Thakur College Of Engineering And Technology

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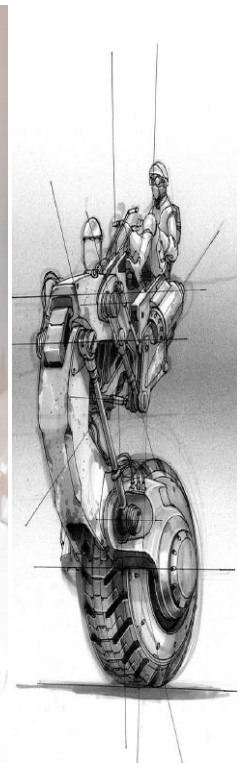



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DR.R.R.SEDAMKAR

MESSAGE BY DEAN

It is a moment of pride for me to announce the release of 'MECHON' magazine's fourth 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.

DR.SANJAY KUMAR

MESSAGE BY MENTOR DEAN

I feel esteemed to be a part of the fourth issue of the e-magazine of the Department of Mechanical Engineering.Only 3 batches have passed out and the Department has shown great potentional 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 ıst prize at . 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!

DR.SIDDESH SIDDAPA

MESSAGE BY HEAD OF DEPARTMENT

I am delighted to know that our students have succeeded in publishing the fourth issue of 'MECHON' for the academic year 2018-2019. 'MECHON' the departmental magazine has the prime objective of providing aspiring engineers a wide platform to showcase their technical knowledge and to pen down their innovative ideas.

This magazine is intended to bring out the hidden literary talents in the students and 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.

MR.PAWAN TIWARI

MESSAGE BY FACULTY IN - CHARGE

It gives me immense pleasure to present the fourth 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'

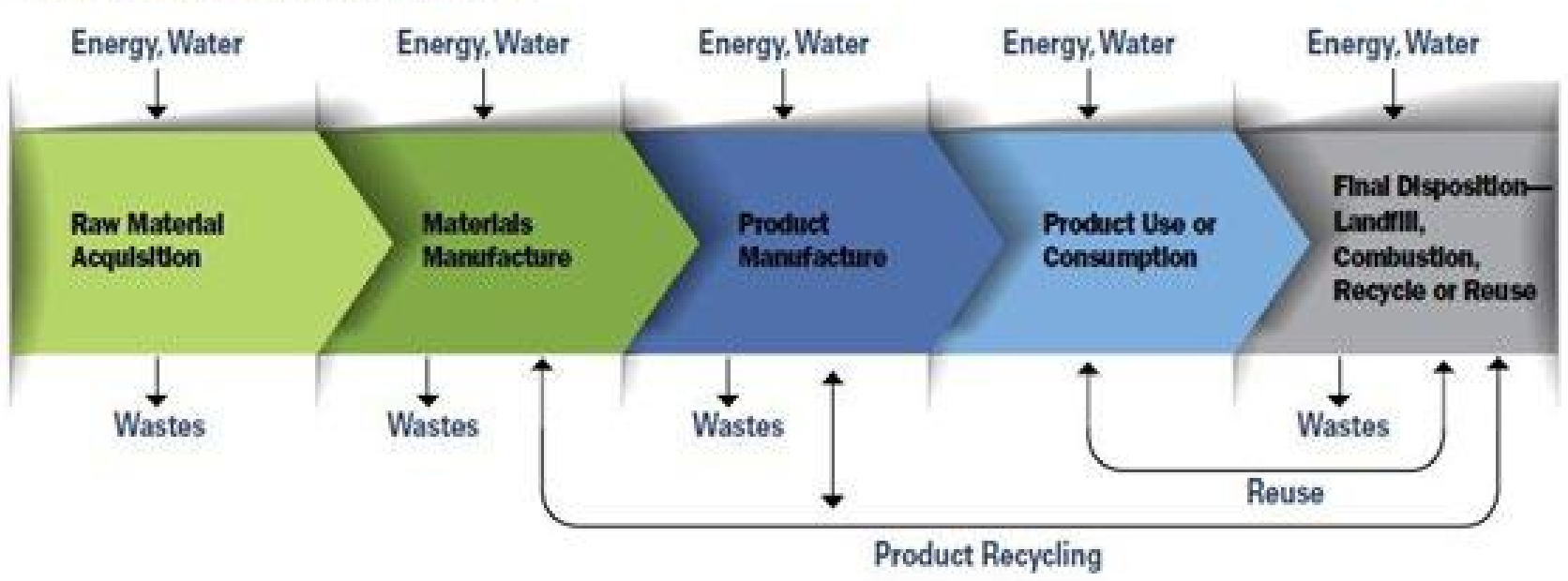
Faculty Articles

PRODUCT LIFE CYCLE ASSESSMENT (PLCA)

Life cycle approach reflects the consideration of cradle to grave conclusions of any actions and guides the overall approach to dealing with environmental and sustainability issues. Thinking in terms of product life cycles is one of the challenges faced by manufacturers today, which requires efforts to increase efficiency throughout the life cycle and do not only lead to an elongated responsibility of the concerned parties. Life Cycle Assessment (LCA) considers the product life cycle as a whole and optimizes the interaction of product design, manufacturing and life cycle activities. The goal of this approach is to prevent resources and maximize the efficiency during utilization by significance of life cycle of product, product data management, technical support and last but not least, by life cycle costing. LCA analysis is both time and resource consuming, due to the collection of the product data needed to enable its performance.

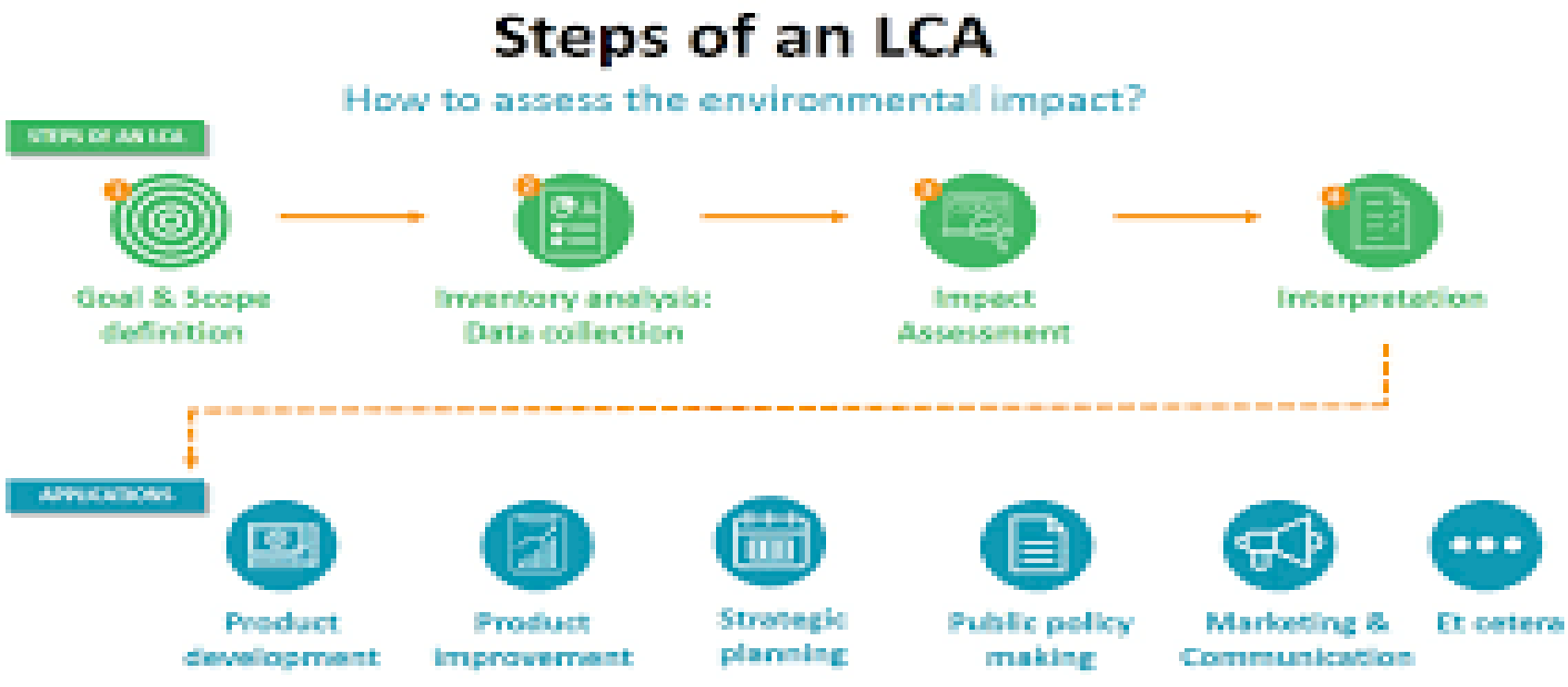
The main tool supporting the life-cycle thinking concept is Life Cycle Assessment, whose prime aim is to designate the environmental consequences of products and accommodations from cradle to grave. The life cycle management concept must be advanced to accommodate as an integral part of engineering, operation and recycling/disposal processes. Fundamental principles must be provided for technical support, product data management, and technical themes evaluation and assessment of economic and ecological parameters or values. The purpose of LCA is to compile and evaluate the environmental consequences of different options for fulfilling a certain function and it is a universally accepted approach of determining the environmental consequences of a sustainable product over its entire production cycle. The LCA methodology can be useful to acquire a comprehensive knowledge of the environmental impacts generated by industrial products during their whole life cycle.

Figure : LCA Systems Approach



Role of LCA in Relation to Products:

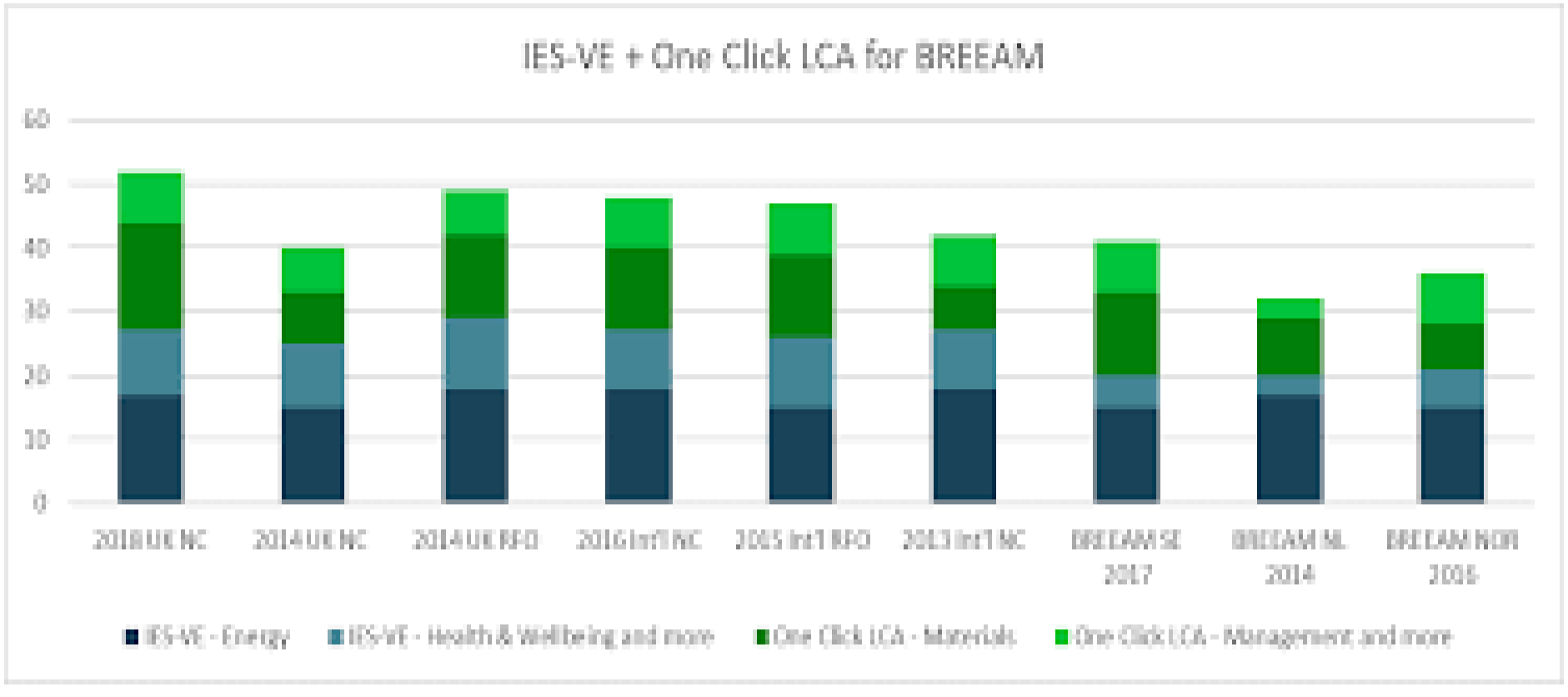
LCA can play an important role in public and private environmental management in relation to products. This may involve both an environmental comparison between existing products and the development of new products, which includes comparison with prototypes. For instance, a major application involves 'green' procurement, that is green purchasing policy which can be implemented by both higher entities and companies. However, ranking of resources, materials or products for purchasing reasons need not be done on a quantitative basis utilizing LCA. Another application concerns eco-labelling (assigning a green label to environmentally friendly products), which enables consumers to make comparisons between products. A further application in relation to products is the design of more environmentally cordial products termed as eco-design. This is an activity of increasing relevance which imposes categorical requirements on the available life cycle information, so that it must be very simple to utilize. In manufacturing, there is a constant need to improve production methods through new machining technology, processes that allow quicker production or new methods that improve the product safety, reliability and to create value. However, for the development of machines and for production strategies, development still exists. In these instances, companies must seek other methods of improvement, such as value stream mapping, which is a philosophy of creating value while mapping the whole process of product. The goal here is to eliminate the waste, to reduce manufacturing costs, improve the quality of the product being manufactured and to shorten the production lead time, allowing quicker delivery of the final product to the customer.



LCA System Approach

If you are looking to examine more than one environmental or energy attribute of a product, and you require to examine trade-offs in making changes that can help identify places to reduce the overall footprint of a product system, it might make sense to consider the broader approach that an LCA presents. LCA is a "systems' analysis" implement that examines the whole system required to distribute accommodations (primarily through the utilization of products) to end-users (consumers). Life cycle Assessment is a foundational tool for a sustainable design. It is a way of quantifying the environmental impact of your designs so that you and your customers can make more informed decisions. Several life cycle stages, unit processes and flows may be taken into consideration, as shown in figure, for example:

- Inputs and outputs in the main manufacturing/ processing sequence;
- Distribution/transportation;
- Production and use of fuels, electricity and heat;
- Use and maintenance of products;
- Disposal of process wastes and products;
- Recovery of used products (including reuse, recycling and energy recovery);
- Manufacture of ancillary materials;
- Manufacture, maintenance and decommissioning of capital equipment;
- Additional operations, such as lighting and heating;
- Other considerations related to impact assessment (if any).



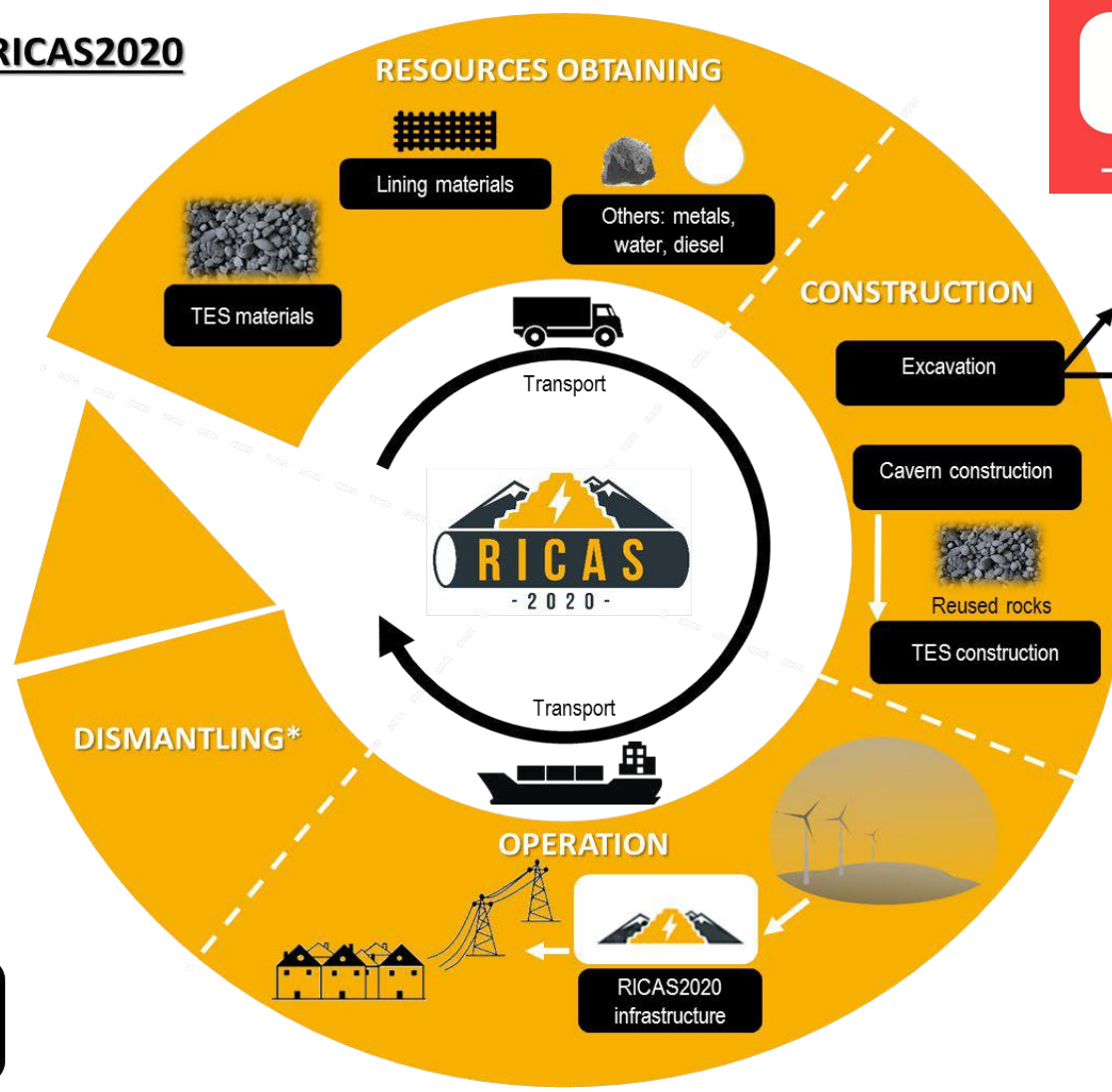
It is necessary to describe the system utilizing a process flow diagram that shows unit processes and their interrelationships. This basic flow diagram shows what definite unit processes for the system being examined are included in every step of the life cycle: An LCA and its results should be relative to a "functional unit." ISO defines a functional unit as the quantified performance of a product system for utilize as a reference unit in an LCA study. Another way to understand the term is to think of the functional unit as the equipollent quantification, or "function," that will LCA study.

The benefits of doing LCA are given below:

- Improved environmental cost allocation
- Allows you to target supply chain improvements
- Help to shape corporate sustainability strategy
- Assess/justify impact of material choices and operational processes
- Assess your product/service/process against those of your competitors
- Supports communications about environmental friendliness of products/services/processes
- Improved environmental performance and reputation
- Strengthened customer loyalty

-Mr. Saurabh Vichare
Asst. Profeesor

LIFE CYCLE ASSESSMENT OF RICAS2020



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TES: Thermal Energy Storage System
* Not included in the Life Cycle Assessment analysis

Students' Articles

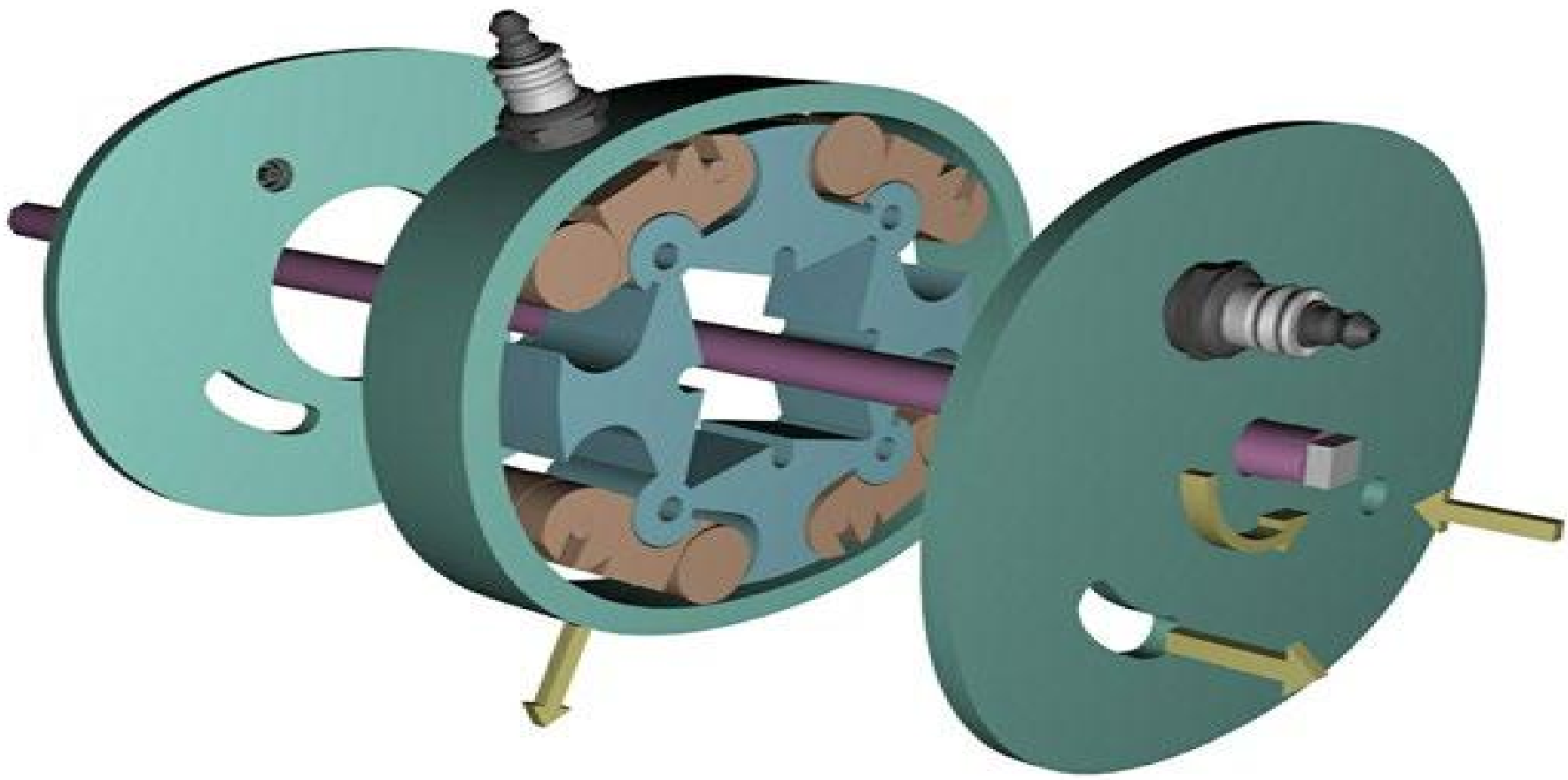
QUASI TURBINE

Quasi turbine is a zero-vibration continuous combustion rotary engine which has four faces articulated rotor with a free and accessible center rotating without vibration nor dead time and producing a high torque at low rpm under different modes and fuels. For extremely compact efficient engine concept, the quasi turbine is an optimization theory.

Each Quasi turbine device is at the cross road of three modern engines, inspired by the turbines. The Quasi turbine comes from a research started in 1993 aimed at combining the compression and power turbine into one entity. This new technology is a new hybrid engine concept, midway between the piston and the turbine engine which requires comparatively few components such as stator with covers, rotating blades, rocking carriages, wheels, and joints. Quasi turbine is an environmental friendly engine, which provides an engine concept free from atmospheric gas pollution, noise pollution, thermal pollution. No matter the power of the unit in this engine, stays constant and optimum

Constructional Details:

The invention is an assembly of four carriages supporting the pivots of a four element, variable shape rotor, which is confined within a chamber called internal housing counter wall-stator. This profile offers the rotary components of the engine a bigger, more uniform radial path, which enables maximum torque to be reached more efficiently than a normal combustion. Two lateral plane covers to close the engine end. The rotor is composed of four pivoting blades playing a similar role as the turbine blades or piston. Each pivot sit into one of the four rocking carriages. Each carriage is free to rotate around the same pivot in such a way as to be simultaneously in contact with housing counter.



A central shaft is not needed for the engine to operate. It can be driven through a set of coupling arms attached to the blades by means of traction slots and the ends of which are linked to central shaft through a set of arm braces. Without dismantling the engine, the central shaft unit can be easily removed through the back cover.

Pivoting blades are shaped with the filler tip to allow the control of remaining volume in the upper and lower chambers at maximum pressure configuration. With the counter wall, carriage wheels should be wide to reduce contact pressure. Roller bearings are inserted in the blade's hook pivots for smoother operation.

Working:

The simpler Quasi turbine model is similar to a traditional rotary engine in terms of looks: A rotor moves inside a nearly oval-shaped housing. However, the Quasi turbine rotor has four elements instead of three. The sides of the rotor seal against the sides of the housing, and the corners of the rotor seal against the inner periphery, dividing it into four chambers.

In a piston engine, one complete four-stroke cycle produces two complete revolutions of the cranks shaft. That means the power output of a piston engine is half a power stroke per one piston revolution. A Quasi turbine engine doesn't need pistons. Instead, the four strokes of a typical piston engine are arranged sequentially round the oval housing. The four cycles of internal combustion can be easily seen even without the crank shaft to perform the rotary conversion.

1. Intake, which draws in a mixture of fuel and air.

2. Compression, which squeezes the fuel - air mixture into a smaller volume.

3. Combustion, which uses a spark from a spark plug to ignite the fuel.

4. Exhaust, which expels waste gases (the by-products) from the engine.

Applications:

1. Quasi turbine aviation

In a propeller airplane, weight reduction allows a larger payload, space saving allows to reduce the aerodynamic drag, absence of vibration increases instruments reliability and flight comfort, the noise reduction increases the discretion level, the high torque allows the use of multi-blades propeller and the better intake characteristic of the Quasi turbine allows higher flight altitude.

A large diameter Quasi turbine could generate enough torque to directly drive of the rotor blades without any gearbox, while making much less noise in a helicopter.

So, considering the high-power density, the low cross section area and the exceptional intakes specialities of the Quasi Turbine, it is reasonable to expect to develop an airplane engine.

2. Quasi turbine Stirling engine

In the Quasi turbine Stirling, all the engine shell is pressurized with helium, so that the inter-chambers leaks are automatically recycle by the central region and require only sealing of a turning shaft. The Stirling engines are known to be large and heavy, which the Quasi turbine-Stirling concept should solve.

3. Quasi turbine pneumatic engine

Since the Quasi turbine is a pure expansion engine, it is well suitable as compressed fluid engine - Air engine or air motor. The pneumatic engine does not show any vibration on the shaft. It does run in heavy smoke and under water.

4. Quasi turbine racing car

Formula Quasi turbine is a proposal to conceive and built of a racing car using the new Quasi turbine rotary engine. Because the piston engine has much lesser specific power density than the Quasi turbine. A single Quasi turbine, at only 3000 rpm, rotor of about 50cm in diameter and 20cm thickness could develop 1000 H.P. Removal of flywheel would allow much higher acceleration. It is proposed to have the racing car with a differential clutch coupling i.e no gear box at all. This would much enhance the racing cars endurance.

