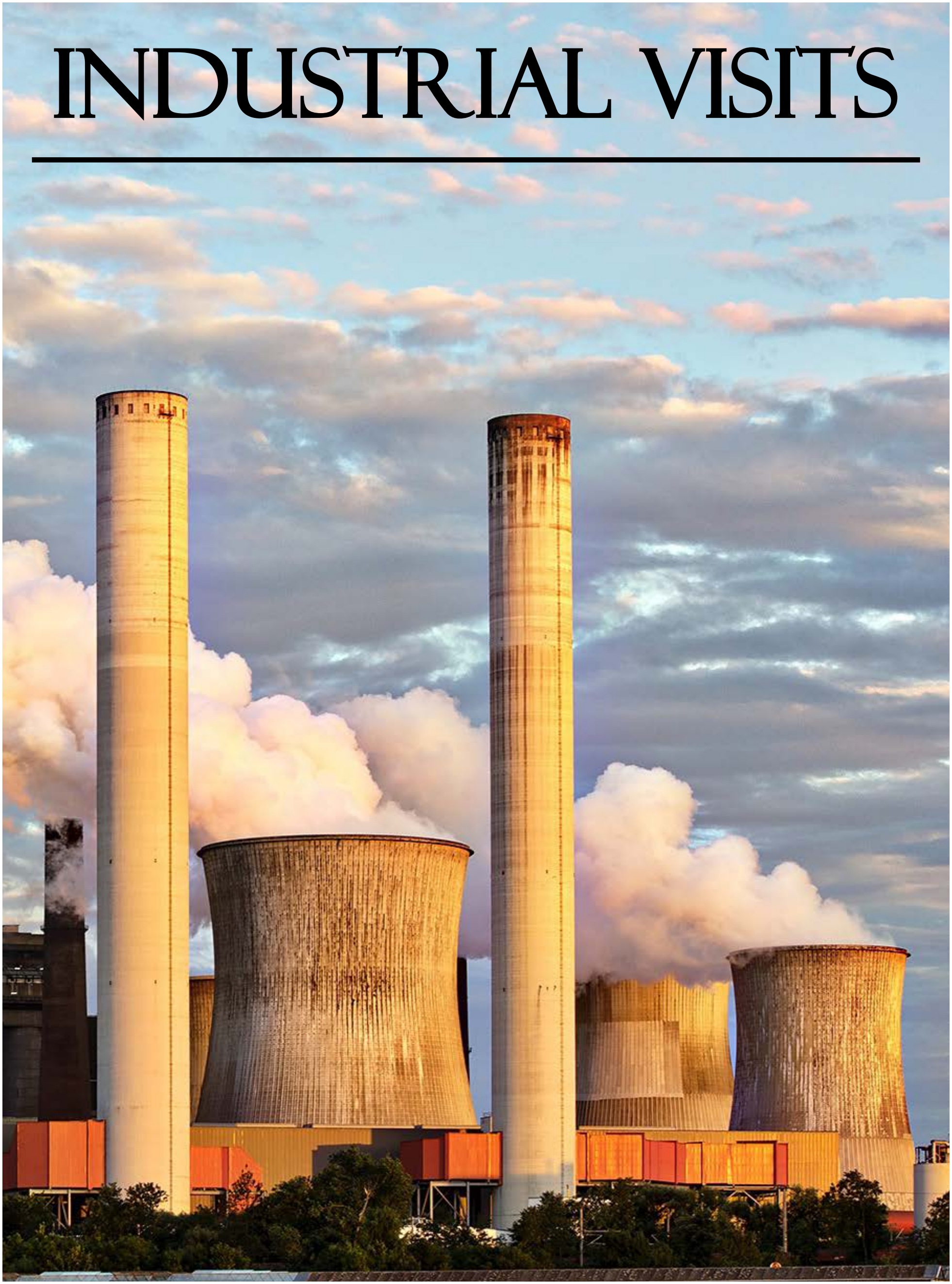
6. Recently you were the first lady to receive the BEST bus license. How was your experience there?