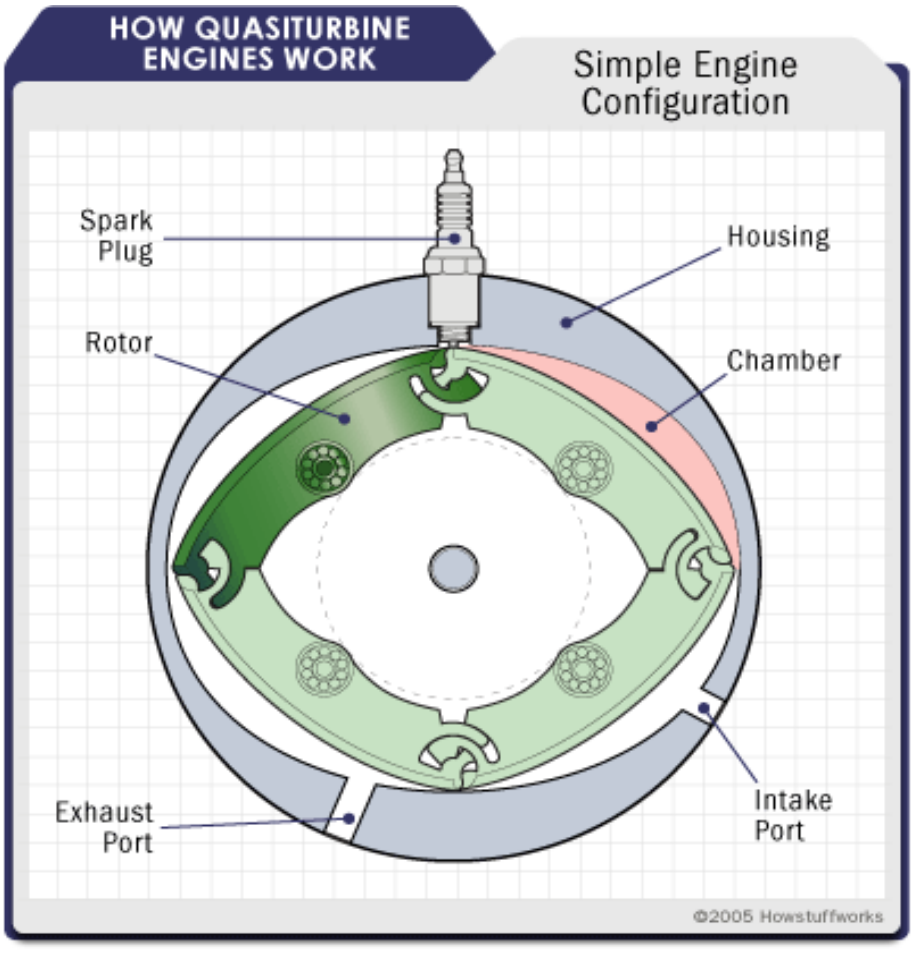
5. Quasi turbine hydrogen engine mode

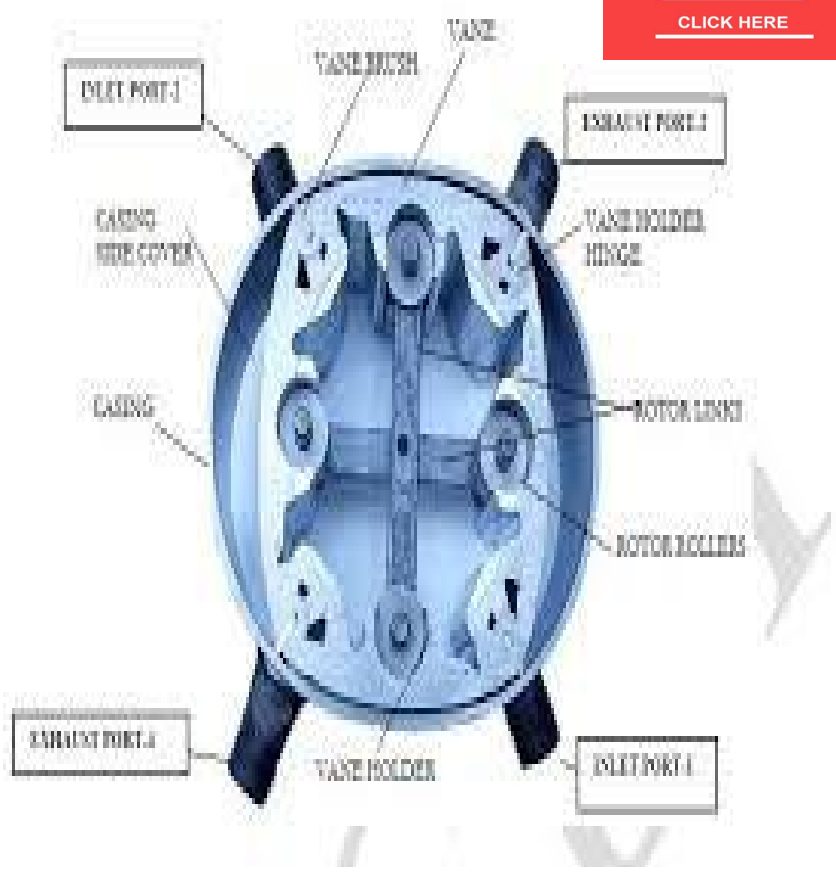
To store Hydrogen, we need to link it with carbon atom. Quasi turbine prefers Hydrogen storage in Carbon molecules. This storage technique is safe and simple and has been appreciated by humans for centuries.

6. Quasi turbine pumps

Quasi turbine is a very compact and lightweight device without power shaft, which allows to pump large volumes. The Quasi turbine has two intakes and exits in the pump mode.

-Mr.Abhishek Narayanan
BE Mech A





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FORGING

Introduction:

Forging refers as the process of plastically deforming metals or alloys to a specific shape by applying compressive forces exerted by some external agency. The portion of a work in which forging is done is termed ‘the forge’ and the work is traditionally performed by means of heavy hammers, forging machines and presses. Forging processes are among the most important manufacturing techniques since forged pieces are used very widely, ranging from small tools to automobiles and aviation industries. Today, forging is a major worldwide industry.

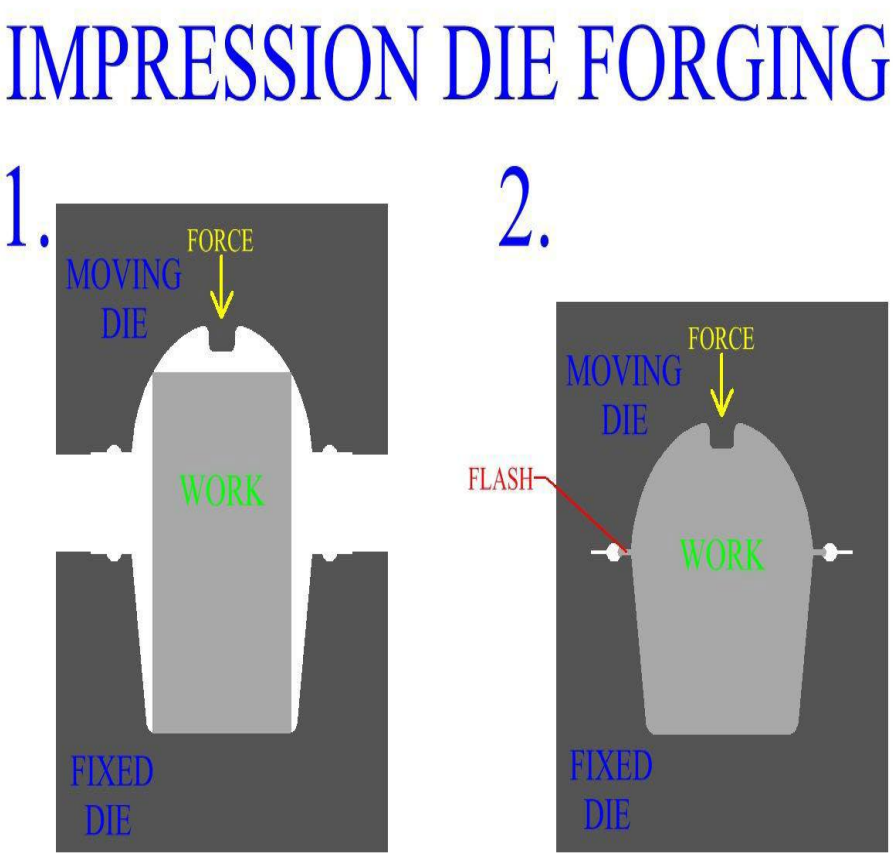
Types of Forging:

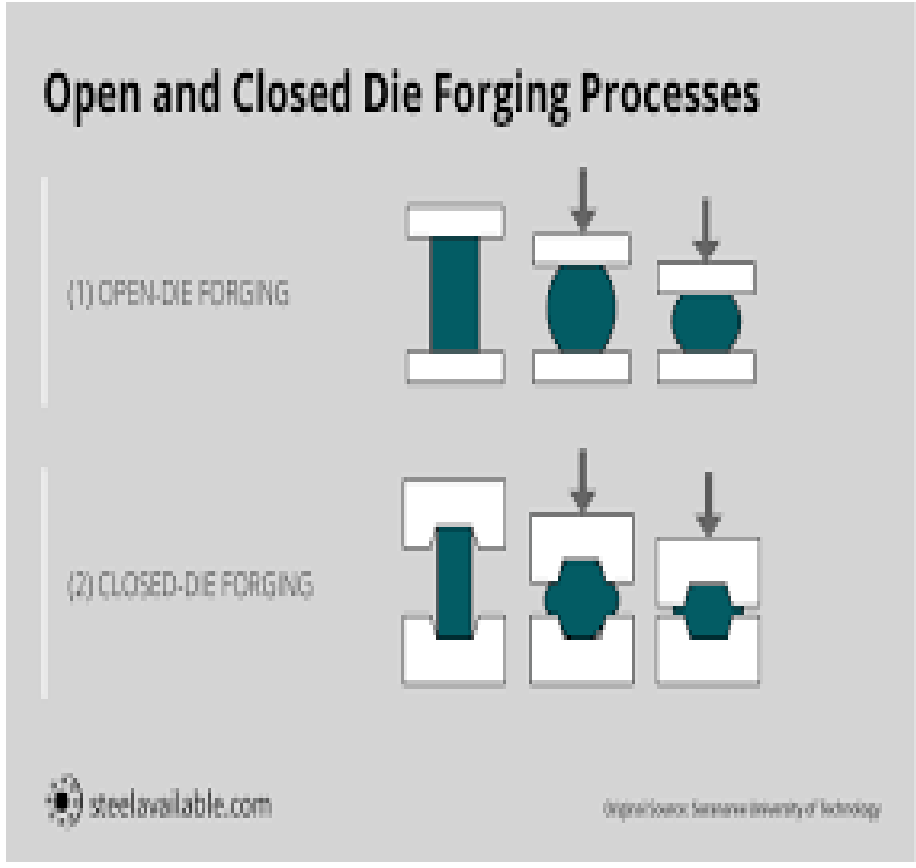
Impression Die Forging:

Impression die forging pounds or presses metal between two dies (called tooling) that contain a precut profile of the desired part. Parts from a few ounces to 60,000 lbs. can be made using this process. Some of the smaller parts are actually forged cold.

Cold Forging:

Most forging is done as hot work, at temperatures up to 2300 degrees F, however, a variation of impression die forging is cold forging. Cold forging encompasses many processes -- bending, cold drawing, cold heading, coining, extrusions and more, to yield a diverse range of part shapes. The temperature of metals being cold forged may range from room temperature to several hundred degrees.





Open Die Forging:

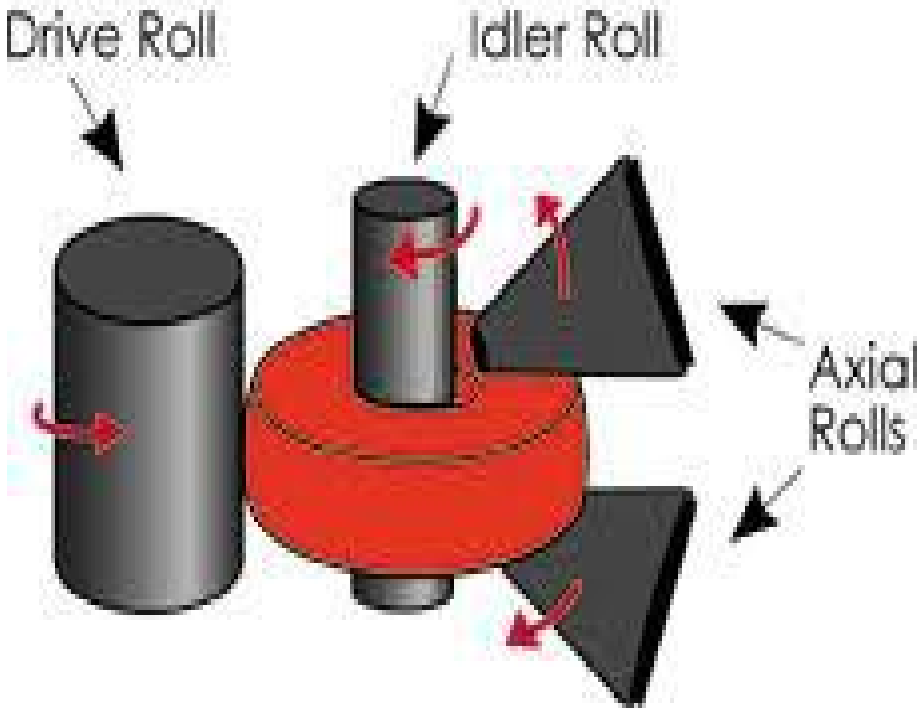
Open die forging is performed between flat dies with no pre cut profiles is the dies. Movement of the workpiece is the key to this method. Larger parts over 200,000 lbs. and 80 feet in length can be hammered or pressed into shape this way.

Advantages of open-die forging:

- Reduced chance of voids.
- Better fatigue resistance.
- Improved microstructre.
- Continuous grain flow.
- Finer grain size.
- Greater strength.

Seamless Rolled Ring Forging:

Seamless rolled ring forging is typically performed by punching a hole in a thick, round piece of metal (creating a donut shape), and then rolling and squeezing (or in some cases, pounding) the donut into a thin ring. Ring diameters can be anywhere from a few inches to 30 feet.

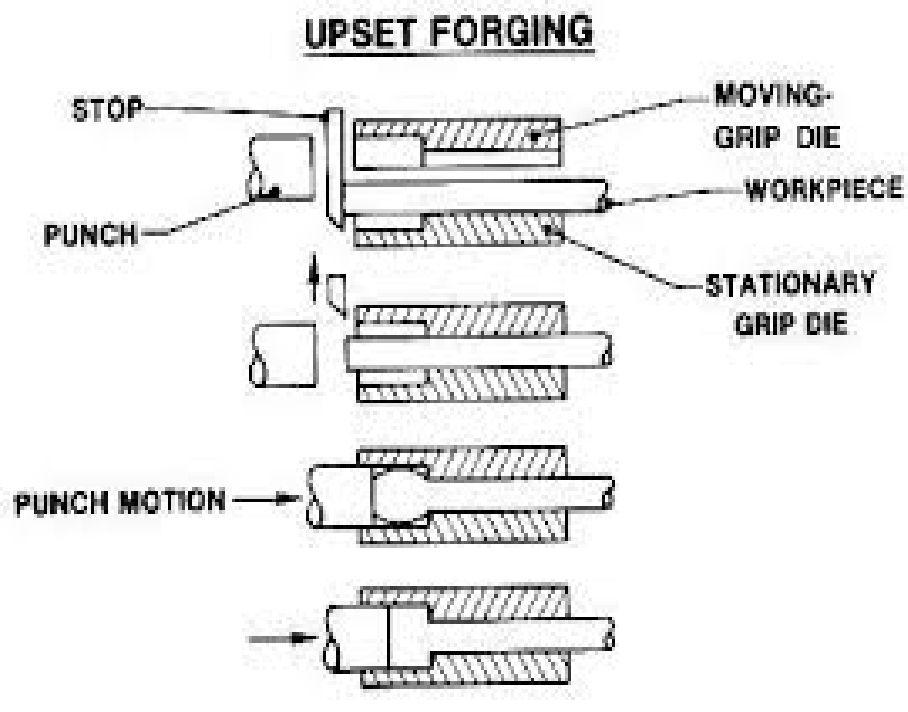


Induction Forging:

In auction heating is a non-contact process which uses the principle of electromagnetic induction to produce heat in a workpiece. By placing a conductive material into a strong alternating magnetic field, electric current is made to flow in the material, thereby causing Joule heating. In magnetic materials, further heat is generated below the Curie point due to hysteresis losses. The generated current is predominantly in the surface layer, the depth of this layer being dictated by the frequency of the alternating field and the permeability of the material.

Upset Forging:

Upset forging increases the diameter of the workpiece by compressing its length. Based on number of pieces produced, this is the most widely used forging process.A few examples of common parts produced using the upset forging process are engine valves, couplings, bolts, screws, and other fasteners.



Upset forging is usually done in special high-speed machines called crank presses. The machines are usually set up to work in the horizontal plane, to facilitate the quick exchange of workpieces from one station to the next, but upsetting can also be done in a vertical crank press or a hydraulic press.

Isothermal Forging:

Isothermal forging is a process by which the materials and the die are heated to the same temperature. Adiabatic heating is used to assist in the deformation of the material, meaning the strain rates are highly controlled. Commonly used for forging aluminum, which has a lower forging temperature than steels. Forging temperatures for Aluminum are around 800 °F, while steels and super alloys can be 1700-2300 °F.

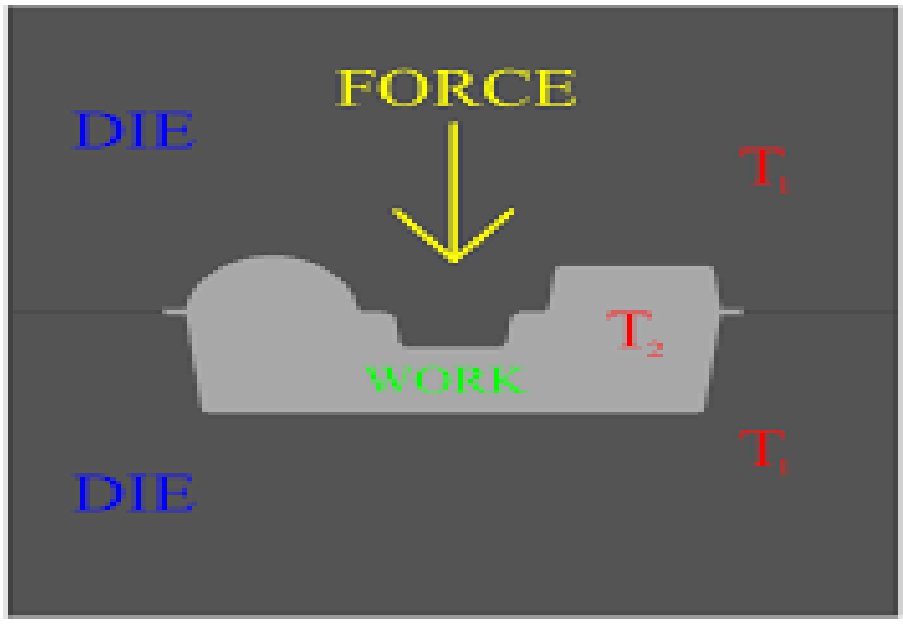
Benefits:

- Near net shapes which lead to lower machining requirements and therefore lower scrap rates
- Reproducibility of the part: Due to the lower heat loss smaller machines can be used to make the forging

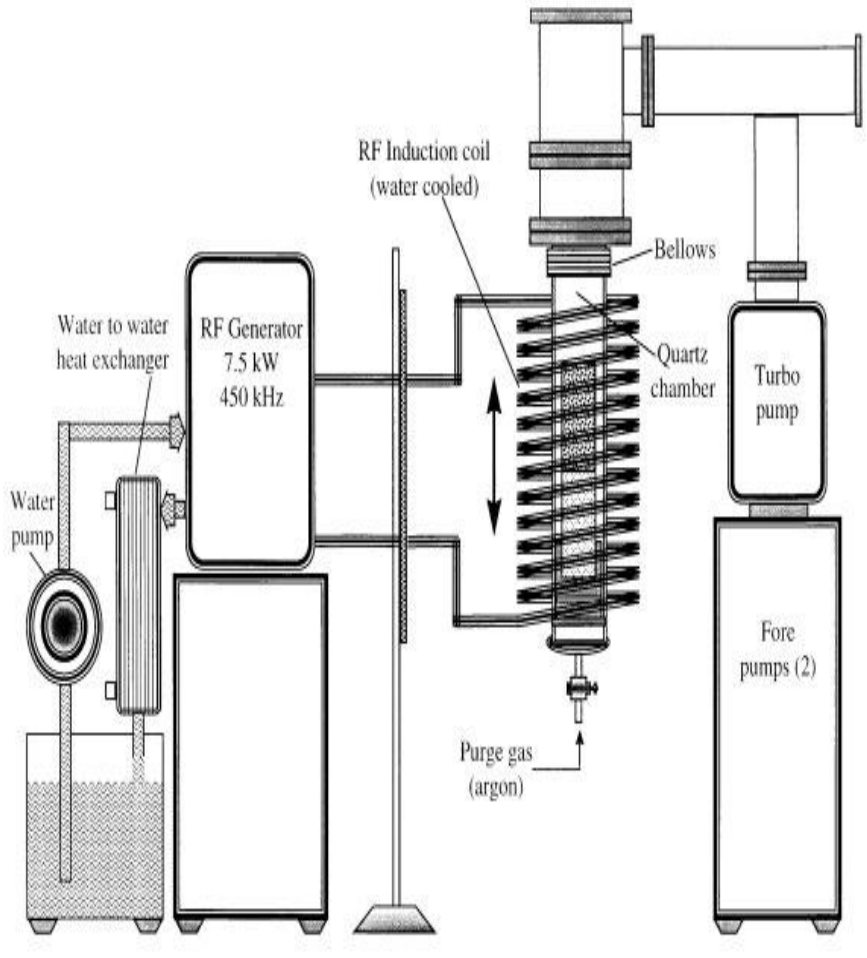
Disadvantages:

- Higher die material costs to handle temperatures and pressures.
- Uniform heating systems are required.
- Protective atmospheres or vacuum to reduce oxidation of the dies and material.
- Low production rates.

ISOTHERMAL FORGING



T_1 = Temperature of the mold
T_2 = Temperature of the work
$T_1 = T_2$



Multi Directional Forging:

Multi Directional Forging is forming of a workpiece in a single step in several directions. The multidirectional forming takes place through constructive measures of the tool. The vertical movement of the press ram is redirected using wedges which distributes and redirects the force of the forging press in horizontal directions.

Conclusion:

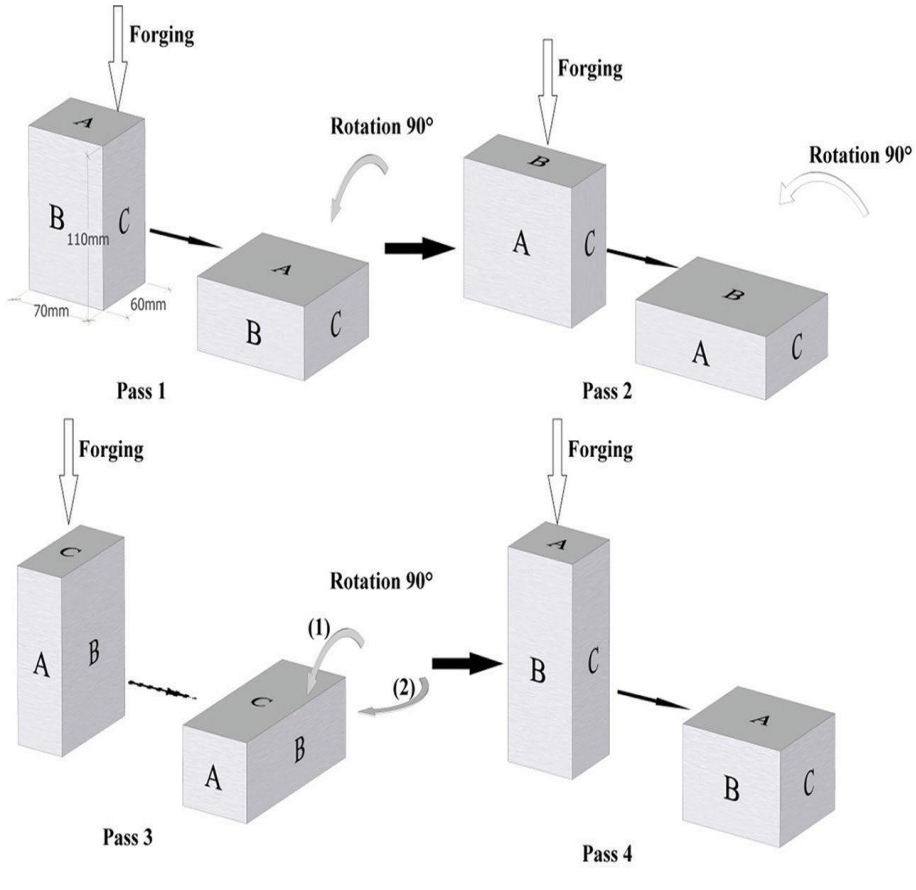
The Future of Forging:

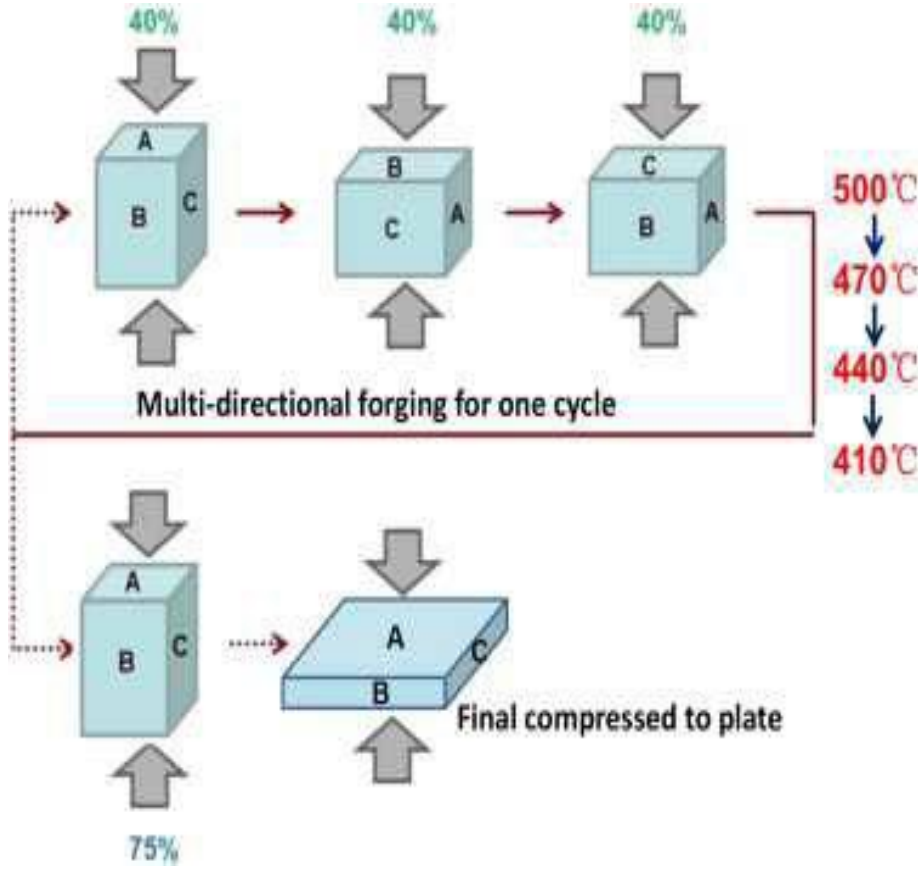
In the year 2020, forging will be the cost-effective, preferred process by which metal components of superior quality, integrity, and performance are produced for critical and demanding applications. In order to meet the competitive challenges of the future and achieve its vision, the forging industry must fortify itself in several critical areas: technology development and application; energy and the environment; cooperative efforts; competitiveness; education; markets and human resources.

Specific areas in which technological issues need to be addressed include materials, die design and modeling, lubrication, process modeling and optimization software, process controls and sensors, real-time preventative maintenance, and primary and secondary processing equipment.

The forging industry of the future will be energy efficient and will protect the environment. Environmentally acceptable, functionally effective, and affordable technologies are needed that integrate pollution prevention into the entire metal forging processing system design.

Technologies are needed that integrate pollution prevention into the entire metal forging processing system design. These technologies must be environmentally acceptable, functionally effective, and affordable.





The following programs will address these issues and significantly impact the forging industry:

1. Eliminate aerosol emission within the plant through the use of advanced die systems.

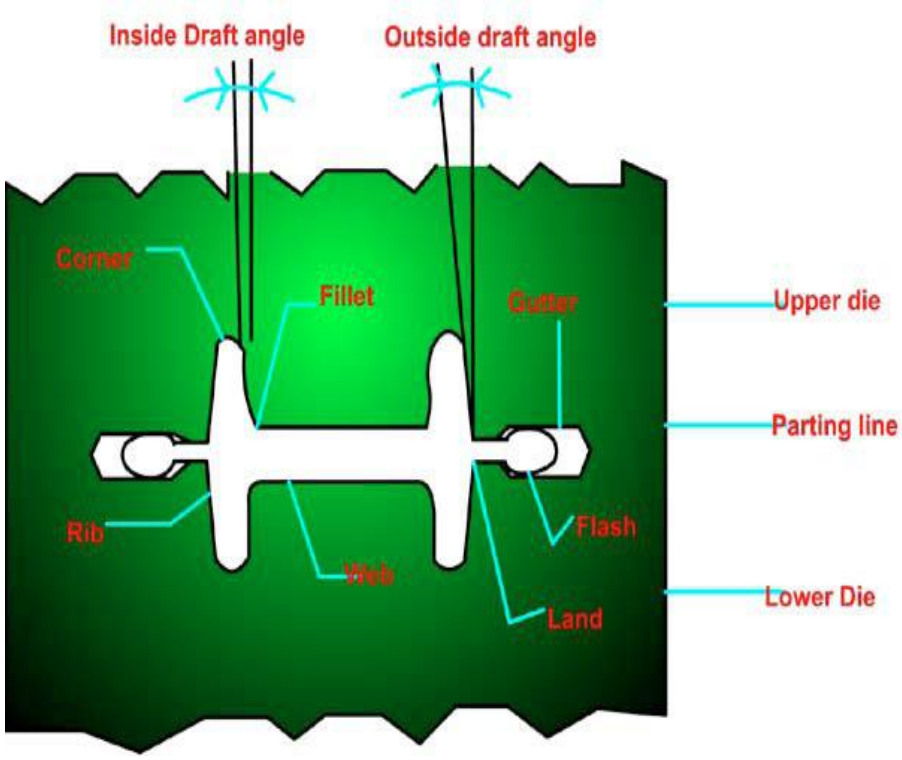
2. The development of cost-effective new production methods (such as net shape forging) will eliminate the need for post-forging removal of surface material.

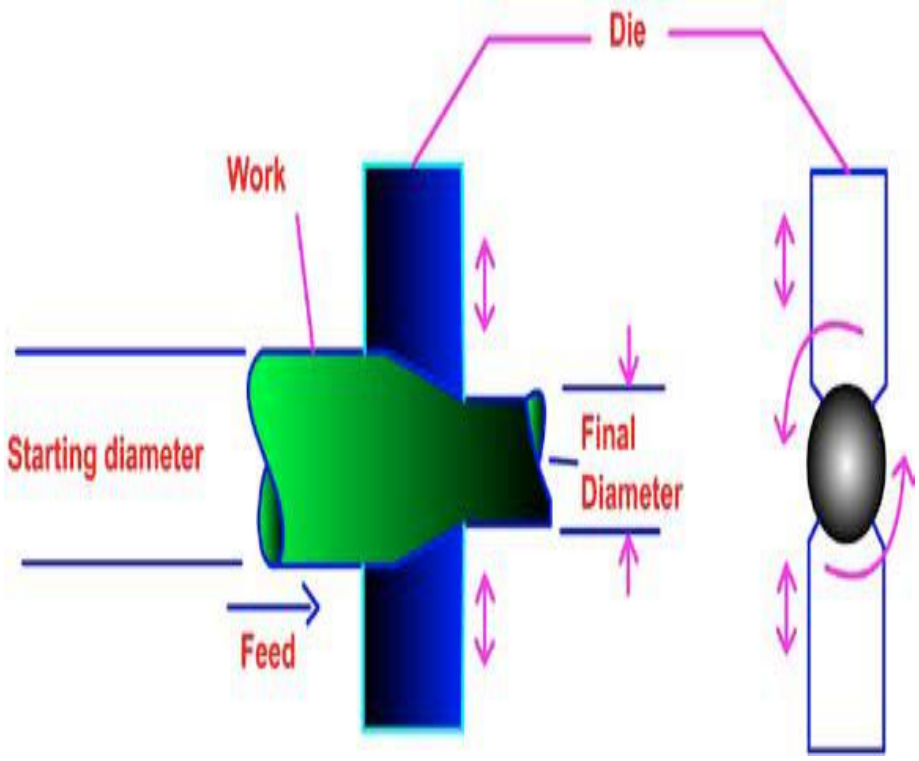
3. Establish a program that develops and deploys environmentally benign lubricants, or eliminates the requirement for die lubrication altogether.

4. Increased use of induction heating and advances in combustion technology will significantly improve energy efficiency in forging facilities and reduce the environmental impact of today's fossil-fuel fired process heating systems completely eliminating harmful products of gas combustion.

New ways to treat waste are needed to prevent damage to the environment. Improvements are needed in methods and technology to minimize forging scale and recycle other process materials and gases that otherwise represent an environmental liability.Renewable energy, advanced technologies for energy and resource efficiency, cogeneration, and other waste reduction process improvements and other cost-effective environmental protection improvements must be developed.

The forging industry must lead the drive for technological advances that benefit many facets of the forging process, and continue to enhance the industry's competitiveness and profitability. Specific areas in which technological issues need to be addressed include materials, die design and modeling, lubrication, process modeling and optimization software, process controls and sensors, real-time preventative maintenance, and primary and secondary processing equipment. Other research and development needs for the forging industry are outlined.





1. New lighter-weight, higher-strength, and higher-quality alloys will be needed to compete with alternative materials and processes and make forgings the components of choice.

Surface modifications of the die-material interface are becoming increasingly important.

2. Die design and modeling software will supplement metallurgical improvements, adding at least an order of magnitude to the life of tooling.

3. Advanced rapid prototyping technology will be incorporated into forged product design and engineering processes. This will serve customers by speeding the time it takes to go from concept to finished part.

4. New, more reliable and predictable equipment must be developed to suit this unique forging process while improving material utilization and producing the near-net and net-shape parts that satisfy the future needs of the industry's customers.

5. New, "smart" forging presses and other pre- and post-forging equipment are needed to improve utilization of energy, raw materials, and labor. They must facilitate efficient and capable of monitoring and correcting the forging deformation process on a real-time basis for the economic production of net- and near-net-shape forgings.

-Ms.Aahana Tiwari
SE MECH B

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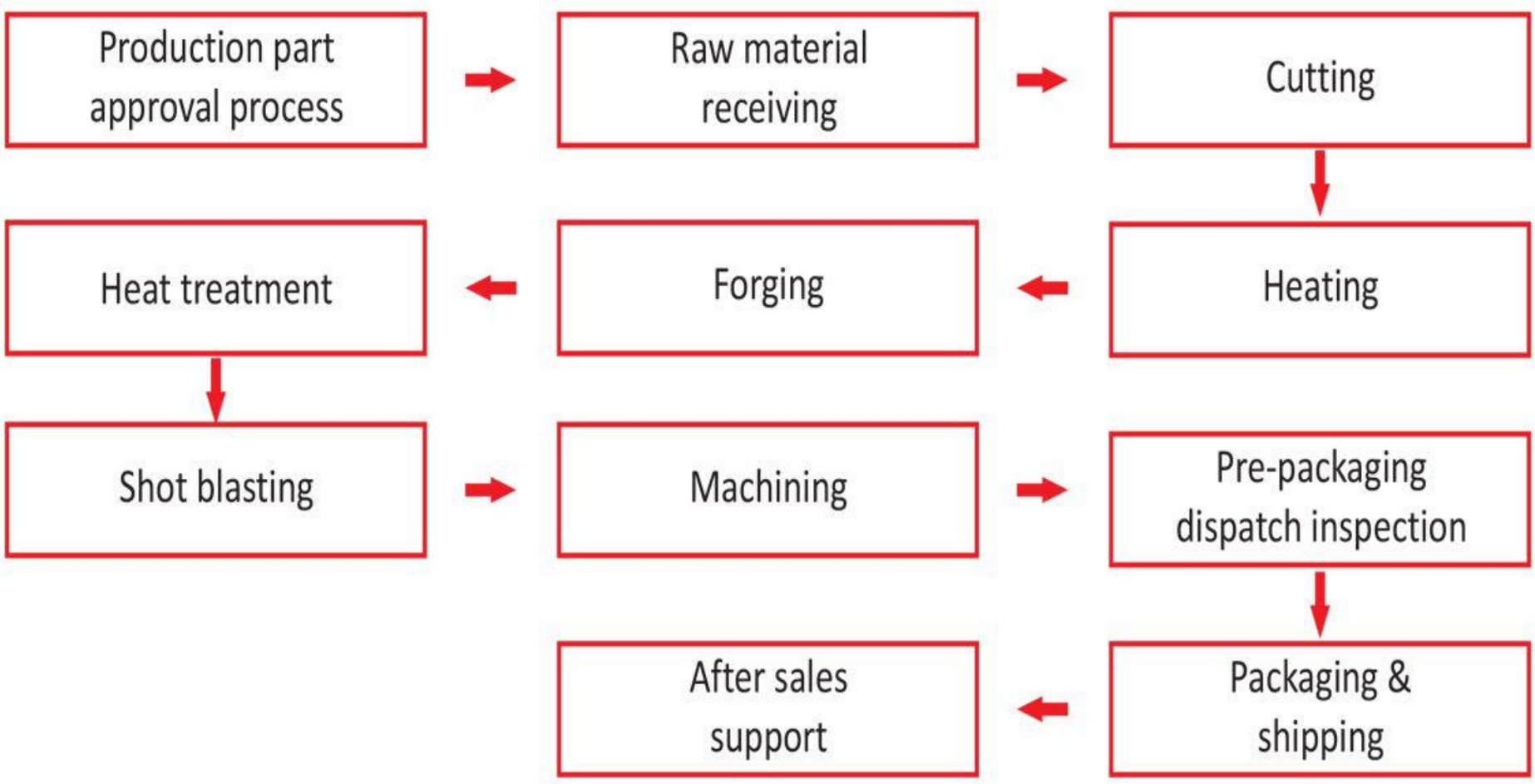
Forging Process Flow Chart



AUTOMATED BOARD CLEANING MACHINE

Abstract:

Cleaning the board every time after every lecture or even during lectures is really a waste of time and efforts specially for teachers. As soon as the teachers turn to rub the board, teachers control over the class is lost. A solution to this problem can be the automated cleaning machine. This machine is automatically given commands and with the help of certain mechanical arrangement, it can clean the board efficiently, therefore saving considerable time and efforts.

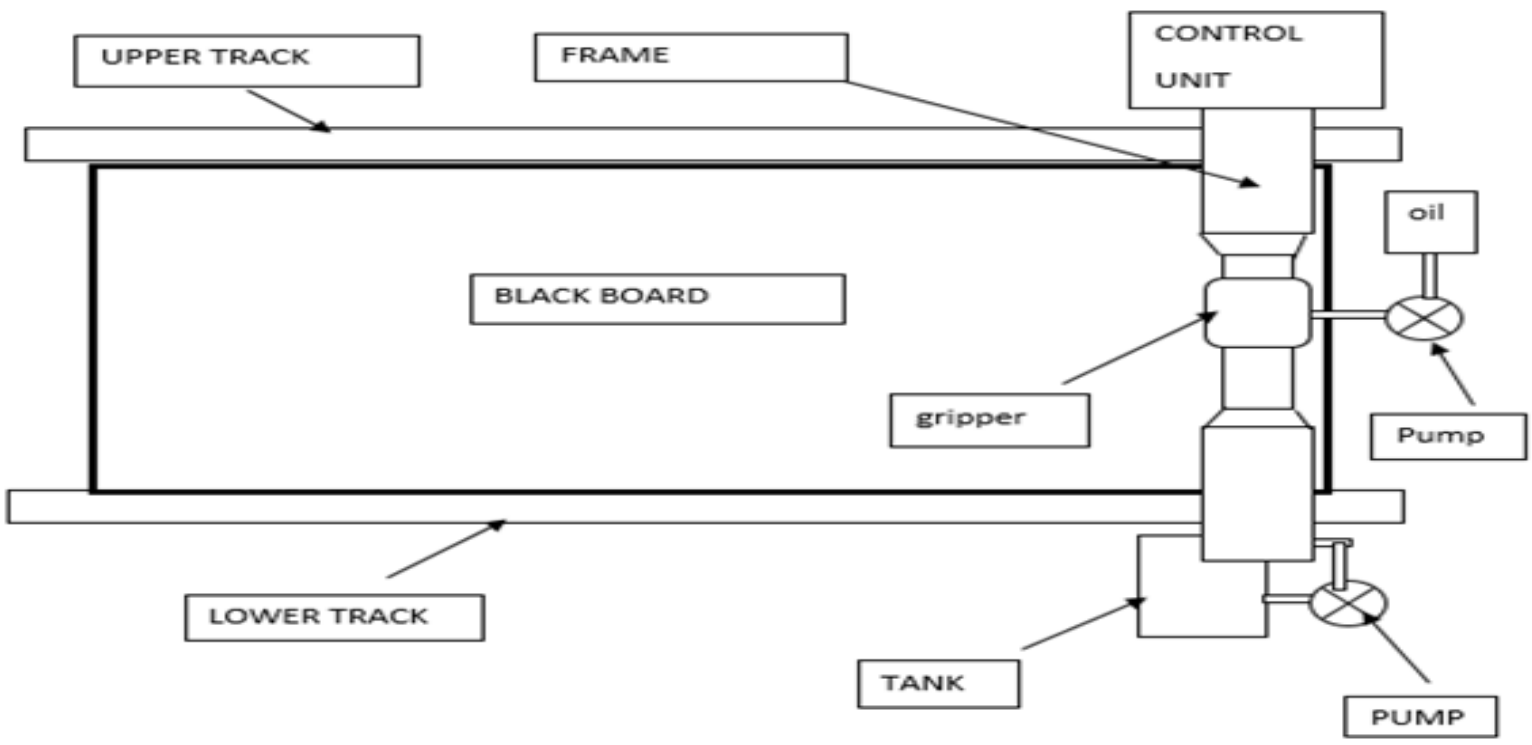
Description:

This machine mainly consists of an aluminium frame mounted with the help of the pre-installed pinion gears on both the ends. It is mounted on the upper and lower track attached just above and just below the board which is to be cleaned.

The track is nothing but the rack gears mounted inside a metal cover to provide stability to the frame while it slides over. On the top frame, motor is mounted to power the entire system specifically pinion gear is attached to the motor shaft to cause a forward movement and another disc is attached with an off centric rotation mechanism for to and fro motion of the duster along the vertical guide way.

Another optionally activated system is involved for the wet cleaning of the surface.

This is installed at the lower end of the frame. It involves an electric water pump, nozzle and a refillable water tank. This can be used for wet cleaning purposes that can be done occasionally. Another mechanism installed is the hydraulic grippers For the purpose of precision cleaning, the hydraulic gripers can be used. This has the function to grip the duster tightly to the board.



Methodology:

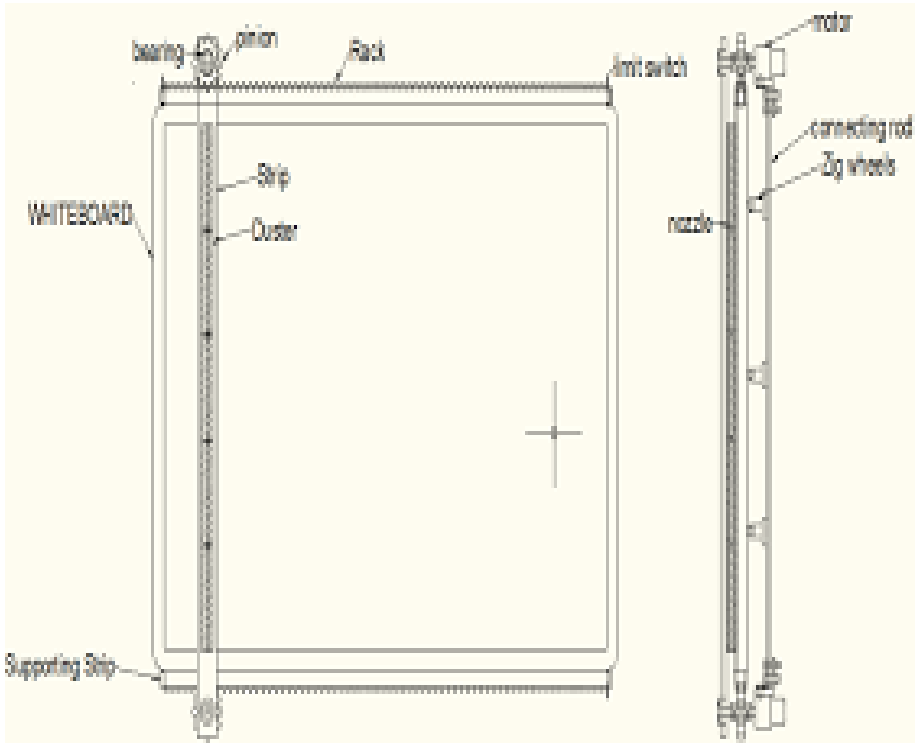
This machine works on the combined basis of different mechanisms.

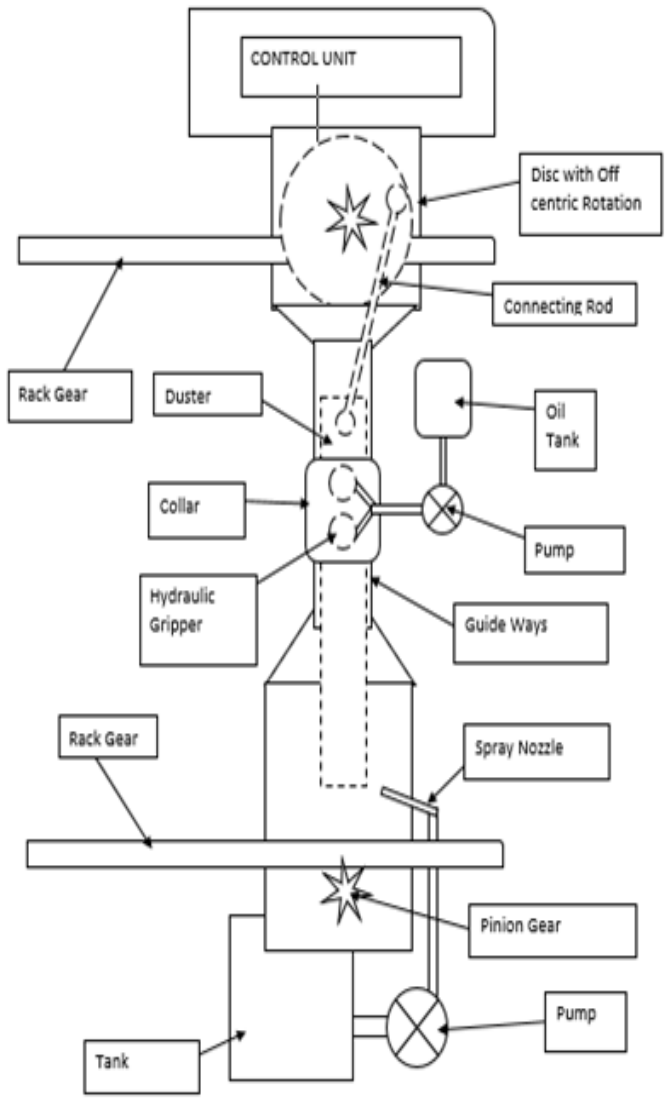
1) The entire machine operated by a primary control system, which activates the different combinations of different parts as per the commands received by it from the user and the timing control unit and distance sensors mounted on either side of the board to keep a track of the distance moved along and number of cleaning cycles.

2) Accordingly, it activates different mechanismseitherindividuallyorsimultaneously (if required).

3) The primary mechanism is the movement of the entire frame which is achieved by the precise arrangement as shown below. The pinion gear being mounted on the frame moves over the rack gears, being driven by a motor mounted on the top of the frame. Similar rack and pinion arrangement is there on the bottom of the frame to keep the frame stable during its movement.

4) The to and fro motion is achieved by an off centric rotational mechanism which has a metallic disc in which there is a rod mounted at a point near to the circumference with hinged pin and this rod is then attached to the plane of the duster/cleaner (may be in series) this allows the rotational motion to be converted to the linear motion. As the frame moves ahead the duster simultaneously moves along vertically.





5) The next mechanism is used for intense cleaning purpose it can be used occasionally may be when there is no need of board to be used for much time as wet cleaning may take time to dry. It is simply a mechanism with a tank and a pump that has a motor and curve shaped wings arranged in vacuum to force out the water from outlet. At the outlet, there is a nozzle that sprays the water directly on board and duster.

6) The next is an important mechanism that is hydraulic gripers that is used to grip the duster on the surface. Usually the duster is kept at a little gap from the board surface and while cleaning is required they are forced on surface by gripers. These gripers are attached to the duster directly, these are mounted on a plate that slides over the guide ways with the help of collar.

7) This griping mechanism is used when only one portion of board is to be cleaned.

Conclusion and Future Scope;

This machine can effectively reduce human efforts and save considerable time. It can accurately clean the board. Not only for boards but this machine can also be used in cleaning of any surface that is long continuous. For example: it can be used to clean the outer sides of train in train sheds. This machine can help us to make cleaning easy and efficient.

-Mr. Karan T Gujaran
SE MECH A

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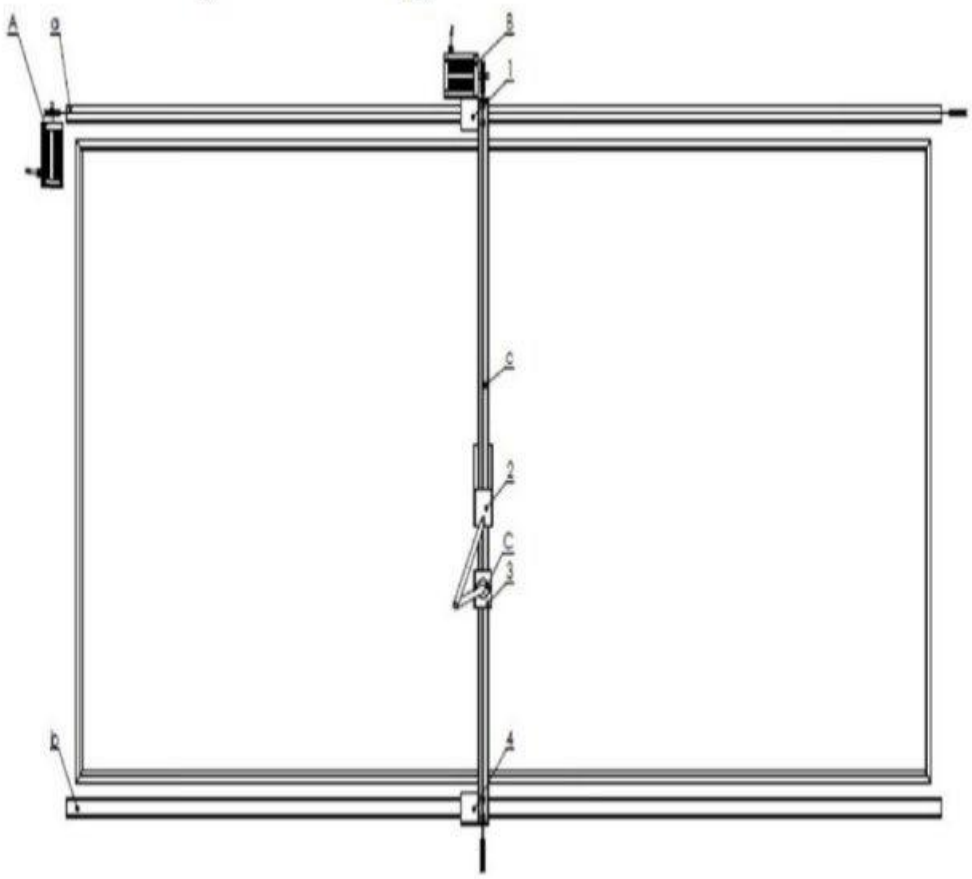
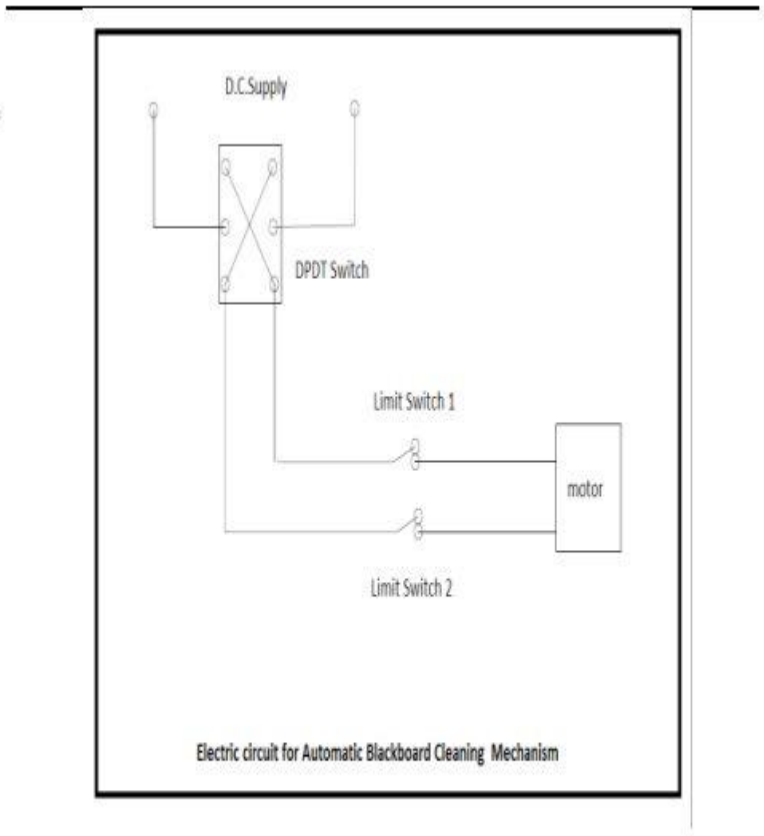




A-Motor for horizontal sliding of cross guide rail C, B- Motor for Vertical sliding wipe system

AIR PROPULSION SYSTEM

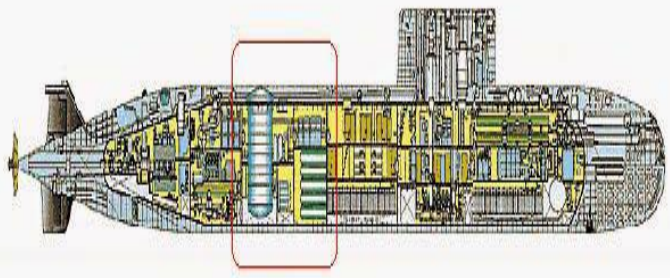
Introduction:

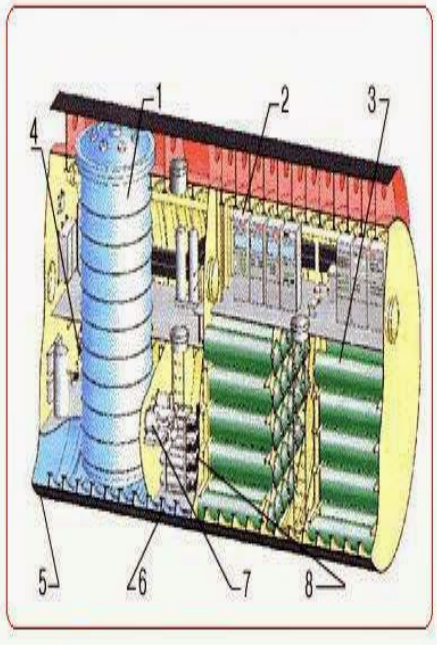
Ever since submarines have become the main weapon in naval warfare, designers have been dedicated on making them quieter and increasing their underwater endurance. Traditional diesel-electric submarines need to surface frequently to charge their batteries and have an underwater endurance of just a few days. As battery technology improved, the endurance of these submarines increased proportionally. But it was not enough to last them beyond a week. The introduction of Air Independent Propulsion (AIP), vastly improved the underwater endurance of these submarines and gave them a distinct advantage.

Diesel-Electric Submarines:

Diesel-Electric submarines run on diesel and electricity. They have a huge network of batteries which are charged by the diesel generator. They snorkel, i.e travelling just below the surface of the water with the periscope and the diesel generator exhaust pipe above the water surface. Once they charge their batteries, they dive into the ocean and run silently on battery power with the diesel generators shut down. After running for a few days underwater, the battery gets drained and these submarines have to come to the surface again to recharge their batteries. Diesel-Electric submarines are also referred to as SSK (Sub Surface Hunter-Killer).

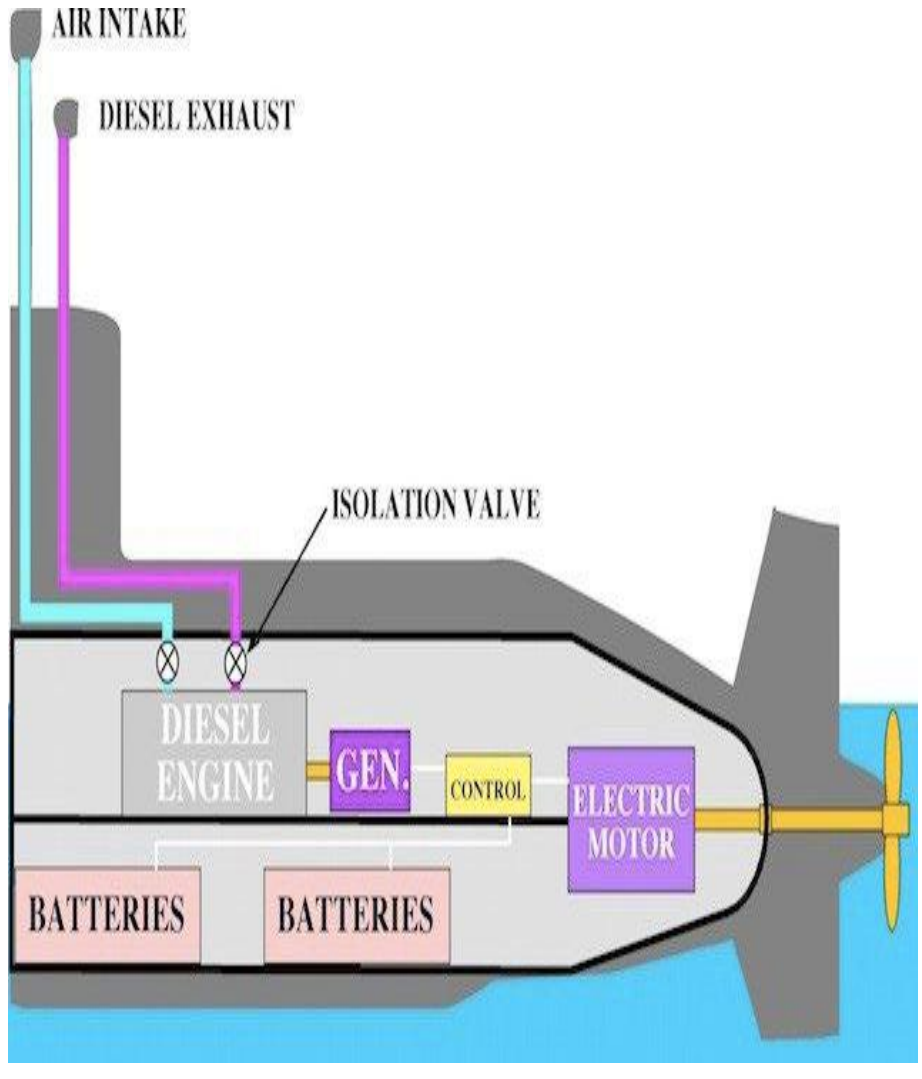
Amur1650
AIP Module





Power plant module with electro-chemical generators

1. Liquid oxigen tank
2. Monitoring panels
3. Hidrogen accumulators
4. Heat exchangers
5,6 Technical water tanks
7. Ventilation and burning system
8. Fuel cells



Why do we need AIP ?

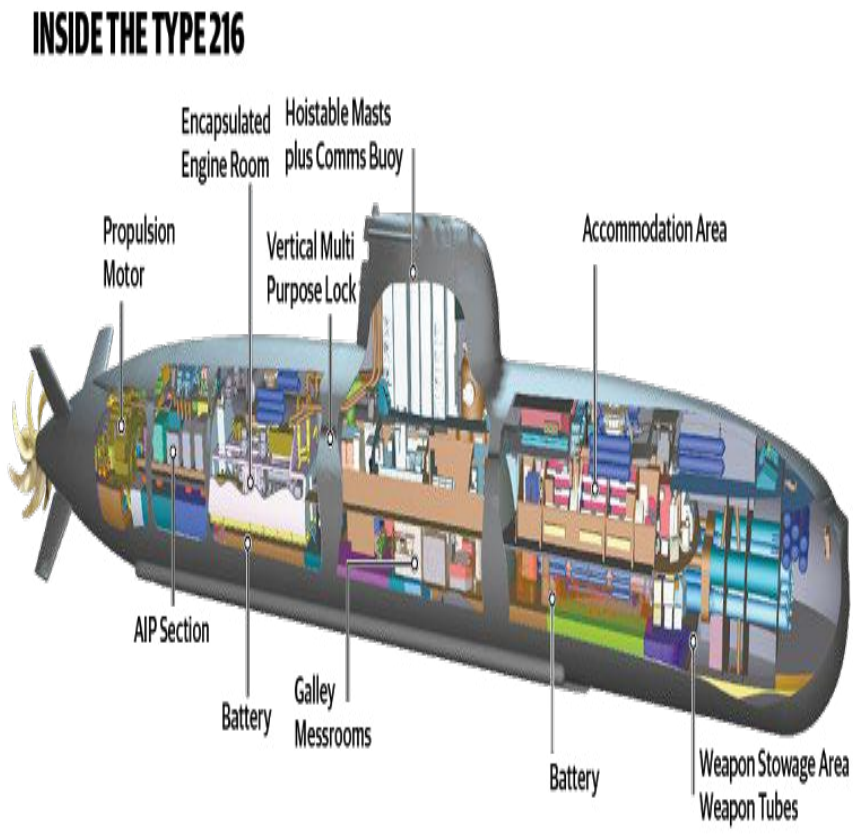
While underwater, the batteries on board power the propeller and other electrical systems on board the submarine. These batteries run out of charge within 4-5 days and the sub needs recharge them. This is done by snorkeling, which exposes them to detection by enemy radars and makes them an easy target for hostile anti-submarine assets. Although modern snorkels are coated with radar absorbing paint and have a stealthy shaping, they are still detectable by high resolution radars. A submarine which needs to surface every day, loses its element of surprise and increases its vulnerability to anti-submarine assets.