I was looking for a heavy-duty vehicle driving school since a couple of years and all I faced was rejections. All the private training schools rejected saying that 'you are a girl', 'you don't have an adequate height'. Then I came across training sessions that BEST offers without knowing that I was the first female to attend those. I distinctly remember the BEST bus trainers being tensed about training a girl and had to face some disapproving stares too. The training they offered was excellent though. The difficult part was the strength required to turn the wheel and the judgment of driving which I developed eventually.

7. What are your future plans?

Now that I have completed my engineering, I aspire to become an RTO officer. If not that I want to pursue higher studies. Someday I want to be able to ride a plane and quite literally touch the sky.

INDUSTRIAL VISITS



AMRITSAR SWADESHI TEXTILE

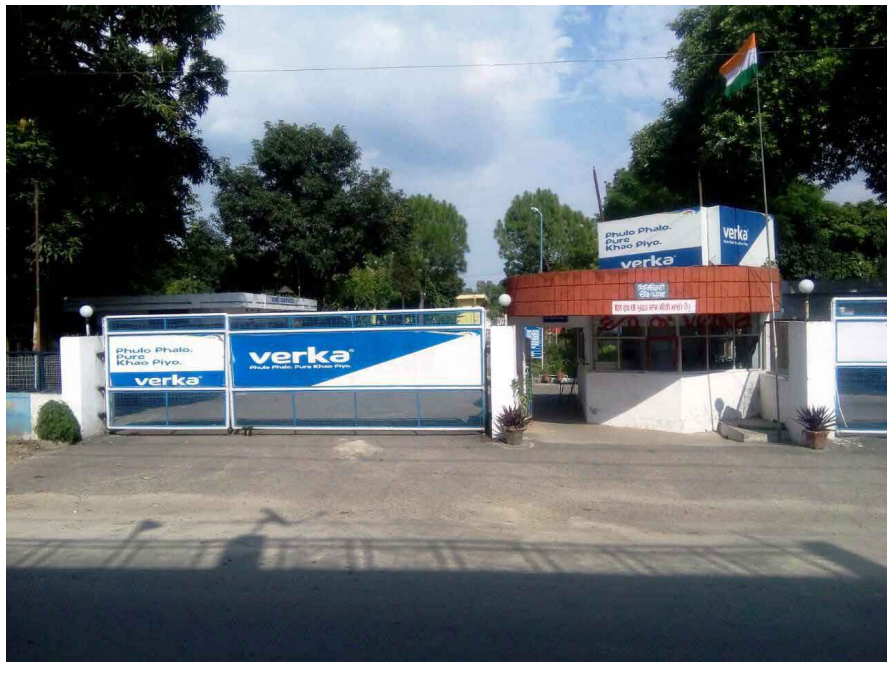
Amritsar Swadeshi Textile Corporation Pvt. Ltd. was founded in 1957, in Amritsar. It manufactures large woollen products including shawls, blankets, etc and supplies to big companies. It is one of the premier organisations of India in woollen blanket, fabric and garment manufacturing. Amritsar Swadeshi Textile Corporation Pvt. Ltd has complete in house weaving capacity of 405,000 Meters or 165,000 Blankets per month. Also, a garment manufacturing unit with 194 Juki stitching machines, 223 Singer/Union Special and other special application stitching machines and 27 Overlock and buttoning machines are present here. This industry has a capacity to produce 40,000 Garments to 50,000 Garments per Month.

The official visit to this industry was organized by the ASME-TCET Students' Chapter on 03 January, 2019. Here, students saw the exact condition of the place where they are supposed to work in the future. They got to know how a company works and what all difficulty they might face when they exactly enter in corporate world.