Therefore, there is a need for a system which can allow diesel-electric submarines to recharge their batteries without running their engines. This will allow them to continue sailing underwater and retain the element of surprise without being detected.

The system should allow the SSKs to keep their extremely low noise signatures and shouldn't compromise on the performance of the submarine. The system which permits all this is called Air Independent Propulsion (AIP).

Although nuclear submarines offer far better endurance and speeds, they are unsuitable for the shallow littoral waters and most navies cannot afford to build and maintain them as they are very expensive. Also diesel submarines have the advantage of being able to switch off their engines completely and lie in wait unlike nuclear submarines whose reactors cannot be switched off at will. This combined with the ultra-quiet nature of modern diesel subs, has made AIP-equipped diesel subs an alternative for many countries. Navies who wish to operate non-nuclear subs with long-range and large weapons payload are now optional large diesel submarines equipped with AIP, which provide the closest alternative to nuclear powered submarines.

DCNS Air Independent Propulsion



A Model of DRDO's AIP System

Some examples are the Soryu class of Japan, Type 216 being developed by Germany and the Shortfin Barracuda of France which will be operated by Australia.

Working:

The types of AIP systems are:

- Closed Cycle Diesel Engines.
- Closed Cycle Steam Turbines.
- Sterling Cycle Engines.
- Fuel Cells.

Closed Cycle Diesel Engines:

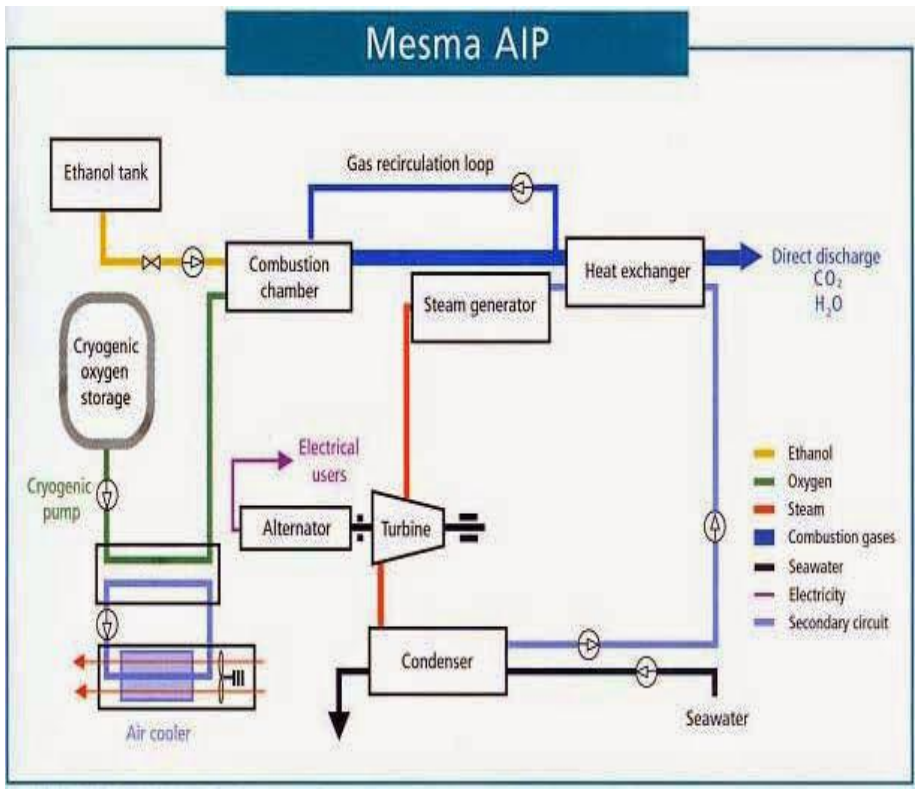
This technology involves storing a supply of oxygen in the submarine in order to run a diesel engine while submerged. Liquid oxygen (LOX) is stored in tanks inside the submarine and sent to the diesel engine for combustion. The oxygen is mixed with an inert gas (usually argon) because they need to simulate the atmospheric oxygen concentration for the engines to run safely without getting damaged.

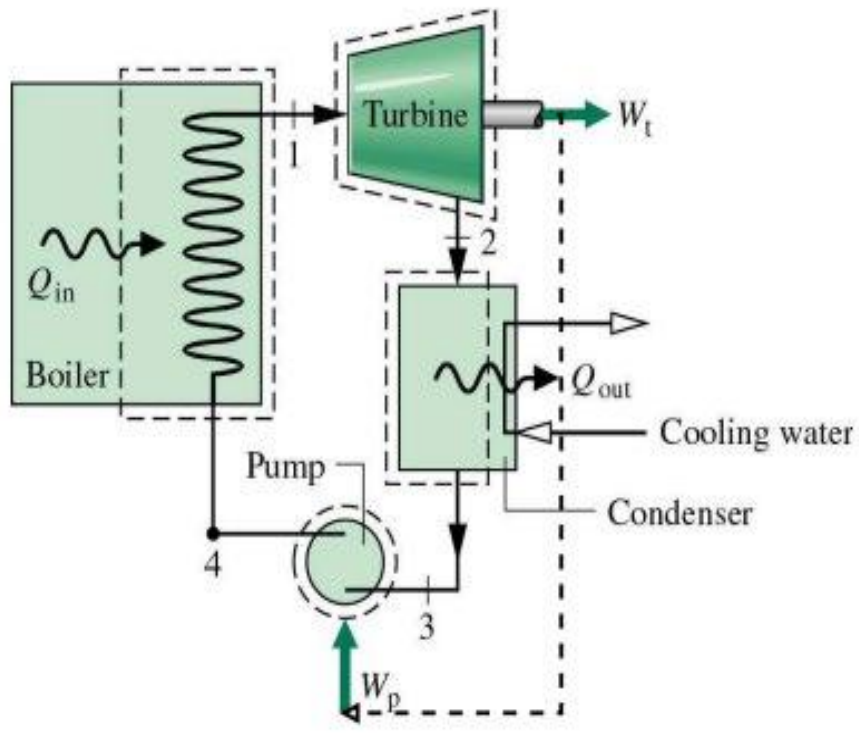
The mixture is then sent to the engine. The exhaust gases are cooled and scrubbed to remove any leftover oxygen and argon from them and the remaining gases are discharged into the sea after being mixed with seawater. The argon which is removed from the exhaust is again sent into the diesel engine after being mixed with oxygen.

The main drawback with this technology is the storing of liquid oxygen safely on board the submarines. Closed Cycle Diesel AIP is therefore not preferred for modern submarines even though it is comparatively cheaper and simplifies logistics by the use of standard diesel fuel.

Closed Cycle Steam Turbines:

In conventional closed cycle steam propulsion, a non-nuclear energy source is used to do the same. The French MESMA(Module d'Energie Sous-Marine Autonome / Autonomous Submarine Energy Module) is a such system available and it makes use of ethanol and oxygen as energy sources.





The combustion of ethanol and oxygen under high pressure is used to generate steam. The working fluid is the steam generated and is used to run the turbine. The high pressure combustion allows the exhaust carbon dioxide to be expelled outside into the sea at any depth without using a compressor.The advantage of MESMA is it's higher power output when compared to the other alternatives which allows higher underwater speeds but it's major drawback is it's lower efficiency. Also the rate of oxygen consumption is very high and these systems are very complex. These drawbacks make several navies choose sterling cycle and fuel cell alternatives.

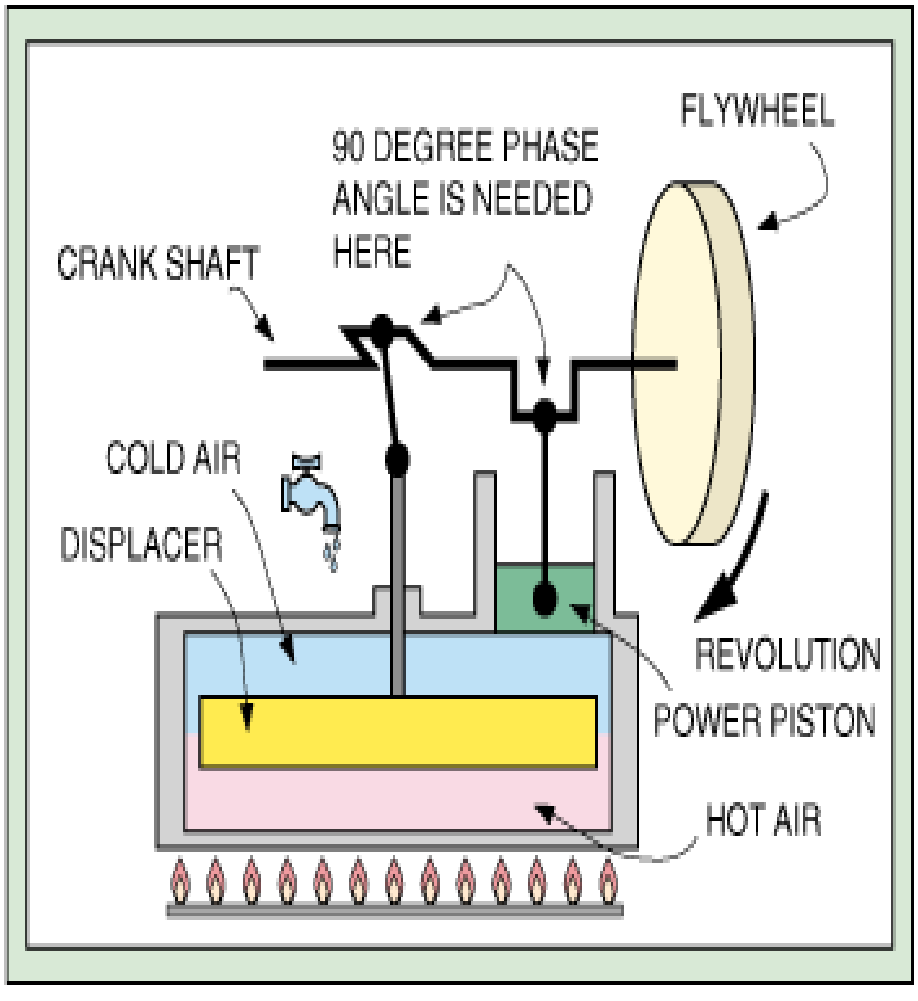
Sterling Cycle Engines:

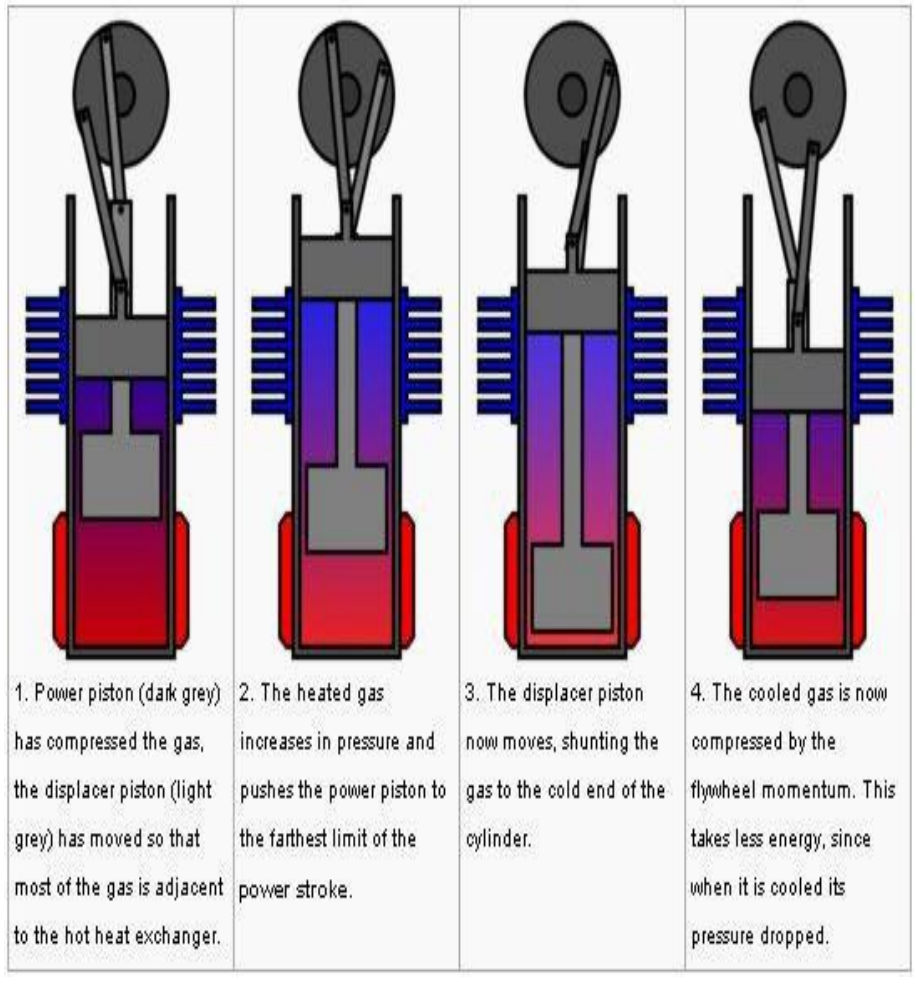
A Sterling Engine is a closed cycle engine with a working fluid which is permanently contained in the system. A source of energy is used to heat this working fluid, which in turn moves the pistons and runs the engine.

The engine is connected to a generator, which generates electricity and charges the battery. The source of energy and diesel fuel, which is burnt in order to generate heat for the working fluid. The exhaust is then scrubbed and released into the seawater.

The advantage of using Sterling engines is the easy availability of diesel fuel and low refueling costs when compared with Fuel Cells. They are quieter than MESMA and hence preferred by the Japanese for their Soryu class, Sweden for their Gotland and Västergötland class and China for their Yuan class.

The drawback is that they are relatively noisy when compared to Fuel Cells due to the presence of a large number of moving parts. They are also bulky when they are compared to Fuel Cells.





Fuel Cells:

Phosphoric Acid Fuel Cells (PAFC) and Proton Exchange Membrane Fuel Cells (PEMFC) are presently used in submarines. Germany is said to be the world leader in developing and fielding this type of AIP, which is backed by the large number of export orders they have received. India is developing a Fuel Cell AIP to be integrated on their submarines.

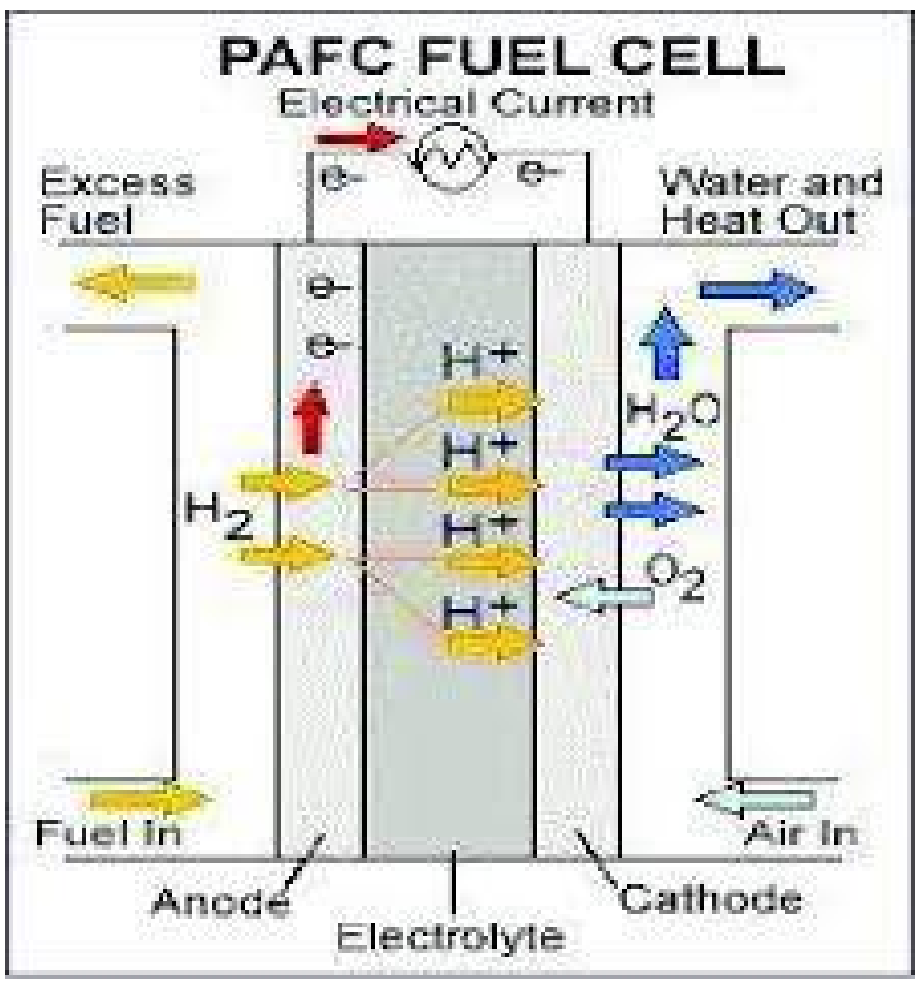
Working of a PEM Fuel Cell:

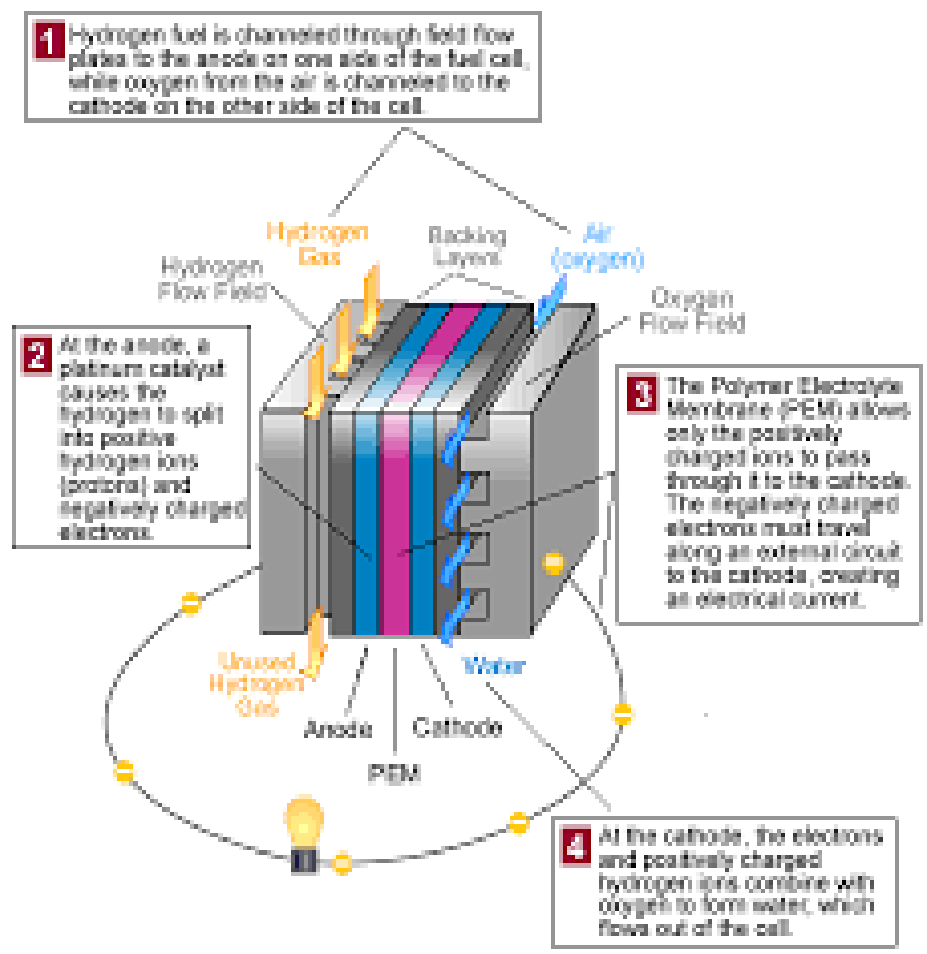
Fuel cell is the most advanced and preferred AIP technology today. This is because of the major advantages they offer in stealthiness and power generation. They contribute to the stealthiness of the sub as Fuel Cells have almost no moving parts, which significantly reduces the acoustic signature of the sub. Fuel Cells can achieve an efficiency of over 80% under certain circumstances.

Depending on the displacement of the submarine, they can also be scaled into large or small sizes. This is easier than developing different systems for each submarine class. Hydrogen Fuel Cells are environment friendly as they generate no exhaust fumes, which in turn eliminates the need to have special exhaust scrubbing and disposal machinery. They are expensive and complex and this is the only drawback.

Advantages of A.I.P:

The use of AIP on a diesel-electric submarine, vastly increases their underwater endurance, allowing them to continuously stay submerged for weeks without surfacing. Although the submarine eventually needs to recharge its batteries and their endurance is nowhere on-par with nuclear powered submarines, the great increase in endurance offered by AIP gives them an advantage over non AIP equipped diesel-electric submarines.



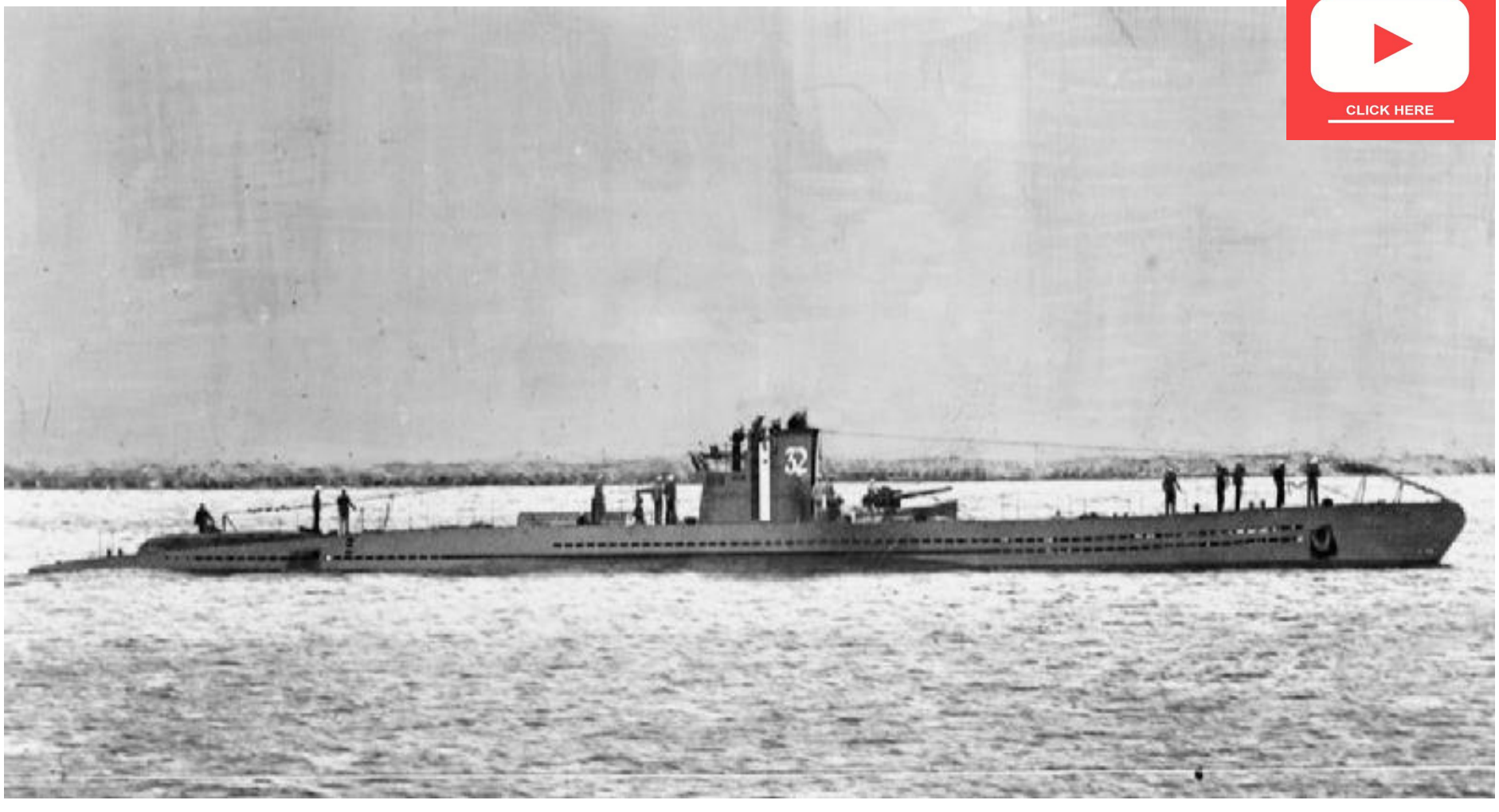


In April 2006, a German Navy submarine U-32, equipped with a Siemens proton exchange membrane (PEM) compressed hydrogen fuel cell AIP, made a 2800 km uninterrupted underwater journey without surfacing. This is in contrast to non-AIP equipped submarines which can cover only 500-800 km before they have to surface and recharge their batteries. In comparison, a nuclear-powered submarine has unlimited underwater endurance.

Also in 2013, U-32 set a record by traveling underwater continuously for 18 days without surfacing. Comparatively, a non-AIP diesel sub has an underwater endurance of only 4-6 days before it has to surface. This proves that AIP-equipped diesel-electric submarines are far more capable than their non-AIP equipped counterparts when it comes to endurance.

Limitations of AIP:

Other than Fuel Cells, the 3 remaining technologies have a lot of moving parts which create noise. This is not desirable as quietness is very important for all submarines. So by using Sterling, MESMA and CCD AIP systems, submarines will be sacrificing some of their stealthiness for additional endurance.Even though Fuel Cell AIP has many advantages, it is very expensive to procure and maintain them. Submarines which use AIP need to sail at speeds of less than 10 kts in order to achieve exceptional endurance of 14-18 days. In comparison, a nuclear powered sub can travel for an unlimited distance at 30-35 kts without sacrificing endurance. So in conclusion, AIP equipped submarines can never replace nuclear submarines when it comes to blue water or extended period operations.



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Combat Scenerio:

The advantage offered by increased underwater endurance can be used for 'ambushing' an approaching fleet. In one such scenario, an AIP equipped submarine can roam, waiting for its target to approach. The sub will be running at ultra-quiet speeds of 2-4 knots for several weeks and then attack the target when it appears, using its torpedoes.

In another scenario, an AIP equipped sub can move near enemy territory for far longer compared to a non-AIP sub. Thus in this situation where intelligence is gathered and spy missions are performed, AIP gives these diesel subs an advantage by allowing them to roam for weeks without the need to surface.

Conclusion:

During regular patrols or in friendly territory, an AIP equipped submarine will snorkel often to recharge its batteries. It is deployed operationally to increase its underwater endurance. This is because most of the fuels, oxidizers and other consumables used in AIP are quite expensive and it wouldn't be economical to replenish them on a monthly basis.

The capacity and reliability of batteries is increasing due to extensive research being conducted in that field. The various AIP technologies mentioned will see large-scale in capabilities. These two technologies combined, will allow AIP equipped submarines of the future to stay underwater for months at a time and make them pseudo-nuclear submarines. This technology has a bright future and we will see more modern navies adopting it for their diesel-electric submarine fleets.

-Ms.Bhavika Sakpal
SE MECH B

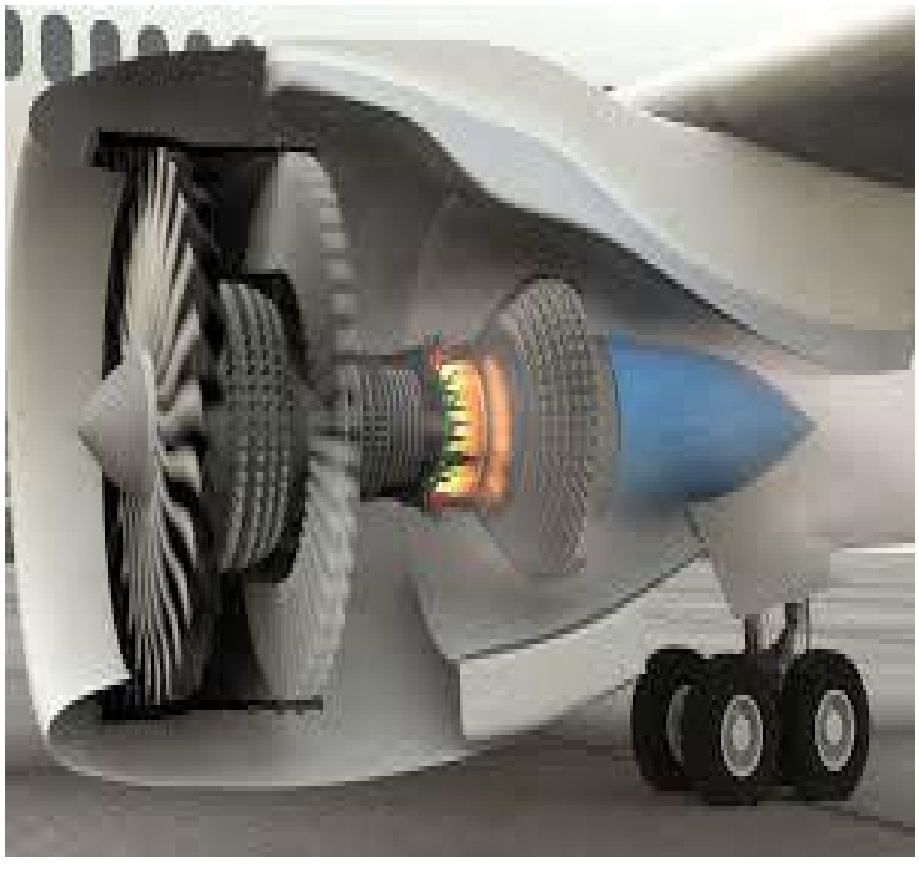
TURBOFAN ENGINE

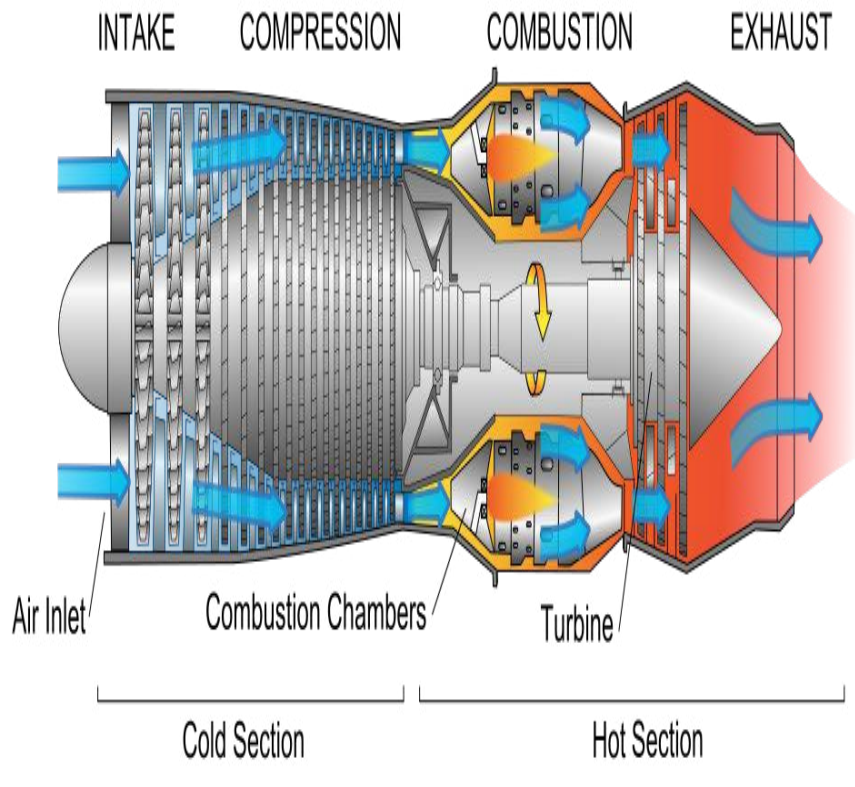
Introduction:

A turbofan engine is the most modern variation of the basic gasurbine engine. Turbofans were excogitated to eliminate the drawback ofturbojets, which was that they were inefficient for subsonic flight (a subsonic flight is the flight of an aircraft at a speed less than or equal to that of sound in air). To raise the efficiency of a turbojet, the obvious approach would beto increase the burner temperature, fit larger compressors and nozzlesand to give better Carnot efficiency but it has its own drawbacks. Tomove an airplane through the air, thrust is generated by some kind of propulsion system. Turbofan engines are widely used by most airliners because of their high thrust and good fuel efficiency.

Construction:

At the front of the engine, to the left, is the inlet. At the exit of the inlet is the compressor. The compressor is connected by a shaft tot he turbine. The compressor and the turbine are composed of many rows of small airfoil shaped blades. Some rows are connected to the inner shaft and rotate at high speed, while other rows remain stationary. The rows that spin are called rotors and the fixed rows are called stators. The combination of the shaft, compressor and turbine is called the 'turbomachinery'. Between the compressor and the turbine flow path is the combustion section or burner. This is where the fuel and the air are blended and burned. The hot exhaust then passes through the turbine and out of the nozzle. The nozzle performs two important tasks. The nozzle is shaped to accelerate the hot exhaust gas to produce thrust and the nozzle sets the mass flow through the engine.





Bypass ratio and Thrust:

Bypass ratio-

The bypass ratio (BPR) of a turbofan engine is the ratio between the mass flow rate of the bypass stream to the mass flow rate entering the core. A 20:1 bypass ratio, for example, means that 20 kg of air passes through the bypass duct for every 1 kg of air passing through the core.

Turbofan engines are usually described in terms of BPR, which together with overall pressure ratio, turbine inlet temperature and fan pressure ratio are important design parameters. In addition BPR is quoted for turboprop and unducted fan installations because their high propulsive efficiency gives them the overall efficiency characteristics of very high bypass turbofans. This allows them to be shown together with turbofans on plots which show trends of reducing TSFC (thrust-specific fuel consumption) with increasing BPR. BPR is also quoted for lift fan installations where the fan airflow is remote from the engine and doesn't physically touch the engine core.

Thrust-

While a turbojet engine uses all of the engine's output to produce thrust in the form of a hot high-velocity exhaust gas jet, a turbofan's cool low-velocity by pass air yields between 30% and 70% of the total thrust produced by a turbofan system.

Mathematical expression:

The thrust (FN) generated by a turbofan depends on the effective exhaust velocity of the total exhaust, as with any jet engine, but because two exhaust jets are present the thrust equation can be expanded as:

FN = ṁevhe - ṁovo + BPR(ṁcvf) where:

ṁe= the mass rate of hot combustion exhaust

flow from the core engine

ṁo = the mass rate of total air flow entering

the turbofan = ṁc + ṁf

ṁc= the mass rate of intake air that flows to t

he core engine

ṁf= the mass rate of intake air that bypasses

the core engine

vf= the velocity of the air flow bypassed

around the core engine

vhe= the velocity of the hot exhaust gas from

the core engine

vo= the velocity of the total air intake = the

true airspeed of the aircraft

BPR= Bypass Ratio

Common types of turbofans:

Low-bypass turbofan-

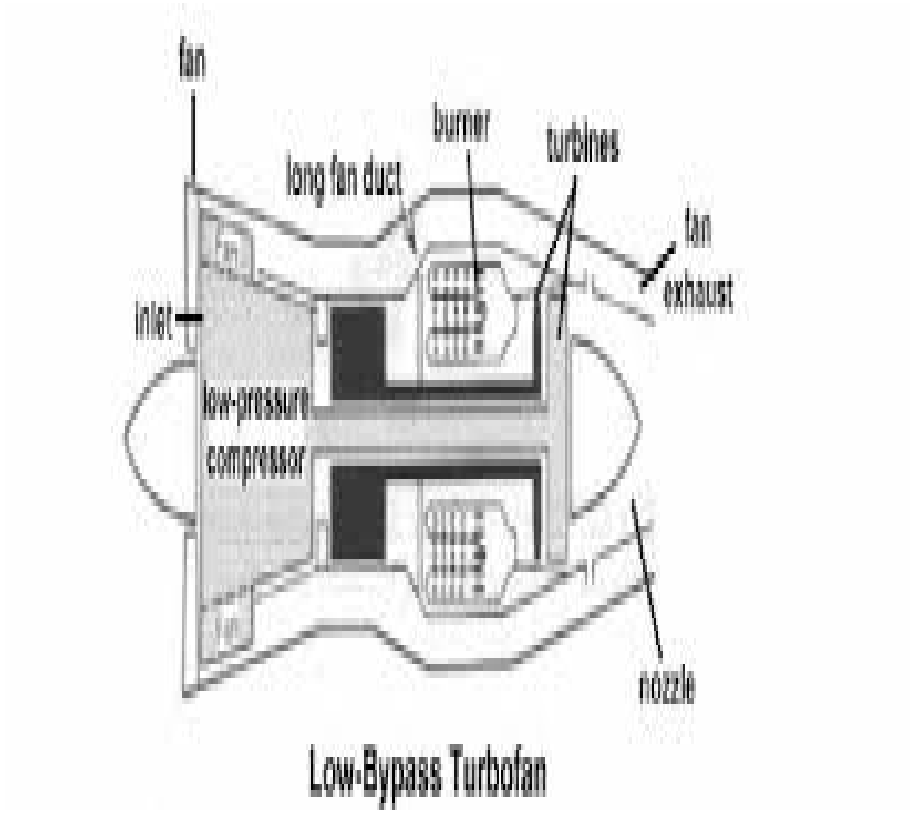
A high-specific-thrust low-bypass-ratio turbofan normally has a multi-stage fan, developing a relatively high pressure ratio and, thus, yielding a high (mixed or cold) exhaust velocity. The core airflow needs to be large enough to give sufficient core power to drive the fan. A smaller core flow/higher bypass ratio cycle can be achieved by raising the high-pressure (HP) turbine rotor inlet temperature.

Application- Military aircrafts use low-bypass engines their priorities are different. While it is true that the high bypass turbofans have better fuel economy (in cruise) and are less noisy, the low bypass engines offer significant advantages when we take into account their intended use in combat aircraft, such as:

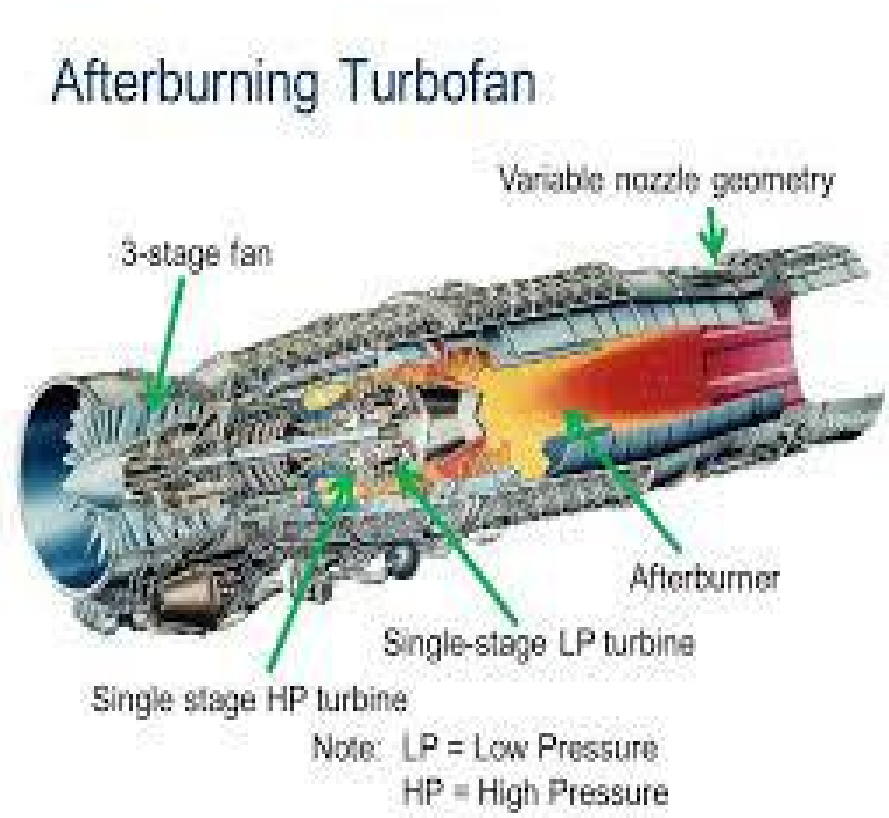
- They have less frontal area, reducing the drag produced. For aircraft expected to fly at supersonic speeds, however briefly, this is important.

Afterburning turbofan-

An afterburner is a combustor located downstream of the turbine blades and directly upstream of the nozzle, which burns fuel from afterburner-specific fuel injectors. When lit, prodigious amounts of fuel are burnt in the afterburner, raising the temperature of exhaust gases by a significant degree, resulting in a higher exhaust velocity/engine specific thrust. The variable geometry nozzle must open to a larger throat area to accommodate the extra volume flow when the afterburner is lit. Afterburning is often designed to give a significant thrust boost for take off, transonic acceleration and combat maneuvers, but is very fuel intensive. Consequently, afterburning can be used only for short portions of a mission.



Low-Bypass Turbofan

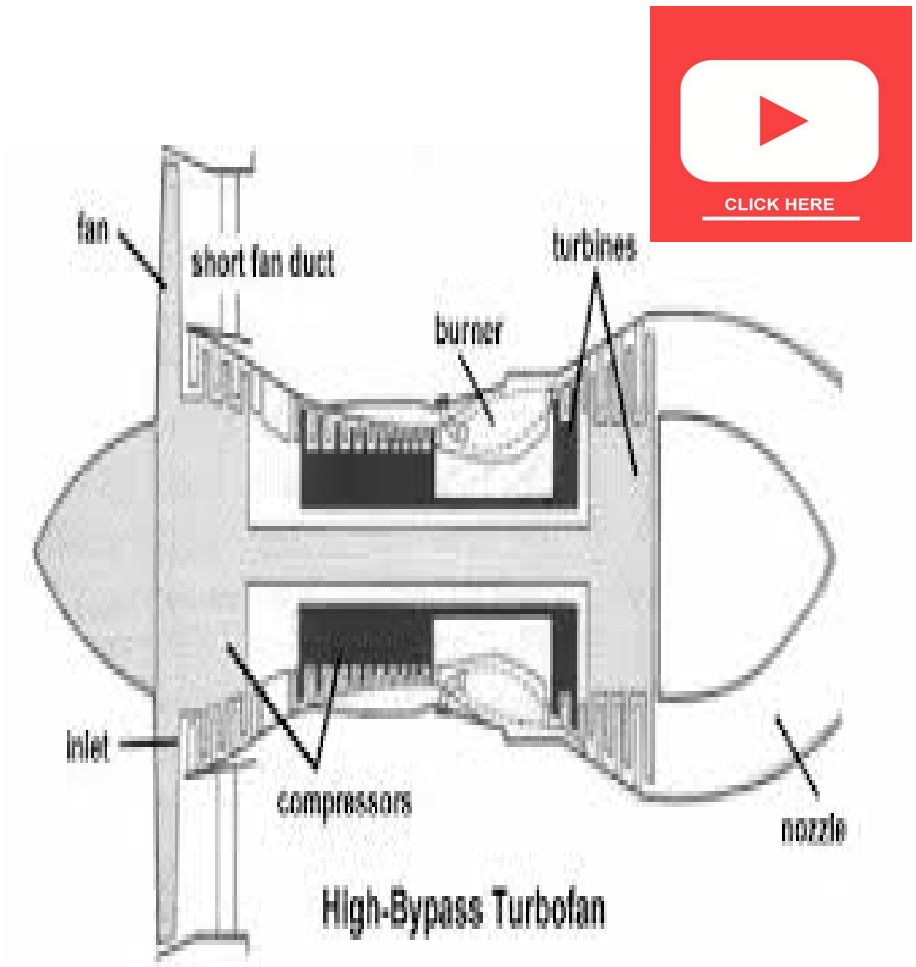


Application-

Afterburners are only used on supersonic aircraft like fighter planes and the Concorde supersonic airliner. (The Concorde turns the afterburners off once it gets into cruise. Otherwise, it would run out of fuel before reaching Europe.) Afterburners offer a mechanically simple way to augment thrust and are used on both turbojets and turbofans.

High-bypass turbofan-

To boost fuel economy and reduce noise, almost all of today's jet airliners and most military transport aircraft (e.g., the C-17) are powered by low-specific-thrust/high-bypass-ratio turbofans. These engines evolved from the high-specific-thrust/low-bypass-ratio turbofans used in such aircraft in the 1960s. (Modern combat aircraft tend to use low-bypass ratio turbofans, and some military transport aircraft use turboprops.)



Application-

It all started with the earliest jet engines, when bypass ratios of 0.3:1 were tried out in the 1960s. With the Boeing 747 and equivalent class of aircraft came turbofans with a bypass ratio of 5:1. Modern commercial fan engines have huge bypass ratios: up to 12:1, and this means more than 80% of the engine thrust comes from the fan.

Turbofan configurations:

Turbofan engines come in a variety of engine configurations. For a given engine cycle (i.e., fan pressure ratio, same airflow, bypass ratio, overall pressure ratio and HP turbine rotor inlet temperature), the choice of turbofan configuration has little impact upon the design point performance (e.g., net thrust, SFC), as long as overall component performance is maintained. Off-design performance and stability is, however, affected by engine configuration.

1. Single-shaft turbofan.
2. Aft-fan turbofan.
3. Basic two-spool.
4. Boosted two-spool.
5. Three-spool.
6. Geared fan.
7. Military turbofans.
8. High-pressure turbine.
9. Low-pressure turbine.

The Future:

Engine cores are shrinking as they are operating at higher pressure ratios and becoming more efficient, and become smaller compared to the fan as bypass ratios increase. Blade tip clearances are harder to maintain at the exit of the high-pressure compressor where blades are 0.5 in (13 mm) high or less, backbone bending further affects clearance control as the core is proportionately longer and thinner and the fan to low-pressure turbine driveshaft is in constrained space within the core.

The weight and size of the nacelle would be reduced by a short duct inlet, imposing higher aerodynamic turning loads on the blades and leaving less space for soundproofing, but a lower-pressure-ratio fan is slower. UTC Aerospace Systems Aerostructures will have a full-scale ground test in 2019 of its low-drag Integrated Propulsion System with a thrust reverser, improving fuel burn and reducing noise.

-Ms.Aahana Tiwari
SE MECH B

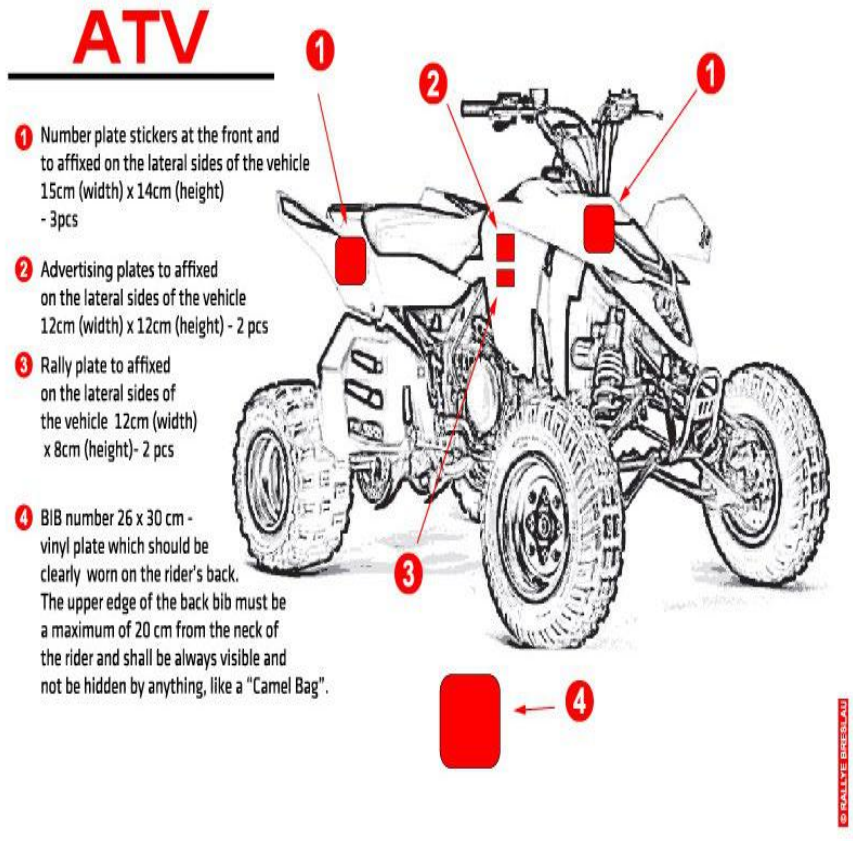
DESIGN & FABRICATION OF AN ALL-TERRAIN VEHICLE(ATV)

Abstract:

Before we get into the challenges faced, let's get to know our ATV. An all-terrain vehicle (ATV), also known as a Buggy, quad, quad bike, three-wheeler, four-wheeler or quadricycle as defined by the American National Standards Institute (ANSI); it is a vehicle that travels on low-pressure tires either with a seat and a safety harness along with a steering wheel in case of a buggy or with a seat that is straddled by the operator along with handlebars for steering control in case of quad bikes. As the name implies, it is designed to handle a wider variety of terrain than most other vehicles. ATVs are intended for use by a single operator, although some companies have developed ATVs intended for use by the operator and one passenger.

Objective:

Designing purpose of an ATV is to manufacture an off-road vehicle that could help in transportation in hilly areas, farming field and as a reliable experience for a weekend enthusiast. There are many facets to an off-road vehicle, such as the chassis, suspension, steering, drive-train, and braking, all of which require thorough design concentration. During the entire design process, consumer interest through innovative, inexpensive, and effective methods is always the primary goal. Making of an ATV involves two steps i.e. Design and Manufacturing.



Designing the ATV:

First we start with the design of the Steering and Suspension systems as both of them are inter-dependent. It involves deciding the wheel base, track width and ground clearance according to our requirements, getting the steering system in accordance with the Ackerman steering mechanism and designing the suspension systems for a wishbone setup. The challenge we face here is that getting a perfect Ackerman steering system while maintaining the required track width, wheel base and ground clearance which is very difficult and almost always leads to a compromise between one or the other aspect. Other factors such as the lengths of the steering arms and tie rods , the steering block placement, the steering wheel diameter, the steering effort, the placement of the dampers, the length and width of the wishbones, etc also have to be taken into consideration.

Once these systems are taken care of we come to the chassis. While designing the chassis, emphasis is given on it being easy to manufacture, light weight, durable, economical and at the same time aesthetically appealing. Once the structure is made in a modelling software it is analyzed for its safety. The next step is the design of the wheel assembly which includes the hub, knuckle, brake disc, brake calipers, bearings & the wheels. It starts with selection of the tyres and rims. Depending on its inner diameter of the tyre, the torque on wheels, the braking power required, etc the hub, knuckle and the brake disc are designed. Other factors like the type of material, its cost, availability, weight are also to be accounted. Finally, we design the powertrain. Employing an engine capable of delivering the required power while keeping the cost to minimum is not possible so we pair it up with a transmission.

It can be either manual or automatic depending on customer requirements. The transmission is designed according to the output speed required. The challenge we face here is to determine the torque required at starting and at top speed, designing the gearing mechanisms for the same and transmitting the power produced be the engine to the wheels as efficiently as possible and as required. In a nutshell this sums up almost all the major aspects of the design part of an ATV.

Manufacturing the ATV:

Unlike the design, the manufacturing actually starts with the chassis. The chassis are made with hollow pipes of alloyed steel as it reduces weight, are economical and are durable. The challenge we face here is during bending of the pipes to the required shaped as they tend to deform and tear of or become thin at the bents susceptible to failure and also during the welding of pipes as welds have a tendency to deform or shrink while cooling. While manufacturing the brake disc material selection and size becomes challenging. Other factors like the weight, strength, life, cost also play a major role.

For effective working of the brakes they have to bleed-well which is very important and challenging at the same time. Selection of dampers as per our requirements while keeping the cost to minimum is difficult as they are usually expensive. This is also true for the engine. Other components like the steering block, the brake calipers, master cylinders, bearings, shafts, tyres, rims, etc also cost considerably.

The manufacturing cost of the gear box, brake discs, etc also add up. So collectively the cost or rather the funds required are one of the major Challenges and finding investors for the same is an even bigger Challenge. Making parts available as and when needed is also difficult as it depends on its availability in the market.

Conclusion:

These are some major challenges faced during the manufacturing of an ATV. Various other factors not mentioned above also play their respective roles but they get taken care of by simple hacks. Overall the ATV should be able to do its job and at the same time it should be affordable is what we keep in mind during this entire process as customer satisfaction always come first.

-Mr. Avishkar Gawde
BE MECH A

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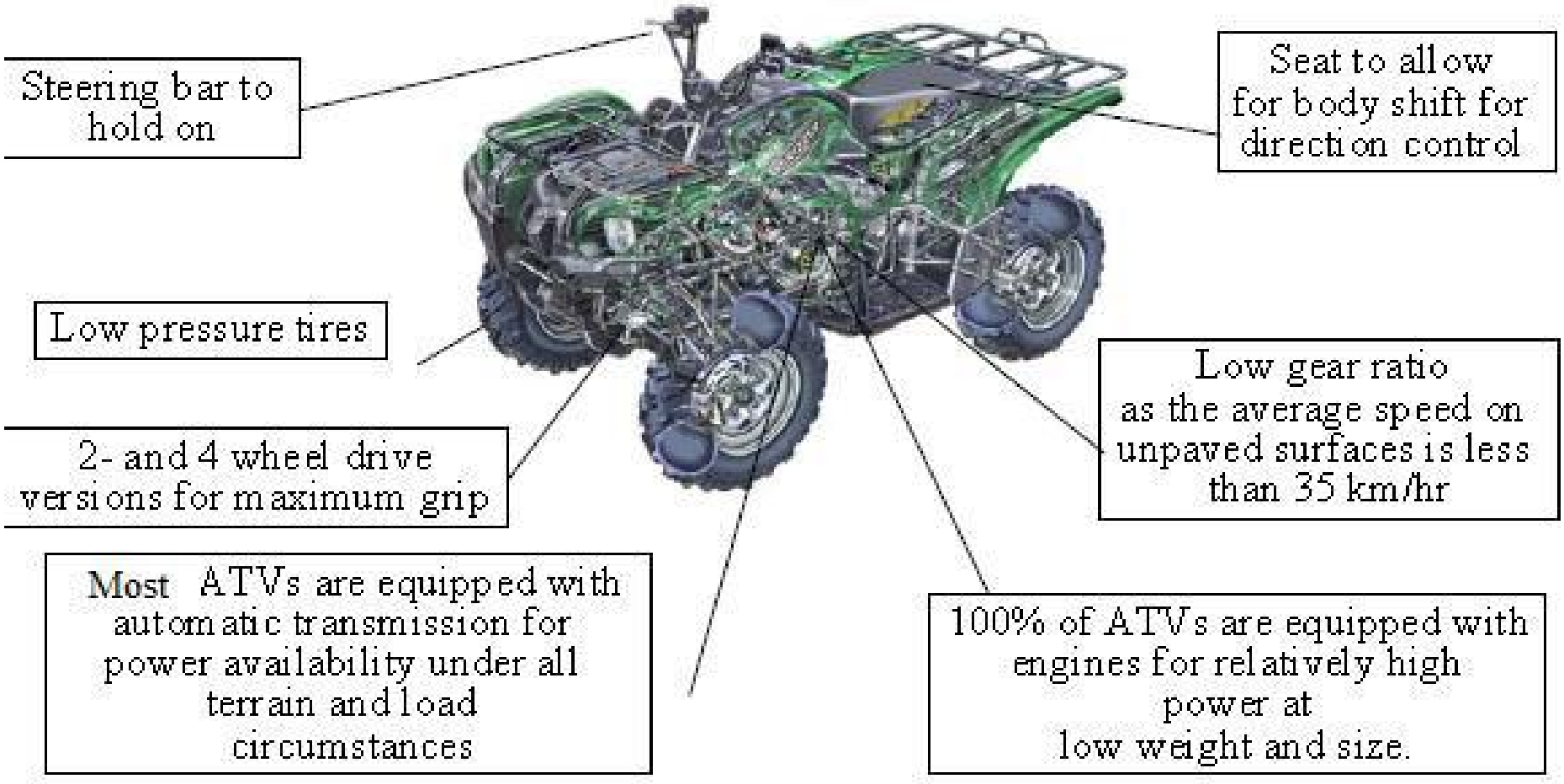


NON-PNEUMATIC TIRES

Introduction:

The solace and security of driving a vehicle principally rely upon the great working states and the beneficial interaction between the segments of the vehicle suspension framework. A suspension arrangement of any vehicle is made out of a safeguard, a spring and above all a tire. The primary goal of this trio is to confine the tenants of the vehicle from any outside aggravations caused by collaboration with a roughened ground while allowing the driver to keep a proficient and safe control over his vehicle. On the off chance that any of these segments is severely composed, made, mounted or utilized, serious results could aggravate the ride solace of individuals inside the vehicle and even endanger their wellbeing. As vehicles have turned out to be more vigorous, solid also, refined, drivers turned out to be less mindful of the significance of their tires.

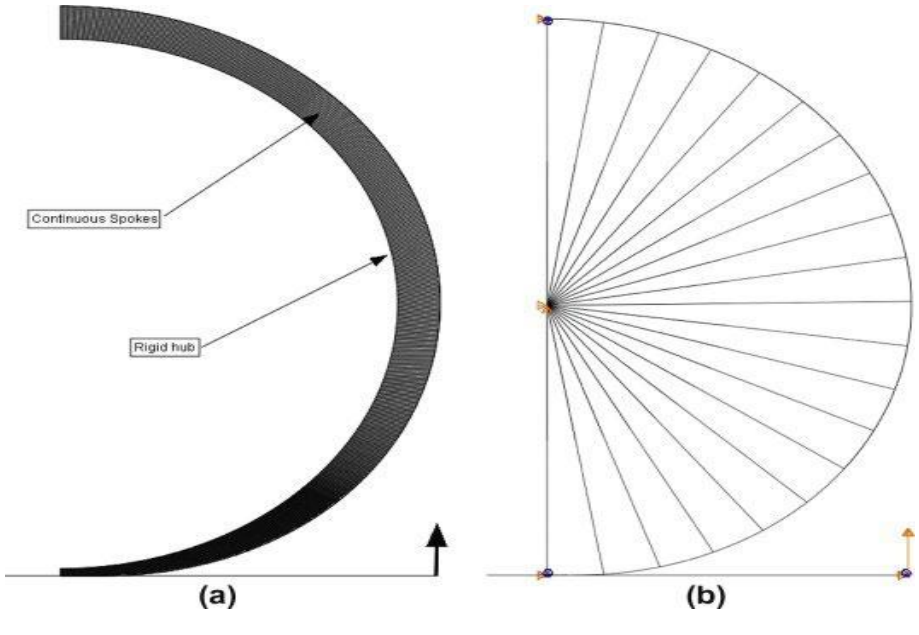
Tires have essentially enhanced as far as wellbeing, execution, and wear, yet regardless they require more consideration than most of the auto part tire is a result of complexly designed composites. It comprises for the most part of a fortified elastic toroid mounted on a metallic edge. the air caught inside makes an expansion weight that is in charge of conveying the heap, transmitting powers, engrossing stun, giving grasp and opposing wear. In a tire, there are huge numbers of segments and elastic details. For fortification, tires additionally have a few sorts of texture and a few sorts and sizes of steel. A portion of the steel is curved or meshed into solid links. On the outside shell, the tread gives the required contact the street surface and gives better footing. The motivation behind the examples on the tread is to encourage the clearing of water and streamline the wear rate.