VERKA AMRITSAR DAIRY

The students of Mechanical Department of Thakur College Of Engineering And Technology visited the famous Verka Dairy Industry on 04 January, 2019. Verka is a flagship brand of MILKFED and came into being in 1973 when MILKFED was mandated for milk procurement, quality processing of milk & its products and marketing of these products. The name “Verka” was christened after the place where the first plant was setup in Amritsar.

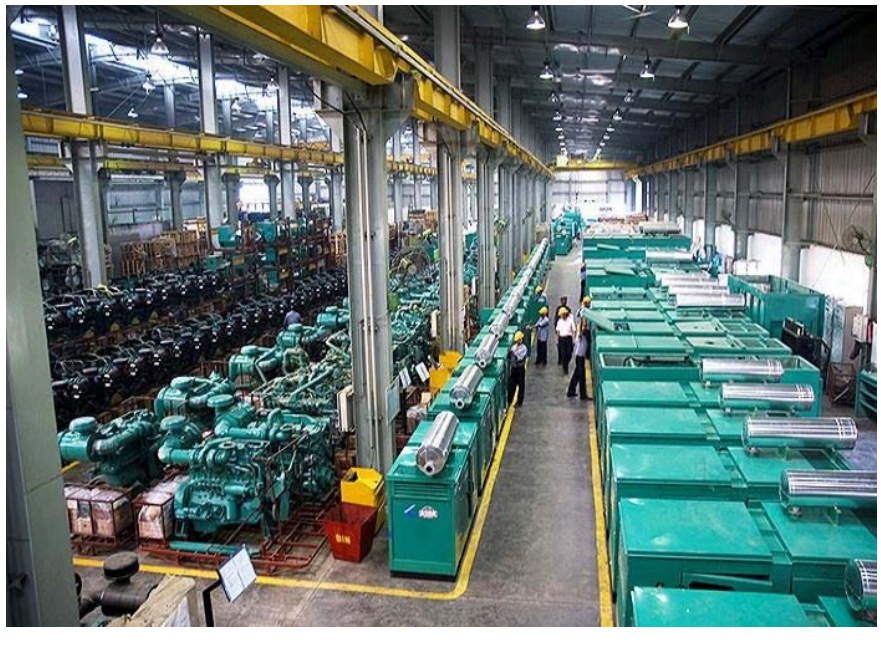
This industry produces various dairy products apart from milk such as butter, cheese, curd, ice cream, etc. It has various productivity enhancement programmes like the fodder development programme, breed improvement programme, calf rearing programme, etc. Their motto is to ensure quality processing of milk and production of milk products in a clean, hygienic manner and making them available to the consumers at reasonable prices through excellence in marketing.