Contrasted with an unbending wheel, the regular air-filled tire has various focal points: great spiral flexibility, better hold with the street and a low mass. Then again, the air tire has additionally numerous powerless focuses: chiefly its defenselessness to the insecurity of gaseous tension. the variety of air weight influences the execution of the tire and significantly changes the ride solace of travelers. Among every conceivable danger, the hazard of a victory out and about is positively the most unsafe one. In expansion to its unpredictable structure, even the computational displaying, what's more, investigation of a pneumatic tire is a dicult and testing errand as well. the fundamental entanglement is because of the nearness of imperatives, for example, nonlinear material, nonlinear geometric conditions, and nonlinear contact limit conditions.

Ongoing development of recently imagined non-pneumatic tires (NPTs), the most widely recognized idea was the utilization of an elastomer layer with fortified rings and an unmistakable structure of spokes, tied down to the inward side of the tire and consistently dispersed around the edge. the arrangement of spokes bolster the heaviness of the vehicle and disfigure to give the padding impact precisely like pneumatic force tire Exploration on NPTs has been effectively led to enhance basic execution; e.g., contact weight, plan, and structure of flexible spokes and moving obstruction. To adapt to the developing interest for more secure tires, the idea of level verification airless tires was conveyed back home to the tires advertise by a few organizations. Because of their specific non-risky conduct and to their great steadiness, creative outlines, for example, those proposed by Bridgestone furthermore, Michelin had just picked up the consideration of scientists for specific use in military and space mission's applications. In both arrangements, the quality of pneumatic tires (PT) was supplanted by an arrangement of adaptable polygon spokes that experience a huge number of tension–pressure cycles while the tire is rolling As of late, adaptable honeycomb arrangement with various shapes, made of polyurethane (PU) has been proposed as another option for NPT spokes, to be utilized in applications that require high twisting. It was discovered that having both strength and firmness while depending solely on material properties is outlandish. Sorts and geometries of the cells are the key factors in deciding the in-plane adaptability of hexagonal honeycombs under uniaxial stacking.

Discrete Spokes Plans:

Up until now, a standout amongst the most widelyrecognizedanswersforthenon-pneumatic tires are the substitution of the air caught inside the toroidal volume around the edge by the utilization of discrete spokes, similarly circulated in the spiral arrangement, between the internal and the external rings. In such plans, the spokes assume the job of versatile components which misshape or twist as per the measure of a load connected in the spiral heading what's more, subsequently convey the required firmness. For the dominant part of the existing arrangements the principal issues are the confinement of the ride quality (straightforwardly identified with the number of spokes), the confined opposition to exhaustion in the zones of pressure fixations, the defenselessness to catching flotsam and jetsam which may make unbalance and plausibility of sound emanation because of spokes vibrations and to air dissemination through the open parallel surfaces Persistent Spokes Outline Not at all like discrete spokes arrangement, the nonstop solidness outline isn't influenced by the point of revolution of the tire, which is the primary advantage that makes this kind of tires the most reasonable regarding ride comfort.



The sequential transformation of the cross-segment is portrayed in Figure 4. The planning procedure began from a fundamental toroidal shell-like a doughnut expanded with air. at that point, the cross area shape has been adjusted a few times, from a standard shut hover, to an open circle (more advantageous for mounting and dismounting), to a more confounded shape with more outline parameters that may encourage the later improvement/ coordinating procedure between the mechanical properties of the old PT and the new NPT.

Primary parts of non-pneumatic tires:

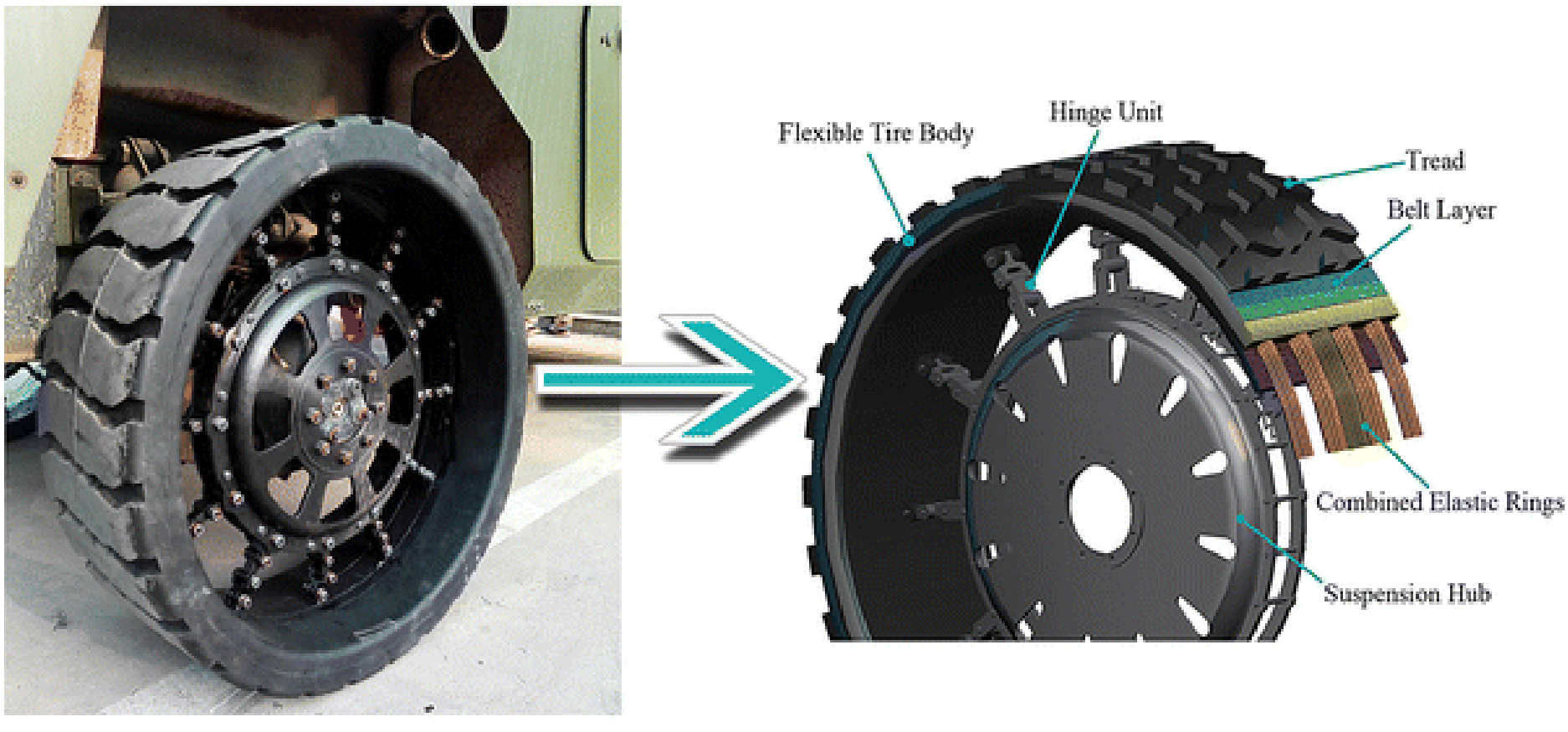
- Center point.
- Polyurethane spokes.
- Shear band.
- Tread band.

Center point:

The center point is for the most part comprised of Steel or Aluminum combination. The normal weight of the center point if its made of steel is around 4 Kg and of Aluminum composite (AL7075-T6) is 2.5 Kg. It is an unbending structure and can't disfigure while running. The edge of the vehicle is associated with the center point utilizing stray pieces simply like the center point utilized in the Pneumatic tires. It is the part in the Non-Pneumatic tire which has the longest life than some other segment. The center is an incorporated piece of the tire and can't be evacuated or supplanted. Isolating a Non-Pneumatic tire from its center point isn't as straightforward as the procedure for a tire in light of the fact that the polyurethane spokes of a tire is shaped specifically to the steel center with a bond that isn't effectively broken. The center is made by conventional throwing process simply like the making of normal centers.

Polyurethane spokes:

The disclosure of polyurethane [PU] goes back to the year 1937 by Otto Bayer and his collaborators at the research centers of I.G. Farben in Leverkusen, Germany. The underlying works concentrated on PU items acquired from an aliphatic diisocyanate and diamine shaping polyurea, till the intriguing properties of PU, got from an aliphatic diisocyanate and glycol, were figured it out. With the decades, PU moved on from adaptable PU froths to unbending PU froths (polyisocyanurate froths) as a few blowing operators, polyether polyols, and polymeric isocyanate, for example, polymethylene diphenyl diisocyanate (PMDI) wound up accessible. These PMDI based PU froths indicated great warm obstruction and fire retardance



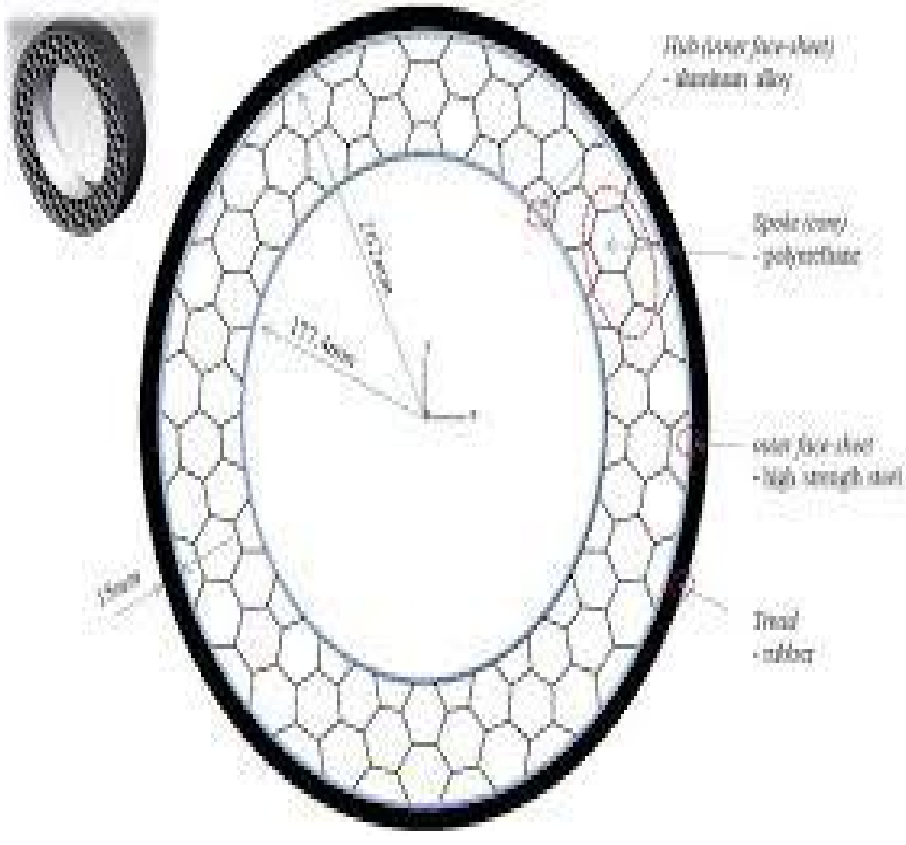
Assembling of Polyurethane:

comprise of two sections, Polyols and Diisocyanate. The Polyols are for the most part Polyesters or Polyethers and the diisocyanates are Toluene Diisocyanate or Methylene Diphenyl Diisocyanate. The response of the Polyols and Diisocyanate is an exothermic response. The prepolymer will be at a temperature of around 60 degree Celsius in the liquid state. The response of this prepolymer, with a remedial, which is abutadiene held at 40 degree Celsius will frame the polyurethane producing process includes the response of a prepolymer with a corrective. The prepolymer ane. The hardening of this polyurethane will happen at 100 degree Celsius in around 4 hours. A square outline demonstrating the arrangement of polyurethane is demonstrated as follows.

Shear Band:

It is an adaptable band which is between the polyurethane spokes and the tread band. The shear band essentially comprises of steel wire twisted in roundabout shapes. It offers fortification to the tread band from shearing off while running. Its assembling is finished with the tread band so it immovably sticks together with the tread and gives incredible cornering firmness to the vehicle. The making of the shear band includes winding steel harmony over a drum until the point when a wanted base thickness of 15mm is acquired. The material utilized as the shear band is ANSI:4340 (American National Standard Guidance codes) which is a high-quality steel.

1. Cable-reinforced band of conventional "tyre" rubber with molded tread
2. Shear band (creates a compliant contact patch)
3. Energy-absorbing polyurethane spokes
4. Hub (for connection to axle)



Tread Band:

It is the piece of the non-pneumatic tire which interacts with the street. It contains elastic hold or treads for footing and grasps out and about surface or some other territories. The outline of the tread relies on the territory in which the vehicle intended to move. The assembling procedure of the tread band is like that of the tread making in pneumatic tires which is the expulsion procedure. The expelled tread is moved on the shear band of wanted thickness so it frames the part which interacts with the ground. The entire gathering is vulcanized in order to give the elastic tread greater toughness and quality. Vulcanisation is finished by treating the elastic thread with sulfur so it shapes interfaces inside the material and winds up hard to break.

Outline Investigation of Honeycomb spokes:

Powerful in-plane modulus of hexagonal honeycombs was produced by before honeycomb engineers utilizing the bar hypothesis and these improvements are all things considered called cell materials hypothesis. The recommended honeycomb outlines of the non-pneumatic tires are as per the following.

Points of interest:

It gives an agreeable ride and builds vehicle taking care of. Its adaptability gives an expansion in the surface zone of contact consequently builds the hold with the ground. It can take weapon shoot and spikes without getting to be stable. It diminishes downtime when contrasted with pneumatic tires as it requires next to no or no support. It expands the heap conveying limit of the vehicle. It lessens the natural effects as the synthetic compounds utilized in the assembling of non-pneumatic tires are less contrasted with customary pneumatic tires.

Restrictions:

The non-pneumatic tires are costly when contrasted with pneumatic tires. The substitution of any segment in the non-pneumatic tire is inconceivable ie. each time the tire is exhausted we need to supplant the entire get together. It can withstand police spikes which may make it troublesome for law requirement. The absence of customizability is one impediment of non-pneumatic tires if once produced can't be changed or balanced. It can't be actualized in quick-moving vehicles over 50mph as the spoke vibrates impressively and is obnoxiously noisy.

-Mr. Bhavesh Chaudhari
SE MECH A

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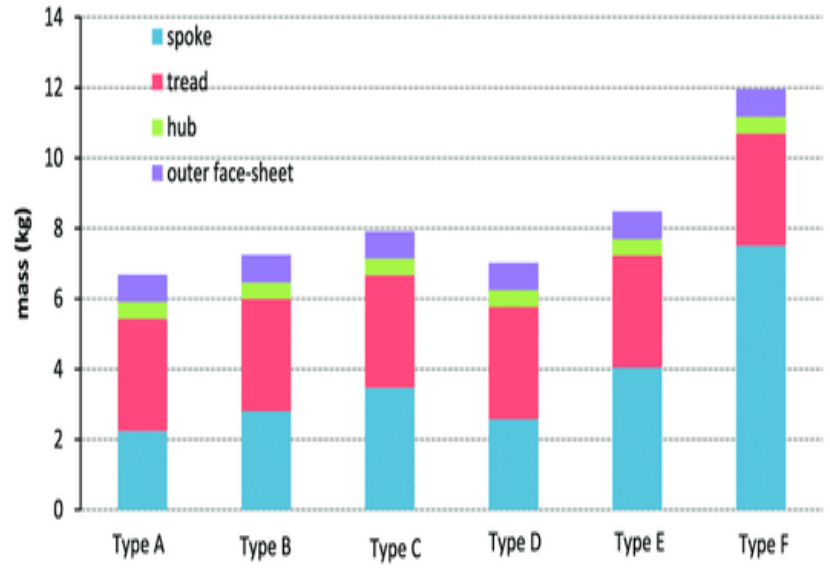
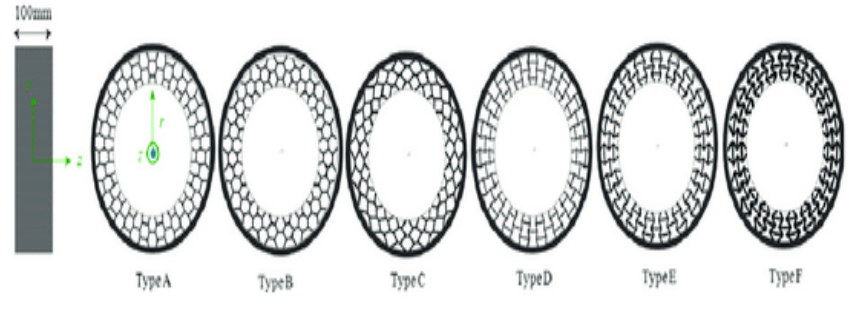
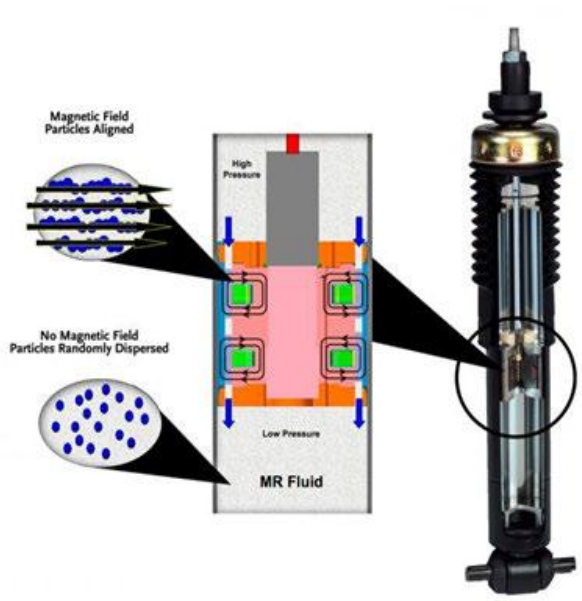




SMART DAMPING

Today, a large number of automobiles manufacturers rely on many different types of the control systems when it comes to the performance optimization. The ride quality, driving pleasure and the driving comfort are important parameters that design engineers keep in mind while designing an automobile. The main issue that hampers the performance of an automobile is vibration. The vibrations that originate in an automobile are due to the road unevenness, the aerodynamic forces and the vibrations that are induced due to the engine. A suspension system is provided in every automobile for vibration suppression. A conventional suspension system consists of a spring-type element placed parallel in a viscous fluid. The damping action is carried out by forcing the viscous fluid through a small orifice and the damping action depends on the viscosity of the fluid and on the geometry of the orifice and the damper. The fluid in these dampers are non-adaptive and can't change their rheological properties on varying conditions. The built-in drawbacks of these classical suspension system are overcome by Magneto-Rheological dampers.



A Magneto-Rheological (MR) damper comprises of a piston and electromagnet fitted in a cylinder filled with MR fluid. MR fluids are smart fluids that change their rheological properties under the application of magnetic field and turn from liquid to solid in just fraction of seconds. They are the suspensions of micron sized, magnetizable particles suspended in an appropriate carrier liquid such as mineral oil, synthetic oil, water or ethylene glycol. When a current is passed through the electromagnet present in the damper, a magnetic field is developed. Under influence of magnetic field, the suspended magnetic particles interact to form a chain like structure that resists shear deformation or flow leading to a change in viscosity. The effect is immediately reversible if the magnetic field is reduced or removed and hence by controlling the amount of current through the electromagnet, damping rate of the damper can be changed.

The MR technology has been developing competitively because of its advantages such as mechanical simplicity, high dynamic range, low power requirements, large force capacity and robustness. While it offers a compromise solution for the two conflicting requirements of ride comfort and vehicle handling, magnetic particle sedimentation and heavy weight of dampers still remains a problem. The challenge ahead lies in developing the Magneto-rheological damper at industrial level in more controlled way.

-Mr. Harsh Chaurasia
SE MECH A

Unveiling New Technologies

AIR CARS

Introduction:

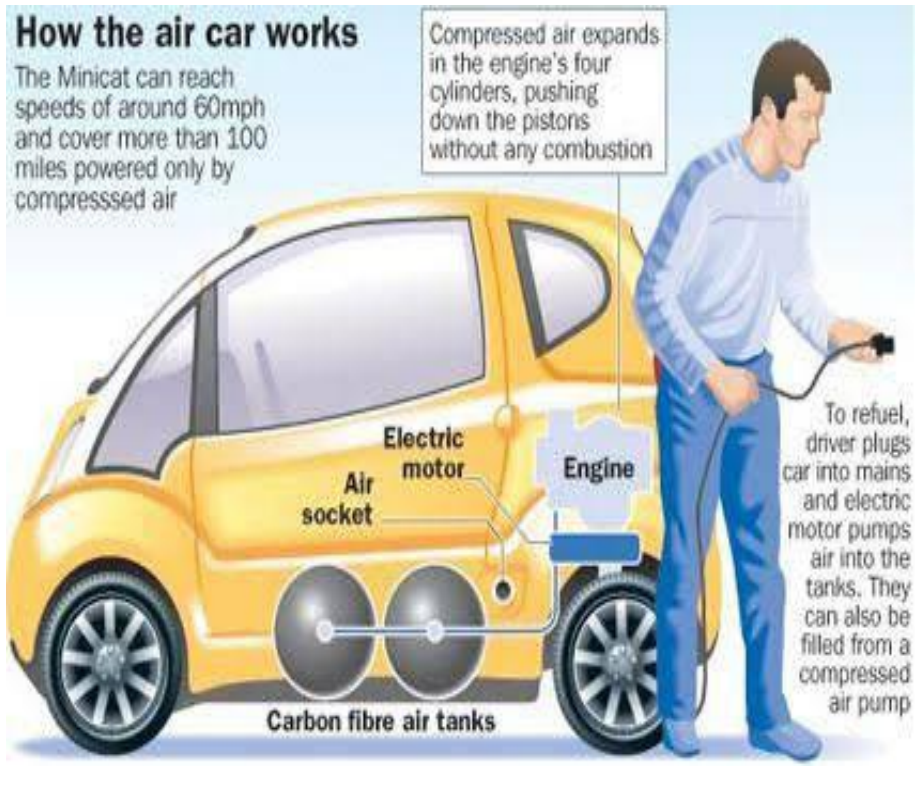
The air auto is fueled via air motor. It is an outflow free cylinder motor utilizing compacted air as the fuel. It was created by Guy Negre French designer in 1991. Rugusci began up Regusci Air and Di Pietro began up Engine Air. He imagined a double vitality motor running on both compacted air as on normal fuel; at that point figured out how to make a packed air just motor, and enhanced his plan to make it all the more intense in the 15 years.

Technical Details:

a) Compressed air tanks(CAT's) - The compacted air tank is a glass or carbon-fiber tank, hold 90 cubic meters of air packed to 300 bars. This framework isn't unsafe in the event of a mischance as there is no danger of task. On account of a noteworthy mishap, where the tanks are burst, they would not detonate since they are not metal, rather they would split, as they are made of carbon fiber. The tanks in CATs vehicles are made out of an inside thermoplastic compartment which guarantees it is impermeable, is held in a wound and crossed carbon fiber shell. The tanks utilized in the CAT's vehicles should keep going for a time of fifteen years, to be tried like clockwork. The tanks weigh 35 - 40 kg for 100 liters of air at 300 bars.

b) The Car Body - The auto body is worked with fiber and infused froth. Two principle favorable circumstances: cost and weight. Nowadays the utilization of sheet steel for auto bodies is simply because it is less expensive to serially deliver sheet steel bodies than fiber ones, be that as it may, fiber is more secure it doesn't cut like steel, is less demanding to repair, it is stuck, doesn't rust and so on.

c) Electrical framework Guy Negre procured the patent for an intriguing innovation for introducing electrics in a vehicle; utilizing a radio transmission framework, each electrical segment gets signals with a microcontroller. So as opposed to wiring every segment (headlights, dashboard lights, lights inside the auto, and so forth), one link interfaces every electrical part in the auto, preferences are the simplicity of establishment and repair, the expulsion of the roughly 22 kg of wires no longer fundamental, additionally the whole framework turns into an enemy of robbery caution when the key is expelled from the auto.



Advantages:

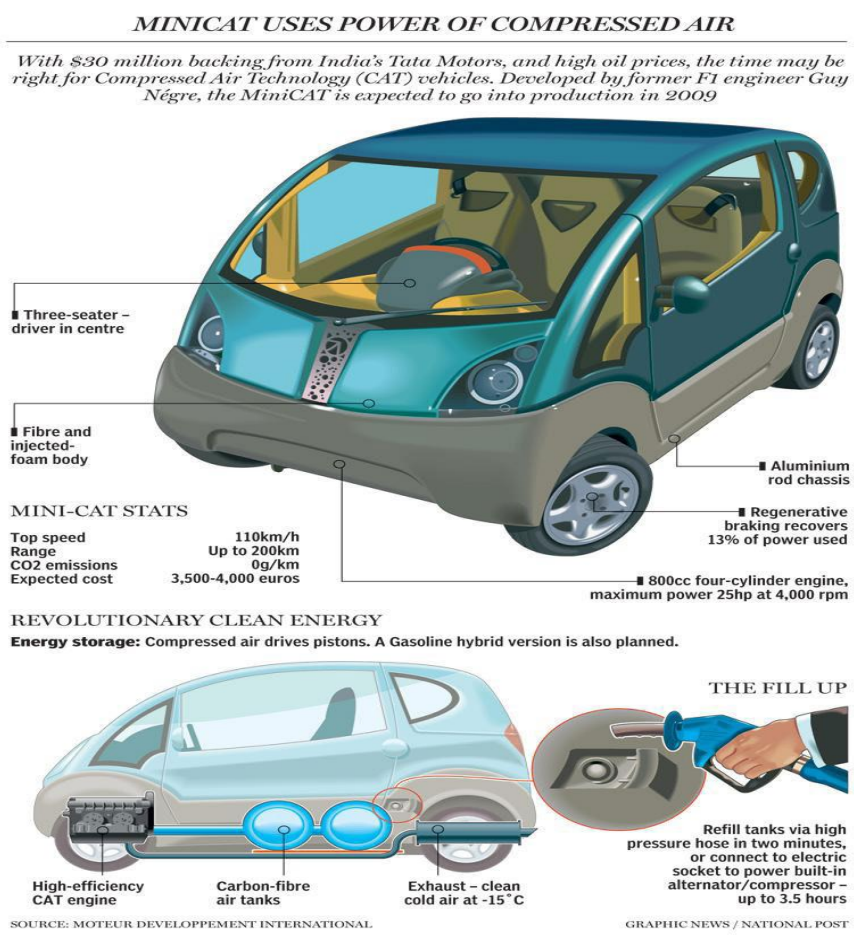
1.With best speeds around 65 mph and a scope of more than 100 miles, compacted air autos offer higher proficiency than most electric autos.

2.Its solitary emanations are cool air.

3.Some packed air auto models as of now accessible in exceptionally restricted amounts are extremely economical (under $15,000)

4.No extra framework is important to help compacted air autos.

5.The oversimplified mechanical plans of the packed air auto are straightforward, and won't be helpless to the sorts of harm expedited by battery utilize and burning.



Disadvantages:

1.The direct expected to pack the air requires electrical energywhich is right now created utilizing for the most part petroleum derivatives.

2.Restricted capacity limits of the packed air tank.

3.A tank containing 30MPA packed air is hazardous and unsafe.

4.Low boot space, as packed air auto, will have a compacted air tank.

5.Running the vehicle on compacted air will require the arrangement for filling the packed air in the tank.

Conclusion:

The air auto is a perfect, simple to drive, elite auto. Moteur Developement International (MDI) Luxembourg has accomplished what the huge auto fabricates have guaranteed in a hundred years time. The final result is a light weight vehicle that can achieve accelerates to 220 km/h (despite the fact that as far as possible is 120), does not dirty like twentieth century vehicles and does not take a lifetime to satisfy. The rule focal points for an air controlled vehicle are: Fast energize time, Long capacity lifetime (electric vehicle batteries have a constrained helpful number of cycles, and in some cases a restricted logbook lifetime, independent of use),Potentially bring down introductory expense than battery electric vehicles when mass delivered.