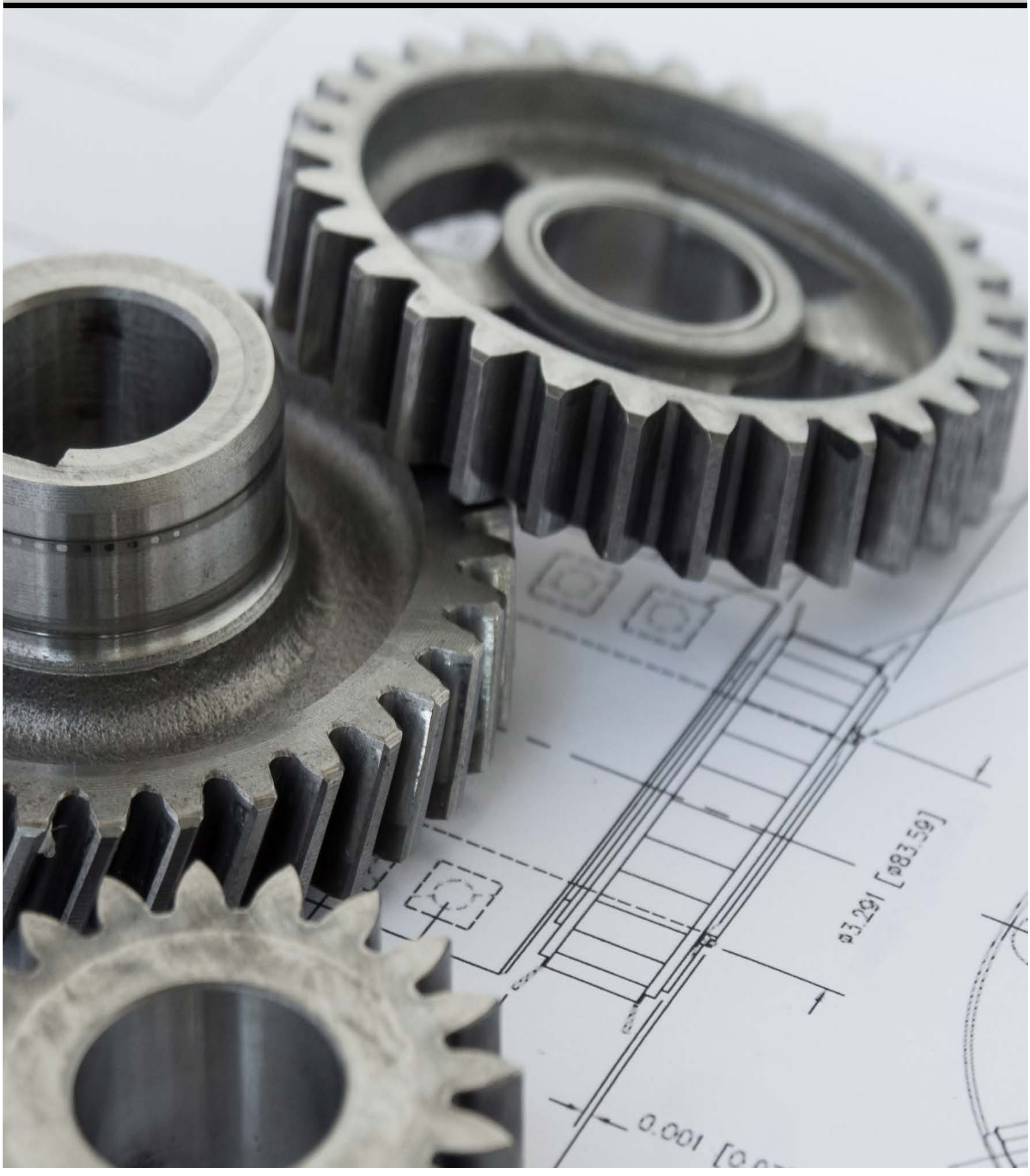
SUDHIR GENERATORS

On 05th January, 2019 ASME-TCET Students' Chapter organized the industrial visit to Sudhir Generators with an intention to provide students with experience of an industrial environment and its proceeding. Founded in 1973, Sudhir Group is committed to new and innovative technology and strives to develop breakthrough products to meet the ever-changing need of power industry.

Sudhir is a name synonymous with Power. An Industry leader in the field of setting up Diesel base Captive Power Plants up to 40 MW having its corporate office in Gurugram & revenue of over INR 1500 crores, it stands tall in the Indian Power Generation Sector, providing complete turnkey Electrical solutions from generation, distribution to electrification.



MECHANICAL TERMINOLOGIES



MECHANICAL TERMINOLOGIES

- **Actuator**

  A mechanism that sets something in automatic action

- **Annealing**

  Hardening a material by heat treatment

- **Axle Assembly**

  The load-bearing assembly of the vehicle which connects two wheels with a shaft

- **Backfire**

  When unburnt fuel seeps into exhaust system leading to ignition and small explosion

- **Ball Bearings**

  A rotating support between two moving parts consisting of small metal balls

- **Bell Crank**

  A pivoted lever that changes the direction of the force applied through a certain angle

- **Boss**

  A cylindrical projection or a circular protruding portion

- **Cam**

  A rotating profile that converts rotary motion to linear motion with the help of a follower

- **Carburetor**

  A device that mixes fuel and air for combustion in I.C. engines

- **Catalytic converter**

  An exhaust emission control device that reduces the pollutants in exhaust from I.C. engine by redox reactions

- **Chamfer**

  Flattening a surface by cutting the edge or corner

- **Chassis**

  The skeleton or base frame of a wheeled vehicle

- **Clevis**

  A U-shaped fastening piece which allows rotational motion, consisting of holes through which a link can be inserted

- **Cold working**

  Working of metals and alloys below recrystallisation temperature

- **Collar**

  A cylindrical feature that prevents sliding

- **Coupling**

  Connecting two shafts together for power transmission using a machine part

- **Differential**

  The shaft and gear assembly that facilitate direction change and power transmission in rear wheels

- **Exhaust**

  Gases expelled from the engine as waste products

- **Factor of safety**

  The ratio of breaking stress to the maximum stress of structure

- **Fillet**

  Rounding off the angle between two intersecting surfaces

- **Firing order**

  Power delivery sequence in a multi cylinder engine

- **Fixture**

  A device used to hold the workpiece in place during manufacturing operations

- **Flywheel**

  A rotating mechanical device that resists changes in rotational speed

- **Gear hobbing**

  A manufacturing process that cuts gear tooth geometries

- **Governor**

  A mechanism that maintains the speed of an engine by regulating the fuel flow

- **Heat Exchanger**

  Any device which transfers heat from one fluid to another without mixing them like radiators, condensers, intercooler, etc.

- **Horsepower**

  Rate of work done by an engine where 1 HP=4500 kg./min

- **Hot working**

  Working of metals and alloys above recrystallisation temperature

- **Hydraulic Brakes**

  Brakes which use pressurised fluid for braking action instead of cables

- **Ignition System**

  The system that produces a spark which ignites the fuel air mixture

- **Keyway**

  Slot in which a key slides

- **Knurl**

  Roughening a turned surface

- **Lathe**

  Machine used for shaping wood or metal

- **Mach number**

  The ration of object velocity to the speed of sound

- **Nozzle**

  A spout which controls the fluid flow on its exit from an enclosed chamber

- **Pinion**

  Gear containing small teeth which mesh with bigger wheel

- **Piston**

  A cylindrical component that slides back and forth

- **Power Rating**

  Maximum power input allowed

- **Radiator**

  A heat exchanger that keeps the engine cool

- **Ratchet**

  A mechanism that permits only unidirectional motion

- **Refrigeration**

  Process of extraction of heat of an object by cooling it

- **Rocker Arm**

  A pivoted lever that transfers application of a linear force

- **Scavenging**

  Removing the exhaust gases from the cylinder of I.C. engine

- **Sheave**

  A wheel with grooves to fit a belt for power transmission

- **Spline**

  Cylindrical pattern of keyways

- **Steering**

  Mechanism consisting of linkages that allows movement of a vehicle

- **Suspension**

  A system of shock absorbers or springs that connect the wheels and axles to the chassis

• **Throttle**

The valve regulating the supply of fuel to the engine

• **Thrust**

The force responsible for moving an aircraft or rocket through the air

• **Tolerance**

A permissible deviation limit regarding physical dimension or property

• **Traction**

The friction between the tire and the road

• **Transmission**

The gears that carry power from the engine to the axle, giving motion to the vehicle

• **Turbine**

A rotary engine that converts kinetic energy of fluid into mechanical energy with help of a rotor

• **Valve**

A device that can prevent or measure the flow of gases and liquids

• **Welding**

Joining two pieces by applying heat and pressure, mostly metals

• **Whiskers**

Thread like single crystals

• **Work Hardening**

Also termed as strain hardening, the process of metals becoming hard and strong during working them

• **X-Ray Radiography**

Process used to detect defects caused during manufacturing processes

• **Yoke**

A clamp that holds two machine parts together

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Ms. Shravani Dighole

Designers

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