-Mr. Mihir Gohil
SE MECH A

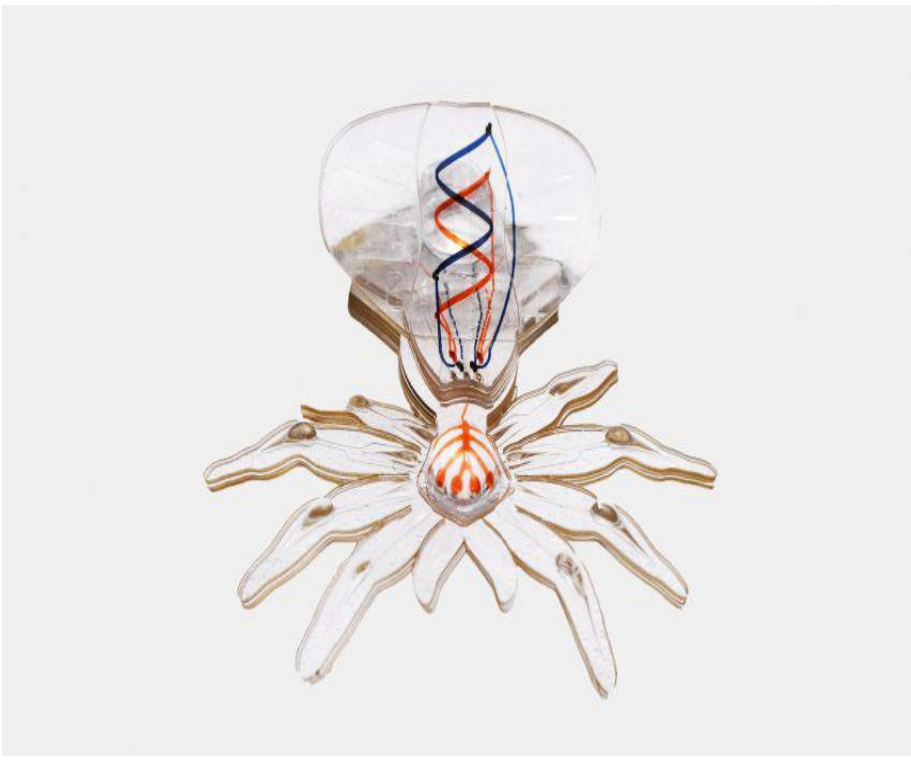
MORPH TECHNIQUE

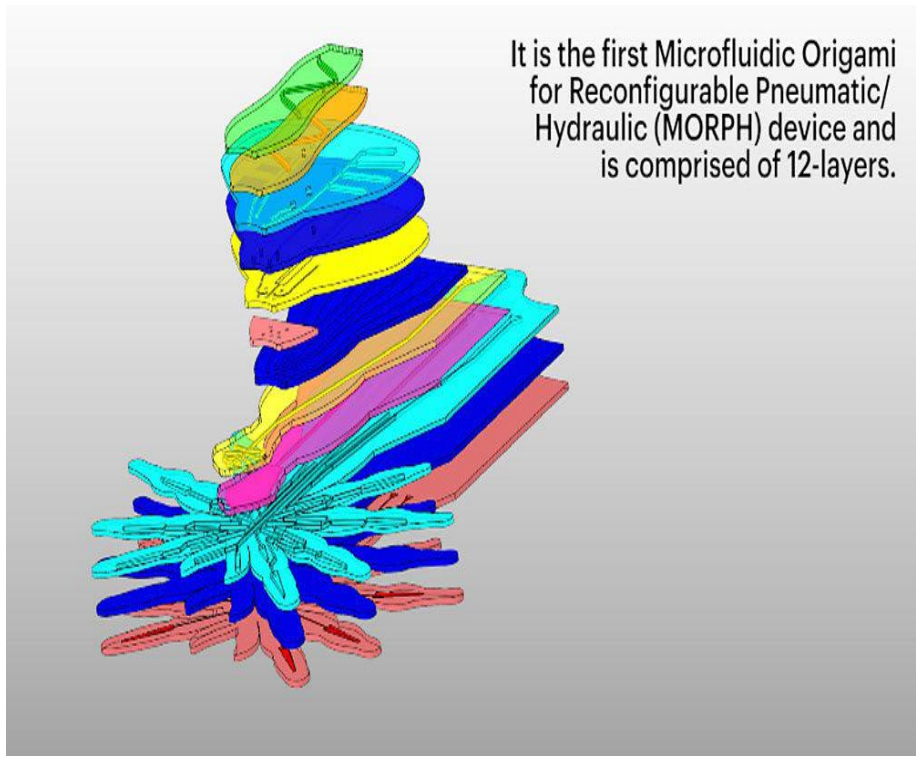
From the last few decades, development of robotics has increased in leaps and bounds. Robots are being made with the centimetre scale but one with a millimetre scale was never heard of. This has been made possible by a team of Harvard's Wyss Institute Of Biologically Inspired Engineering. They have successfully created a technique to manufacture minute robots of the scale millimeter. To demonstrate this technique, they have created a soft, spiderlike robot with colored eyes and moving body parts.

To fabricate soft robots on such small scales, the team first used a soft lithography technique to generate 12 layers of an elastic silicone which together constitute the soft spider's material base. Each layer is precisely cut out of the mould using lasers and bonded with individual layers to create a rough 3D structure. This lithography is done on Microfluidic Origami for Reconfigurable Pneumatic/Hydrolic (MORPH) devices. Lithography or planographic printing process is the one that makes use of the immiscibility of grease and water.

Key to changing this intermediate structure into the final design is a pre-conceived network of hollow microfluidic channels that is integrated into separate layers. Injection-induced self-folding, is the third technique which is used to pressurize one set of these integrated microfluidic channels with a curable resin from the outside. This induces pressure on individual layers, and with them also their neighboring layers, to bend into their surrounding final configuration, which is fixed in space when the resin hardens.

The set of the remaining integrated microfluidic channels were used as additional actuators to colorize the eyes and simulate the abdominal color patterns of the peacock species by flowing colored fluids; and to induce walking-like movements in the leg structures.



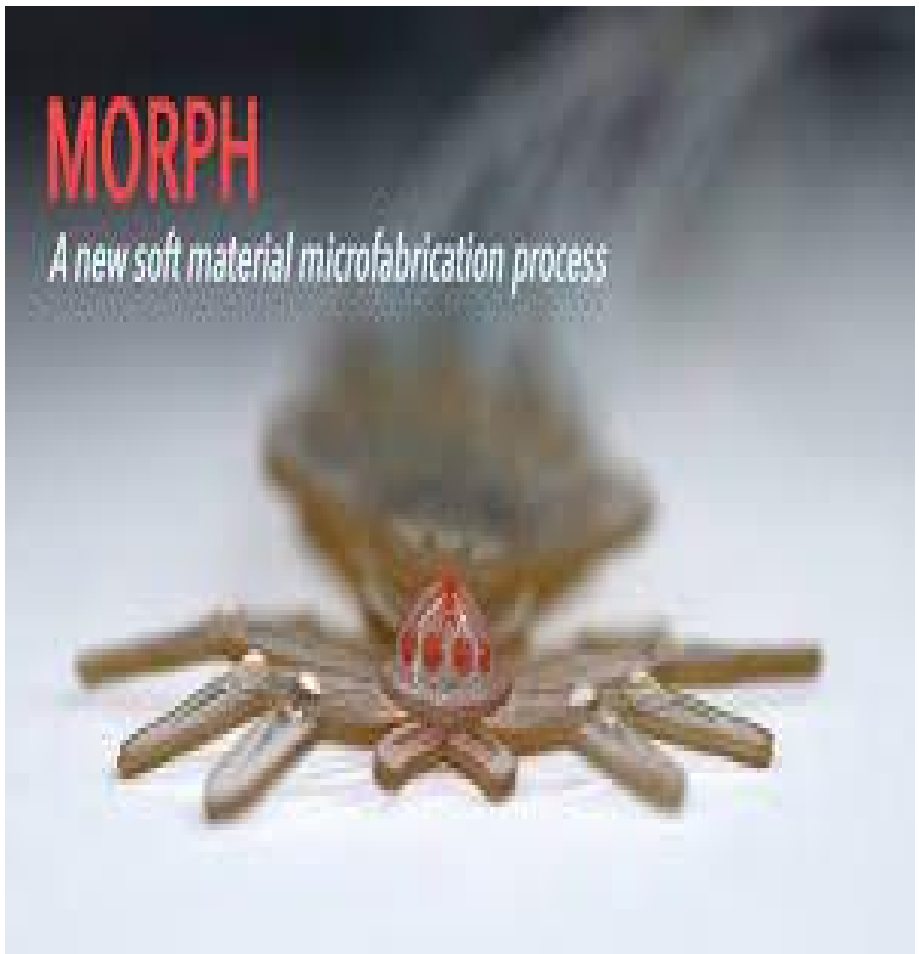


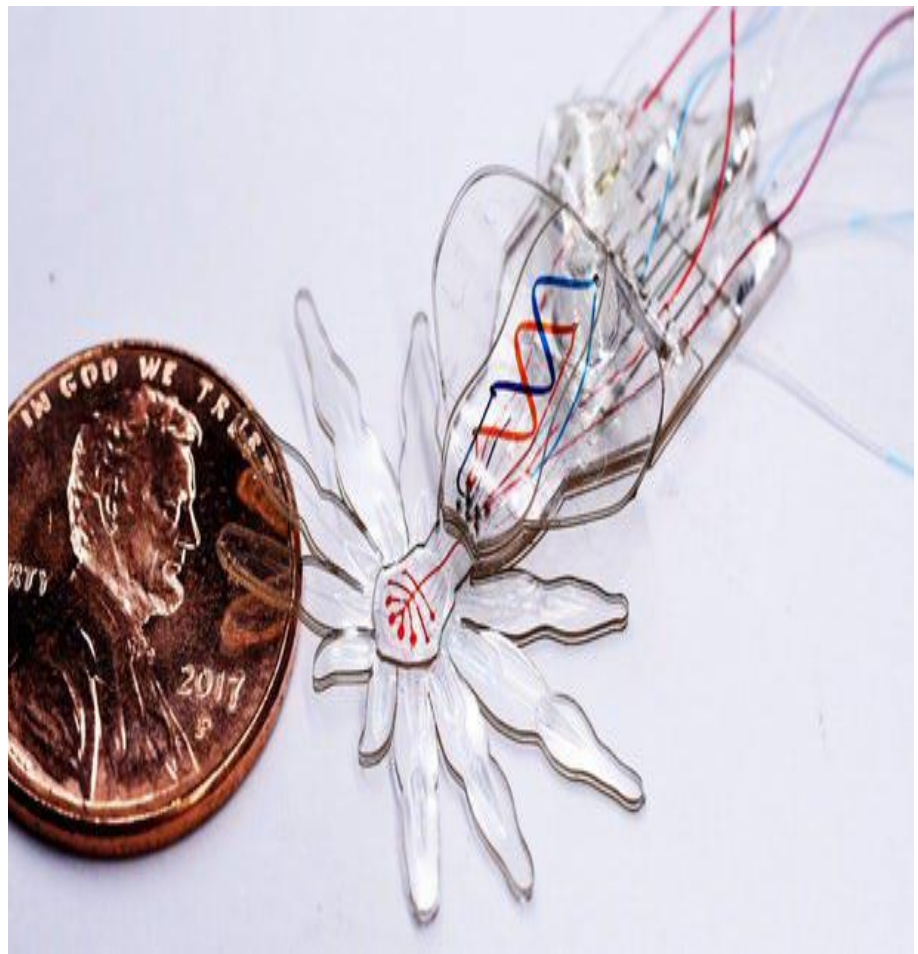
The study of microfluidics deal with the study of flow of liquids inside micrometer-sized channels. In order to consider it microfluidics, at least one dimension of the channel must be in the range of a micrometer or tens of micrometers.A microfluidic chip is a set of micro-channels etched or molded into a material (glass, silicon or polymer). The different micro-channels which later form the microfluidic chip are connected together in order to achieve the needed features.

This origami-like folding process can be controlled by varying the thickness and relative consistency of the silicone material, which is adjacent to the channels across different layers or by laser-cutting at different distances from the channels. During pressurization, the channels then function as actuators that induce a permanent structural change.

This network of micro-channels trapped into the microfluidic chip is connected to the outside by inputs and outputs pierced through the chip, as an interface between the macro-world and micro-world. It is through these holes that the liquids or gases are injected and removed from the microfluidic chip through tubing, syringe adapters or even simple holes in the chip with external active systems (example: pressure controller, push-syringe or peristaltic pump) or passive ways (example: hydrostatic pressure.

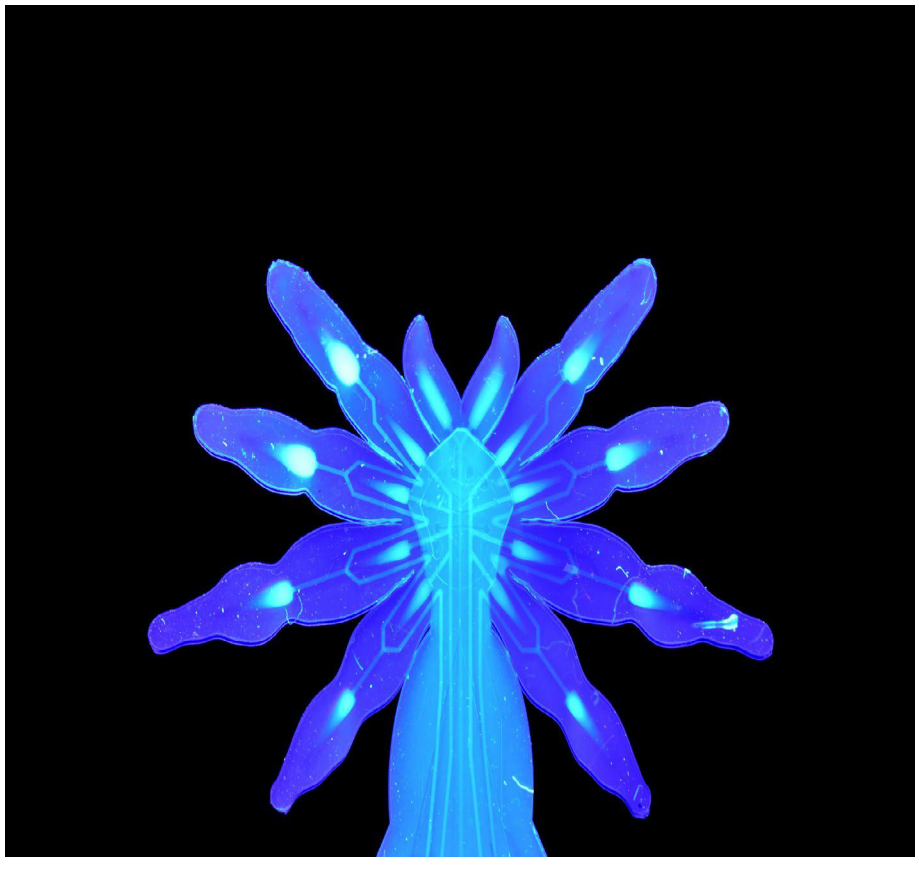
Usually such robots on millimetre scale have only one degree of freedom, which means that they can only actuate one particular change in shape or type of movement. The team was able to give the spider eighteen degrees of freedom encompassing changes in structure, motion, and color, and with tiny features in the micrometer range.

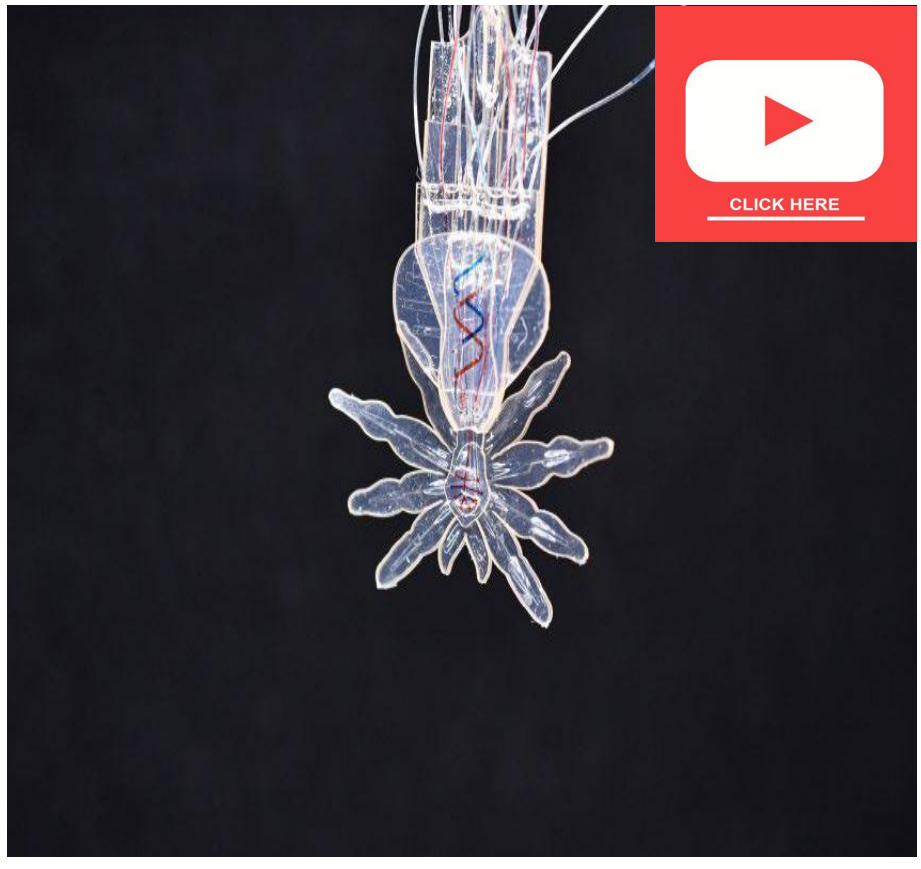




The MORPH approach could help open the field of soft robotics to researchers who specialize in medical applications where the smaller sizes and flexibility of these robots could enable an entirely new approach to endoscopy and microsurgery. These techniques are primarily used to surgically join small blood vessels (arteries and veins) and to coapt nerves. Microsurgery will later prove to heal wounds, restore function after trauma, and restore form after cancer. It could also assist in the recovery and healing of a wide array of medical issues, from emergency amputations to reconstoration of the human breast.

-Ms.Bhavika Sakpal
SE MECH B





MAKING THE FAST, FASTER

The thrill of witnessing a Ferrari roar to life is inexplicable. It's been five years since the 458 Speciale conquered the tracks with its banshee 9000rpm rev limit, and now, arrives the track-honed version of the twin-turbocharged 488 GTB. The 488 Pista is Ferrari's latest Challenge car.

With a stunning 182bhp per litre the key figures are now 710bhp and 770Nm of torque, but the loss of 18kg from the engine alone is extremely impressive. The cylinder heads have been reinforced along with the pistons, while new titanium connecting rods are approximately half the weight of the standard ones. The mesmerising Inconel exhaust manifold is a work of art in itself, and accounts for a 9.7kg weight saving, and with the twin-scroll turbochargers now have integral speed sensors that enable a more precise, balanced control between the two of them.

The aim has been not just to increase power, but also to improve the throttle response and of course, to save weight. The car's kerb weight is 1385kg (or 1280kg 'dry') and it could all be possible because of carbon fibre body panels and other weight-savings throughout. The cooling system has also undergone some transformation, which now has radiators that lie down backwards in either corner of the nose for better weight-distribution and drag. The hot air now exits through the floor, generating an aerodynamic fairing around the front wheels and keeping its distance from the side intake as it flows through the tank. The large holes which used to be sources of air-intake are now on the rear deck, mainly for the larger intercoolers that can sit higher, and thus work more efficiently. Most obvious change is the F1-inspired 'S-duct' that forces the passage of air through a narrow opening before letting it out over the fine bodywork. The changes in the chassis are relatively minor as even the anti-roll bars are unchanged.

Other specifications of the model:

1]Transmission : seven speed F1 DCT, rear wheel drive.

2]Front suspension : Double wishbone, coil springs, adaptive dampers, anti-roll bar.

3]Rear suspension : Multi-link, coil springs, adaptive dampers, anti-roll bar.

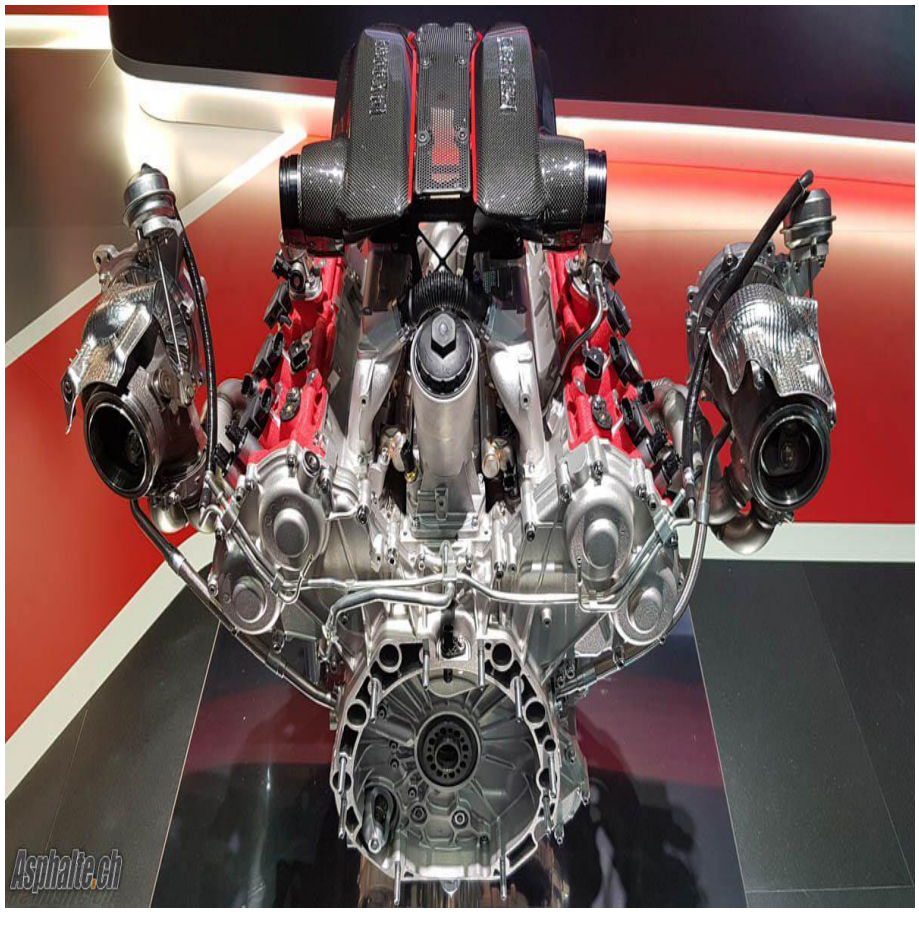
4]Brakes : carbon-ceramic discs.

5]Power-to-weight ratio : 521bhp/ton

6]Top speed : 340kmph+

The Pista's turn-in is typically fast, its steering light not overly so, and its unerring precision just occasionally undermined by a very slightly artificial response on self-centring. It's that precision which helps unlock the Pista's front end , which seems to have a perpetual supply of grip on turn-in. That's the amazing thing about Pista: all violence in one moment, deft precision in the next. Ferrari has clearly met its targets when it comes to an excellent throttle response for its turbocharged V8. A turbocharged engine effectively uses recycled exhaust gases to increase power. This engine has eight cylinders mounted on the crankcase in sets of four, driving a common shaft, it is put to work only when required. When the car accelerates, the engine is put to work…but when the car reaches its constant cruising speed, the load on the engine is reduced and the V8 then deploys four of its cylinders. The eight cylinders work in absolute synchronisation to improve the car's performance.

-Ms.Aahana Tiwari
SE MECH B



CLICK HERE

HYPERLOOP TRANSPORTATION TECHNOLOGY

Hyperloop is the concept proposed by 'Elon Musk' in year 2012 and his vision to build the fastest mode of transportation which he named Hyperloop Transportation Technology (HTT). In year 2015 the US companies 'Tesla' and 'Space X' collaborated to work on the Hyperloop concept commercially.

Concept:

•Vactrain is a vacuum tube train which is designed for high speed rail transportation. It is a maglev levitation line using partly evacuated tubes or tunnels.

• These tubes or tunnels are made of steel to create vacuum and total air resistance to permit Vactrains to travel at very high speeds with relatively little power upto 6,400-8,000 km/hr. This is 5-6 times the speed of sound in Earth's atmosphere at sea level.

•If these trains could reach the predicted speeds, they could surpass aircrafts as the world's fastest mode of public transport.

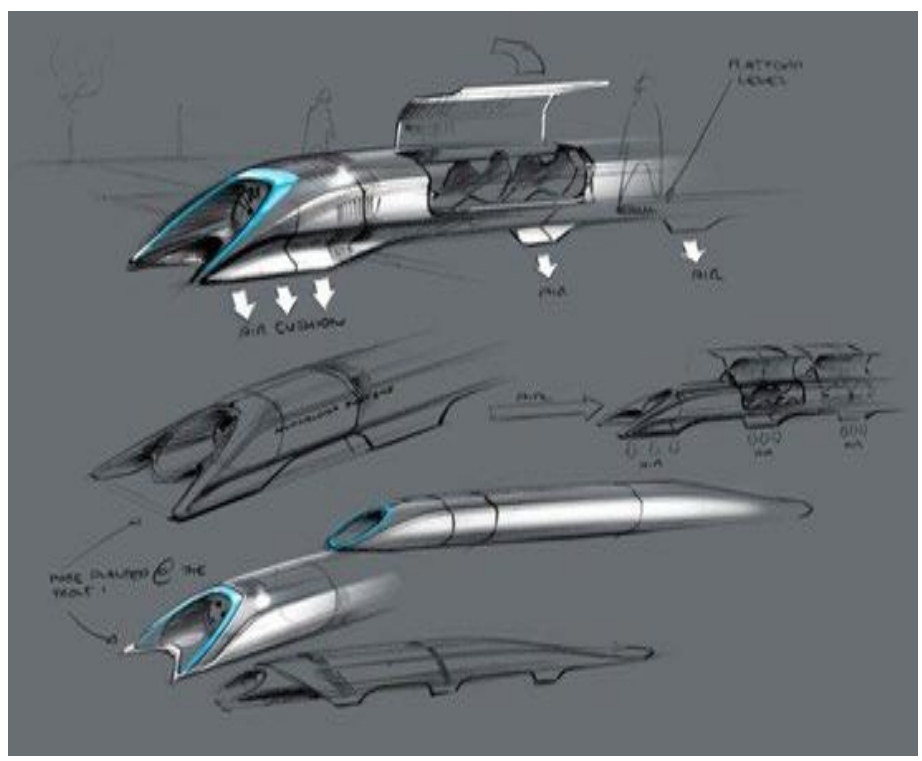
Design:

Hyperloop Transportation Technology runs inside a vacuum steel tube on a Maglev line and people are transported through a 'Capsule'.

•The Capsule is designed in such a way that the Axial Compressor will be in the front part, the passenger will be sitting in the middle part, the Batteries will be in the rare part and Air Casters in the below area of the capsule.

•The Capsule is driven by 'Linear Induction Motor' and 'Axial Compressor'.

•Linear induction motor maintains the linear or straight motion of the capsule and it is located along the Tube which would accelerate and decelerate the capsule to appropriate speed for each section of Tube route.



•Axial Compressor and ‘Inlet Fan’ are placed in front of the capsule to actively transfer high pressure air from the front part to the rear part of the Tube which benefits of high efficiency and large mass flow rate particularly in relation to their size and cross section. It also resolves the problem of air pressure slowing down the vehicle.

•These capsules rides on ‘Air Bearings’ on levitated line and each capsule floats 0.5 to 1.3mm layer of air provided under pressure to Air Caster similar to how packs are levitated above on air hockey table.

•The capsule is designed such that 6-8 passengers can accommodate in 1 capsule and there are 3 capsules in each Hyperloop train.

Practical test:

The projected speed with the passenger ‘Pods’ reach a top speed of 1,220 km/hr to maintain Aerodynamic Efficiency. The design proposes that passengers experiences a maximum inertial acceleration of 0.5g, about 2-3 times that of a commercial airlines on takeoff and landing.

Conclusion:

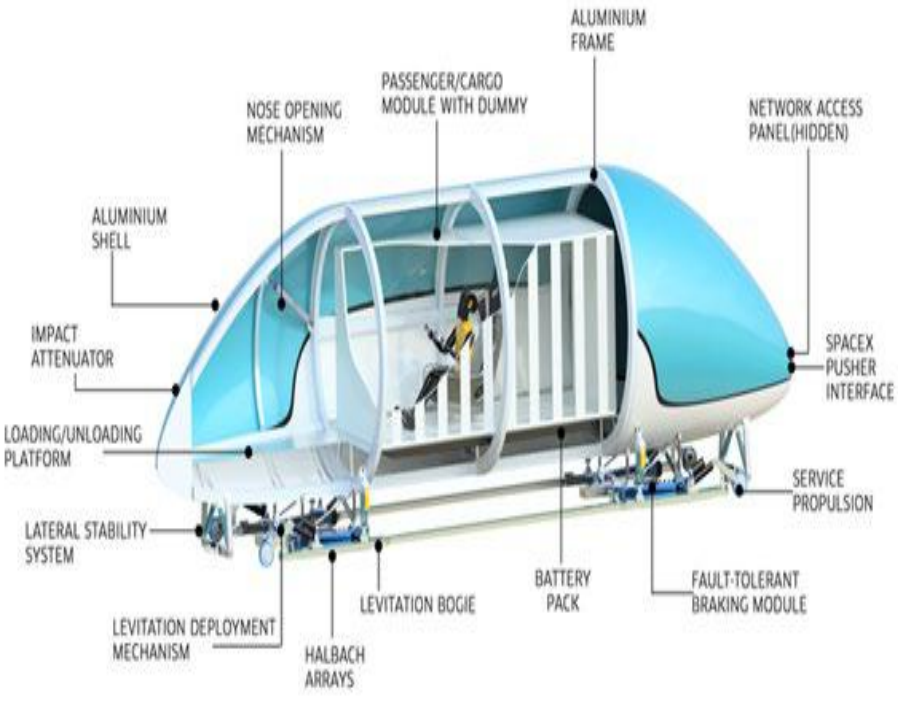
Hyperloop Transportation Technology is a new phase of technology which should be incorporated commercially as it will be the fastest mode of public transport and it also works on renewable energy which is environmental friendly. Hyperloop is different from the conventional mode of transport in following ways.

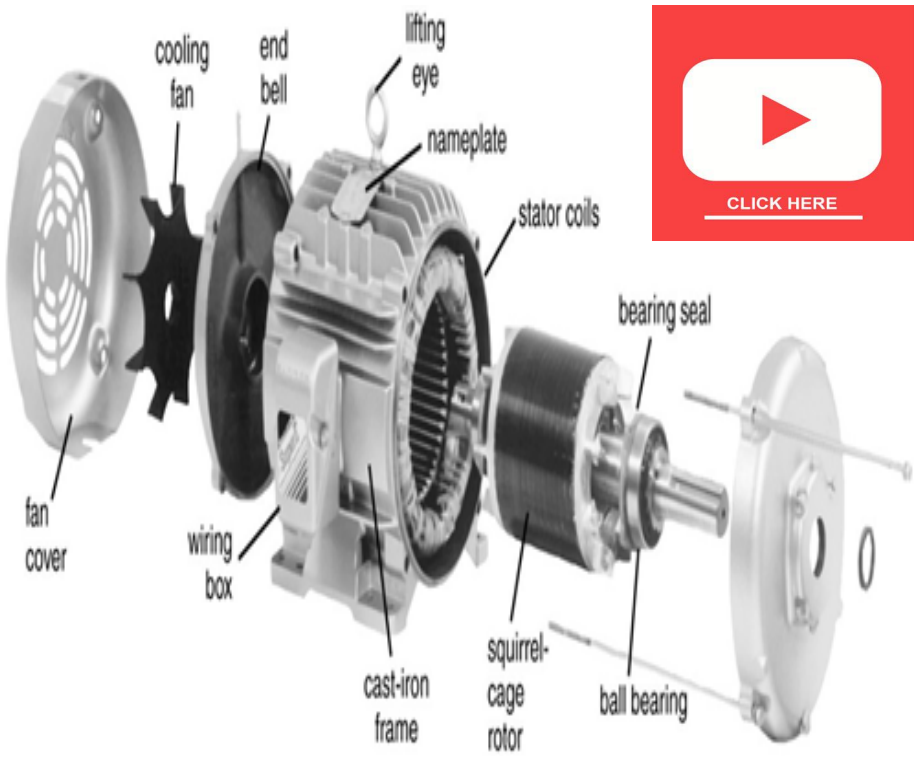
•No air resistance because it runs inside a vacuum tube.

•No frictional loss because of Maglev levitation.

•It achieves a top speed of 1,220 km/hr which is highest among the other public transport.

-Mr.Manas Ghumare
TE MECH B





Interviews

BHARAT FORGE LIMITED

SOMALINGA M SHIVAKUMAR

VICE PRESIDENT,

BHARAT FORGE LIMITED,

DEFENCE

BHARAT FORGE | KALYANI

Type:	Public company (Bombay Stock Exchange BSE & NSE)
Industry:	Forging Metals Machinery Engineering
Founded:	1961 by Dr. N.A. Kalyani
Headquarters:	Pune, Kharadi Maharashtra, India
Key people:	Baba Kalyani Chairman
Products:	Front axle assembly and components, general engineering equipment, hydraulic and mechanical presses, bandsaw machines for cutting metallic rounds, couplings and material handling equipment

1.Can you give us your brief introduction?

The company has a 10,000 strong, highly skilled, global base of engineers and technicians at its various manufacturing locations. BFL's global forging capacity is the largest in the world and has achieved global leadership. The company's USP lies in the full service supply capabilities that it has developed. These range from product conceptualization to design, manufacture, machining, testing and validation. Based on these, the company has built strong, sustainable and durablecustomerrelationshipswhichhaveresulted in the company's partnering with customers in their long term product development programs.

2. Can you tell us about the Company and its operations?

Bharat Forge Ltd. (BFL), the flagship company of the USD 2.5 billion Kalyani Group, is the world's largest forging company with manufacturing facilities spread across India, Germany, Sweden, France and North America. Bharat Forge manufactures a wide range of high performance, critical & safety components for the automotive & non-automotive sector. It is India's largest manufacturer and exporter of automotive components and leading chassis component manufacturer in the world. BFL's customer base includes virtually every global automotive backed by several decades of experience in component manufacturing & metallurgy, the company is now looking beyond automotive and has embarked on an ambitious and exciting journey.

3. Bharat Forge is amongst the Top innovative companies in India. How important is it to have a spirit of innovation and how can engineering students develop this spirit?

The Kalyani Group strives to be a world class organization and a leader in every aspect of its business. The spirit of innovation fuels us to aggressively grow our businesses by accessing global markets, to deliver products and services of uncompromising quality and integrity, consistent with the Kalyani brand and image. Our business has flourished with innovation at its core in every facet of our operations. It is considered necessary to imbibe a spirit of innovation for success in today's competitive business environment. Engineering students can develop this spirit by inculcating keen observation skills and learning to innovate in problem solving including processes. Old ideas and concepts could be applied innovatively to solve new problems.

4. What skills do mechanical engineering students need to develop to become successful professionals?

In my opinion, the key skills to success for any engineer are: Knowledge of fundamental concepts and Practical knowledge for solving real-world problems in their field; Teamwork; Time management; Knowledge of software packages with a specific level of proficiency dependent on role; Problem Solving beginning from Concept development, Detail design, Analysis, Testing and culminating in Production; Creativity; Communication skills (both verbal and written) are also critical to success; and Intellectual Curiosity, constant desire to understand and apply.

5. How can students bridge the gap between the university-curriculum and industry requirements?

There is arguably a gap between academia and industry as per recent statistics. While joint efforts between the industry and academia to address this problem are underway by aligning curriculum with industry requirements, emphasis on skill based education, up-skilling of faculty etc. the students can pursue parallel efforts in bridging this gap. The students could have workplace exposures through internships, live part-time projects, and corporate interactions. These also provide practical insights about how the industry operates and exposes students to current realities of the workplace and boost students' confidence as they absorb by being present in the work environment.

Questions pertaining to Defense sector

6. What challenges lie ahead in terms of skill levels in India and the business environment?

Challenges in terms of skill levels in India will emerge due to ever advancing technology especially in the defence sector. Innovation will once again play a pivotal role in shaping future defence solutions (both in products and services) especially when operating with dual use technologies. The business environment would be shaped mainly by the demands of emerging markets. Challenges posed by asymmetric threats and unconventional proxy warfare would have to be countered.

7. What kind of projects/ orders do you hope to execute in the future in India or abroad?

The Kalyani group is focusing essentially on artillery systems, ammunition including fuzes, combat vehicles including the Futuristic Infantry Combat Vehicle (FICV). The company also hopes to make a significant entry into the Air Defence (AD) market with AD guns and short range missiles.

8. We hear that the Indian Government is opening up Defense sector to Private players. What is the scenario on ground?

One of the focus areas of the present government is a thrust on 'Make In India (MII)' and defence is one of the key sectors identified as part of this initiative. Several policies and procedures are being aligned towards promoting MII and the latest Defence Procurement Policy-2016 (DPP-2016) enunciates re-vitalizing the defence industrial ecosystem through Strategic Partnerships (SP). Defence procurement is being replaced by a spectrum of emerging business models, ranging from the traditional procurement of equipment, via acquisition of equipment and support, to acquisition of capability and availability. The concepts of SP and Developmental Partnership have emerged as a consequence of this new approach.

9. What skills does a mechanical engineer require to work in the Defense sector?

As brought out earlier, I would again underscore the importance of a comprehensive foundation of fundamentals with practical knowledge, teamwork essential in today's competitive environment, creativity, curiosity and sound communication skills as the key skills to success for a mechanical engineer.

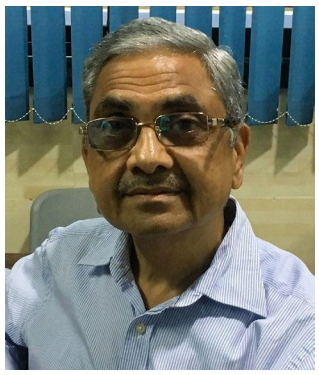
10. Any other thing you would like to add?

I would like to add here that the key to successful career in any field today would be hard work and constant focus towards excellence in small little steps.

11. Your concluding remarks and word of advice to students

I would encourage students to identify their key strengths and weaknesses before choosing any specific domain of their liking in mechanical engineering. Summer internships, projects and interactions with industry (seminars and guest lectures in college) would possibly provide answers to the emerging queries in young minds. Once you choose, give it your best shot and I am sure that success would certainly follow.

B.E.M CO PVT LTD



Name- Mr. Umesh Gupta

Designation-Director

Company- B.E.M Co Pvt Ltd

Q- Can you tell us about your company?

My company's name is B. E.M private Ltd. It is situated at Charkop, Kandivali west. We make beams and trolleys.

Q-What skills is required for working in industry?

Students should have a complete knowledge of the engineering curriculum. It is important that students have a complete understanding of their syllabus. Many problems in the practical world, can be solved by using the mix of the various knowledge that they have gained in 4 years. It is important that students should have the basic knowledge of the curriculum. I have noticed that the new batch have very less knowledge of their own syllabus.

Q-Do you think internships play an important role in holistic development of a student?

Yes, I do think internships are important for students. They help in gaining practical knowledge. Internships also give an in depth knowledge of a topic. Internships assist in getting a better understanding of the subject.

Q- What soft skills does a student require to work in a core industry?

Knowledge about the curriculum is important. We have observed that students have about 10% of the curriculum knowledge. Also, practical knowledge is important. Other skills such as communication skills, bargaining skills and behavioural skills give the student an edge over others.

Q-What future trends do you think will be coming in mechanical engineering?

Mechanical engineering will go through tremendous change. In the next few years, the entire mechanical systems will be very different. It is very important that the students of the present batch should be induced to know more about IoT, which will be soon linked with our industry. Automobile and thermal engineering will be some areas where there will be a huge changes.

Q-What advice would you give to our student?

You should work hard during your 4 years of engineering. Keep track of various new technologies that are coming every day. Involve yourself in projects that will give practical knowledge.

ALUMNI INTERVIEW

Name- Mr. Shubham Dubey
Company- L&T Infotech
Domain- Quality Assurance
Graduated from TCET in 2017

Type:	Public
Industry:	Conglomerate
Founded:	Bombay, Bombay Presidency, British India (1938; 80 years ago)
Headquarters:	L&T House, N.M. Marg, Ballard Estate, Mumbai, Maharashtra, India
Key people:	Group Chairman A. M. Naik, S. N. Subrahmanyan (CEO & Managing Director)
Products:	Heavy equipment Electrical equipment Power Shipbuilding Defence

Q- Can you tell us about your journey in college?

We had this subject called SPA and our teacher taught so well that it became my favourite subject. Everything went smoothly and I scored well. I also enjoyed all the industrial visits and cherish the memories. I did well in all the interviews because of the training provided by Training Placement Cell. It really helped me to do well and I am here because of those grooming sessions.

Q- How and when did you decide your domain?

As I told you earlier, SPA was my favourite subject and since then I always had an inclination towards coding. I learned new programming languages too. My logic-building abilities were excellent and I had a knack for designing algorithms quickly. I even helped many classmates in coding for their arduinos. I also enjoyed Mechatronics thoroughly. I was sure that I wanted to work in an IT Industry as I was very passionate about coding.

Q- How does the curriculum train you to solve problems in real life?

In engineering, you get to learn a lot. Our curriculum is very debilitating and in order to survive and do well, we have to work smartly. For example, we can complete assignments on time and still score well on tests. We learn how to manage time and work efficiently. We learn the “problem solving approach” and that is what counts in real life. Engineers can work in any industry and totally own it.

Q-What skills are hunted for in an IT-Industry Interview?

When I went for the interview I was completely groomed by our TnP cell. The interviewers usually check your logic building ability within the given time. They give you either a simple program or a complex algorithm. Your soft skills are observed and emphasised on.

Q- As a mechanical engineer, how are you treated in your industry?

There is no discrimination between a mechanical and an IT engineer in the industry. In the beginning everyone was trained together so we all are at the same level. Some are actually awed by my coding skills despite my bachelors in mechanical engineering.

Q- Is post graduation essential in order to get a good post in the industry?

Yes, there is a lot of competition and many brilliant minds for you to tackle. In order to do well, you have to be either extraordinary in your field or do post graduation. That will reduce the competition to a certain extent but it will still exist. I feel that post graduation will definitely give your career a boost.

Q- What are your plans for the future?

I want to continue working and then pursue an MBA after a few years. Our professors always motivated me by telling me that I have good managerial skills. It is also my interest because being the class representative throughout engineering taught me a lot.

ALUMNI INTERVIEW

Name- Ms.Hetal Ganesh Gohil

Company- Aditi Die Cast

Domain- Manufacturing

Q- Can you tell us about your journey in college?

My journey in college is very memorable. I was a very sincere student since first year, but I still got two kts in Mechanics and BEE. Then in the second year, I did not understand Fluid Mechanics much, but our professors encouraged me and constantly helped me throughout to clear all my doubts. I passed everything thereafter, with excellent marks. I would like to thank our professors for their incessant support.

Q- How and when did you decide your domain?

I was always interested in power plant engineering. In the second year, I did an internship in Uran where I got the opportunity to quench my thirst for knowledge. That was when I decided that I wanted to work in the power plant engineering sector. I stood second in the University in that subject. But that was not somewhere fate took me, because I now work in a Casting Industry and I love it.

Q- Which skills helped you to bag a job in the core company?

At that time, I was the first girl the interviewer had ever interviewed for a job in a core industry. He began with asking me, “What is the least count of the Vernier Caliper?”. I answered his question with ease, after which he asked me various basic technical questions. After I got selected, I was told that I had one month to prove myself. I worked very hard and dedicated myself completely to this job. So, according to me you need to know your basics very well and you should always be ready to learn more.

Q- As a female, how has your experience been working in a Casting Industry?

There is absolutely no gender discrimination in the Industry. Everyone works together in harmony. Me being an engineer, the workers on the shop floor expect me to solve their problems and fix any machine. They don't care if I'm a woman, they simply expect me to fix their machines so that they can continue working. The best part about working in the industry is, that you get to enhance your leadership skills because you have to work with the workers and maintain superiority at the same time.

Q- Do Internships play an essential role in a student's holistic development?

Yes, they do. I think that everyone must do at least two internships. The experience that you get is very valuable and you can actually see what you're studying in your curriculum. They help you to gain the practical knowledge that you lack. But internships help you only if you are ready to observe and learn.

Q- What advice would you like to give to the students of our department? How should we effectively utilise these four years?

The first thing is, never stop learning. You should always keep your mind open and be ready to learn more. This attitude is what the companies are seeking these days, and it will take you ahead in life. Secondly, attend lectures and clear all your concepts and doubts. The professors are always ready to help you, and believe me, it makes them happy. Thirdly, apply for Internships. They help you far more than you think. If you have seen something then you can clearly describe it in your exam and get good marks. The fourth and most important point decide what you want to do after graduation in the sixth semester itself. You will save time and be able to prepare well for the exam or interview.

Q- What are your plans for the future?

Well, I want to continue working for some years and eventually open my own Foundry. I want to hire the transgender people to improve their quality of life. Many of them have began working, but there are many out there who struggle to make ends meet. They have many problems which we are capable of understanding, because we're all humans.

Achievements

ADAPTABLE BLADELESS DISC WIND TURBINE

I.Introduction:

Wind power is one of the perennial sources of energy along with being available during daytime as well as at night time almost throughout the year which could be harnessed from most of the parts of the planet. But modern day wind turbines could convert only up to around 45 percent of the total energy content in the wind. Along with this, the space constraints are a major concern in any developing or developed country and this should be considered as one of the major factors when energy generation through wind power is at stake since wind energy generation requires a considerable amount of free space. Considering all these factors, Disc Turbine design is a new form of a wind turbine, requiring less amount of space along with being able to convert most of the wind power into usable energy and minimize various difficulties associated with conventional wind turbine design related to an on-field application. This design uses three disc-shaped rotors along the central hub with adaptability depending on wind conditions by a servo mechanism. This is one of a kind unique design of a wind turbine which uses radically different concepts for wind power trapping and apt for increasing future energy demands.

II.Limitations of Current Design:

The traditional design of the wind turbine is less efficient, consuming a great amount of space and providing low output electrical energy. The cost of the entire wind farm project is very high and this could be the main reason for the reluctance to most of the wind energy projects.

The manufacturing facilities required for construction of massive blades of the turbine are not cost effective to build. The transportation cost involved in carrying huge and heavy machinery is high. Along with this the setup measures required to assemble the traditional wind turbine on site are quite cumbersome and involves a high amount of risk. The blades of the turbine are made sharp to minimize the wind resistance, but these sharp edges take the lives of thousands of migratory birds and bats all over the world [1].

The allied cost involved with the traditional technologies like the cost involved in raw materials, manufacturing, labor, transportation, and on-site assembly is substantially high and this makes it less practical for implementation for any governmental or non-governmental organization and are naturally gravitated towards the fossil fuel based energy source which is cheap but pernicious to our environment.

Limitations of the traditional wind turbines are low torque for the given wind flow. These turbines are effective only when wind speeds are quite high, they are inefficient in low wind conditions. Some of the available designs harnessing low wind speeds are only capable of intercepting surface wind and hence are unable to capture the full potential of the wind like the Invelox System [2].

III. Design:

Our design is inspired by the canopy of the umbrella and the sails of the ship. We realized that immense drag force is produced when the gust of the wind is obstructed by a specific geometry such as the canopy of an open umbrella. An umbrella held in the wrong direction against the wind could generate a huge amount of drag force enough to overturn the entire fragile umbrella structure. The sails of the wind work in a similar manner by trapping a large portion of the wind flow and converting into drag force which in turn propels the ship further. By altering the angle of attack of the wind with respect to the sail, a component of the drag force could be utilized for changing the direction of the ship. We combined the two concepts of umbrella canopy producing immense drag force and changing the angle of attack could make the drag component work in the required direction. If this force component is made to work in a tangential direction with respect to a shaft attached to the central hub, then a torque could be produced. The turning moment depends upon the diameter of each disc and the length of the shaft. The speed of the turbine will depend on the velocity of wind flow.

Our bladeless design of the turbine consists of three circular discs which are slightly concave or funnel-shaped towards the wind facing direction. These three discs are fixed to a central hub by means of a connecting rod. All the three discs are mounted equally on the hub with 120 degrees angle between two consecutive discs. These three discs are given a certain angle so as to produce a tangential thrust effect required to generate rotary motion of the turbine. The preliminary prototype shown below is constructed with above specification as a proof of concept of our innovative turbine. The actual turbine would have an electrical servo motor attachment in the central hub to equally change the angle with which each turbine is attached. Another servo motor will be mounted on the whole generator turbine assembly in order to smartly adjust the front side of the turbine towards the wind direction or upstream direction. These servo motors would be using a small amount of electrical energy generated by the turbine itself and smartly controlled by a microcontroller depending on the real-time wind condition and the flow direction or directly through a base controller.

IV. Working:

Our design is inspired from one of the oldest sources of wind energy harvesting technique which is the sail of a ship along with the shape of an umbrella. Sail ships are propelled by the huge drag force experienced by the massive sails which are kept at a certain angle with respect to the direction of wind flow in order to steer the ship in the desired direction in the downstream of a wind current. Our turbine works in a similar way but allows the sails to rotate in order to obtain power, we are referring this technique as wind capture, and this will be discussed shortly. Another technology that we are using is the reactive force thrust generation, in which the wind when moves past the blades which are moving in relatively lesser speed than that of the wind impart some tangential reaction force while leaving the disc edge thus providing an extra moment towards the center. Yet another technology, which in fact is a controlling technology that we are using, is the adaptable blade technology in which the angle of these blades relative to the central shaft will be automatically changed depending upon the wind conditions. All these three key techniques are further briefed below.

Wind Capture Technique: As mentioned earlier our design is largely inspired from the sail of the ship. A sail of the ship is used to provide a motive power for the ship to move. When the sail is tilted along the direction of wind one side of the sail faces the wind directly on its frontal area than the other sides of the sail, due to this high pressure is created on the windward side than other sail sides and the sail gets a pushing force from the high-pressure side. In a sailing ship due to the angle of the sail, some wind power is utilized in moving the ship forward and some power in moving the ship sidewise since the high-pressure side generates almost a perpendicular force to the wind velocity, but a ship utilizes a stabilizers and long fins submerged under water which minimizes this lateral movement and only allows forward thrust. Our disc will perform in almost a similar manner with the change being, our design would utilize the lateral force generated when the wind is imparted on the discs.

Due to the disc design, the wind will impose a huge drag force in the direction of the wind; again as these discs are angled relative to the central shaft, this drag force now could be resolved into two components one tangential component and other simple pushing force. This tangential component acting at the end of the connecting rod where the disc will be mounted is the most important factor as it would provide a turning moment necessary to rotate the turbine and hence the generator connected to the central shaft and produce electrical energy.

Reactive Force Technique: When the wind blows over the disc most of the kinetic energy of the wind is used to create the drag force when it is imparted on the discs, but still it contains enough energy to flow past the discs. These discs are angled, due to which one side of the disc is higher than the other side. The wind flows past these discs from the side which is slightly lower than the other side. Here the wind speed is still slightly higher than the tip velocity of the rotating disc and hence while leaving the disc it imparts some reactive force on the tip of the disc in the direction of motion of the disc tip. This force contributes to the total torque generated at the center and this torque can be calculated as the force times the distance between connecting rod disc attachments to the center of the shaft.

Adaptable Disc Technology: This is the technique which we have developed and it gives the turbine the name adaptable bladeless disc wind turbine. An ideal turbine should provide almost constant power output in variable wind speeds and also offer a control over the turbine speed in case of emergency or high wind conditions. This control over the speed could be effectively achieved by changing the blade angle with respect to the central shaft. When the wind flow is having a lower velocity the angle of all the blades could be increased due to which greater tangential forces would develop; when the wind speeds are very high, this angle will be reduced due to which lesser tangential force would be generated and hence the speed of the turbine could be maintained in the given range of wind speeds.

This change of the disc angle could be either made by a servo mechanism or by a mechanical means such as a torsion spring. Here we are initially using a tension spring which will make the entire system less bulky than a servo and a controller unit. The tension spring will be mounted between the connecting rod and the central hub inside the hub itself. Some initial tension would be maintained in the spring and when excess stress would develop due to high wind conditions the torsion spring would slightly twist thus twisting the connecting rod and eventually the disc angle and controlling the turbine speed in most of the variable wind conditions, acting as a mechanical governor system.

V. Proof Of Concept:

In order to realize the concept in the form of workable model a small scale model of Bladeless Disc Turbine was built and along with this a model of a traditional three-bladed wind turbine of similar dimensions was tested.

Experiment:

An experiment was designed to compare the electrical output power produced from a traditional and the advanced design. Two turbines having the similar center to tip distance were constructed and were exposed to the wind draft generated by a horizontal fan, the distance between the fan and the turbine was fixed for both the turbines under test to 7 meters. The fan was set to constant speed to generate approximately same wind speed as experienced by both the turbines.

Outcome and Conclusion:

The experiment carried out under similar wind conditions displayed the higher efficiency of Bladeless Disk Turbine over a Traditional Wind Turbine. Our design was capable of producing a peak voltage of 19.8 volt DC as against the traditional one producing a peak of only 7.1 volt DC. The average voltage generated by our design was around 16 volts DC and that for the other was around 5.5 volts. Disc Turbine is capable to produce voltage more than twice that for a traditionally made turbine. The area swept by both the turbines is same indicating that same power could be generated by the advanced design with consuming only half the space as occupied by a regular one.

VI. Applications:

Adaptable Bladeless Disc Wind Turbine is essentially a design for generating energy by harvesting the wind energy by consuming minimum space and producing much higher power output and capability to work in low wind conditions. Due to this, there is an immense scope in various fields which require energy to function. The scaled version of such a turbine can be used for offshore wind-farm projects which work away from the coast and can generate adequate power to meet the demands of a small city. It could be effectively used for off-grid power requirements where such turbine could suffice the need of small power requirement.

These kinds of turbines are well suited for military outpost and cities of developing and developed countries as it occupies less space and does not produce noise when it is operating. Along with this, the huge disc could even capture the lightest breeze which enables it to produce electrical power in low wind conditions in cities.

VII. Conclusion:

Wind turbines are today primarily used for the purpose of generating electrical power without depending upon the depleting sources of fossil fuel. Wind Power has tremendous environmental benefits over any fossil fuel burning power station, but due to the massive size of these structures, their noise pollution in the locality, requirement of immense free space, constant high windy conditions, difficulty in transport of each fragile blade over long distance and a large amount of capital requirement has restricted the wide scale applications of all traditional wind turbines.

This research of Adaptable Blade-Less Disc Wind Turbines aims at curbing various issues which cause the hindrance to the implementation of these power generators. This design requires much less space and can even produce power in very low wind speed conditions.

The material used for their construction would comprise of glass fiber central skeleton covered with a synthetic polymer fiber similar to the construction of an umbrella with a sophisticated design. Due to this the material cost of the turbine is much reduced. This kind of design can be constructed in a modular fashion which facilitates the ease of transportation over long distances. Utilizing such kind of design would allow us to increase the energy production from the renewable source and eventually lessen the dependence over fossil fuel.

Voltage Generated by each Turbine

Achievements

Team Members:

1.Meet Lakhani. 2.Raj Oak. 3.Avinash Gupta.

4.Deepak Gupta. 5.Omkar Bhogale 6.Deepak Pandey.

Team Mentor:

Mr.Rupesh Deshbhratar

1.Project won 1st prize in Smart India hackothan 2018 held at IIT Guwahati.
2.Project won 1st prize in an competition held at IIT Kharagpur.
3.Project was selected for “All India Accenture Innovation contest-17” amongst the top 5, in the Disruptive business out of 7k participants.
4.2nd prize winner for the “AAVISHKAR” state level project competition held at Xavier institute of engineering, with a cash amount of Rs.4500

ISNEE QUAD-TORC

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 organizing committee gives an opportunity to the undergraduate and diploma engineers to research and develop innovative projects. Design challenges organized 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 6 feet. Many other events such as the DisAsm, Suspension test, Maneuverability, Kill the Hill and other documentation events such as the Design Validation, Evaluation, and Business plan presentation are planned accordingly. The final stage of the competition includes a 4-hour endurance race on the track to test the vehicles reliability.
Team Technocrats is the particular team from Thakur College of Engineering & Technology to participate in ISNEE QUAD-TORC national level competition. The Quad-Torc 2018 was held at Bijnor, Uttar Pradesh from 25th-30th September 2017. The team initiated its journey by participating for the Second time in 2018 with 35 members and are confident to participate and showcase their improved skills in 2019 with a total of 40 team members.

Achievements

Team Captain:

Somnath Gosh

Team Mentor:

Mr.Sachin Oak

Team "Technocrats" participated with full enthusiasm at the Quad-Torc 2018 which is a national level quadbike designing and fabrication competition. The team received great appreciation from the technical inspectors and judges. Being one of the few teams who surpassed the:

1) Drop Test.
2) Technical Inspection.
3) Brake and Acceleration Test.
4) Attempted all the dynamic events such as Suspension , Maneuverability and Traction Test.
5) Bagged the Second Place in Business Plan.
6) Secured the Second Place in Quad-Bike photography contest.
7) Ranked 15th in the final day continuous 4hour endurance race out of 56 registered teams.
8) AIR 18th out of 56 registered teams.

BAJA

Achievements

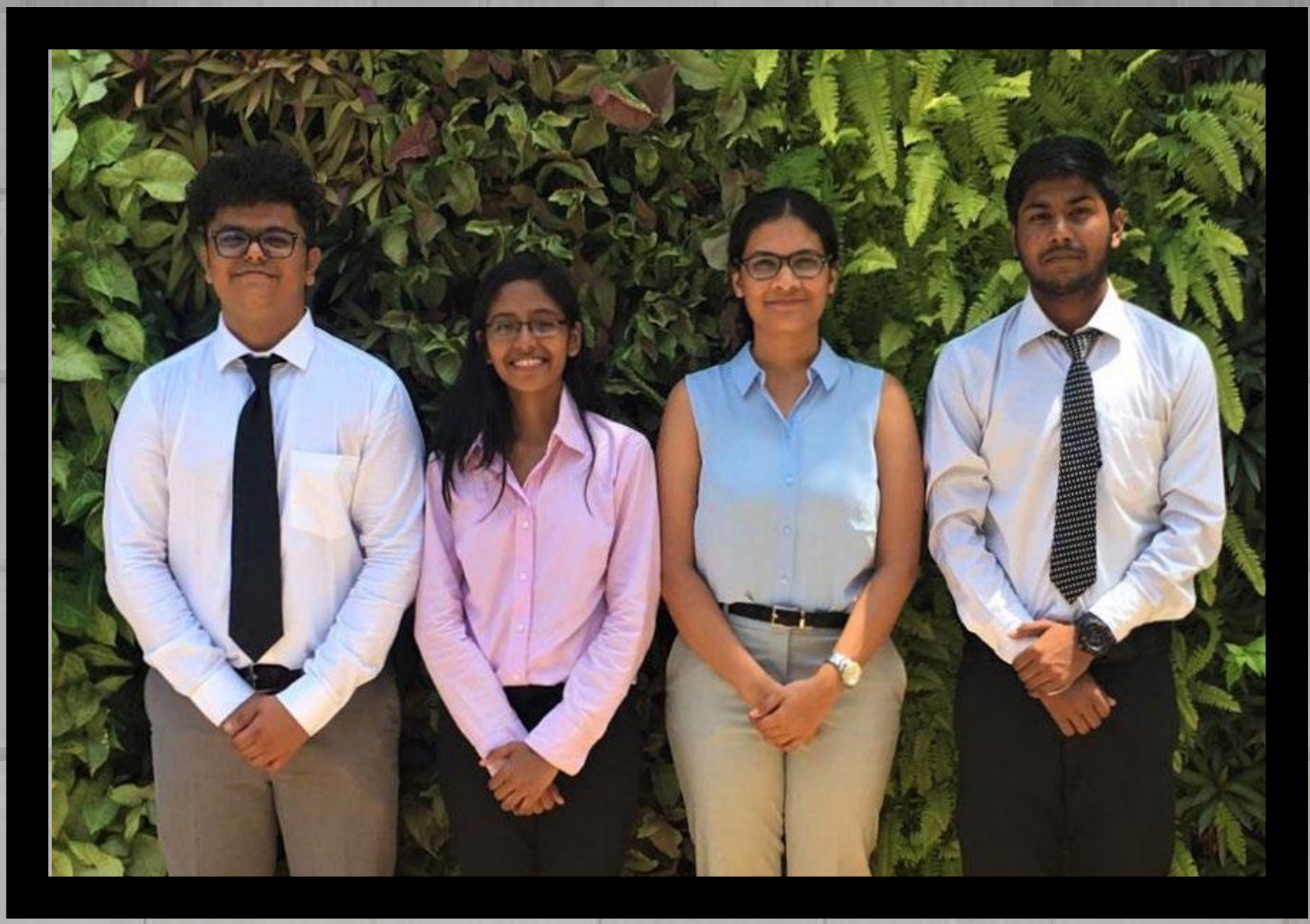
1.Virtual round rank 51 out of 386 teams all over the India.
2. They scored 3rd and 4th rank down IIT's and VJTI being experience team,who have been participating for almost a decade.

HVC

Achievements

1.Virtual round 8th out of 50 teams all over india.
2.Pre Virtual 4th rank.
3.New comer team without any financial and technical help we have achieved it and also our car has lowest cost of manufacture than any other team.
4.Team Mavericks is the first team to participate in Baja & Formula Imperial (HVC) from thakur college.

The Student Editorial Committee



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