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ABSTRACT

Energy is a major input for overall socio-economic development of any society. From Decades man has been trying to convert different forms of energy into electric power. Most of the machines generate mechanical energy when provided with electrical energy and vice versa. The main form of conventional energy for different forms of energies is the electrical energy. The main aim of this project work is to generate electric energy through the train tracks mechanism. To prove this concept practically, a prototype module is constructed with spring loaded type mechanical structure at the bottom of the railway track, which is aimed to generate energy whenever the train goes over its surface.

The mechanism is designed using electro-mechanical technology and to generate electricity one small DC motor is used. This motor functions like dynamo and its shaft is coupled with the mechanism through a geared wheel. Whenever any train passes over this mechanism, because of the weight exerted by the train, it is pressed and the motor shaft will be rotated automatically; thereby the motor generates electric energy (a maximum voltage of 9v approximately). The external shaft of the motor will be rotated at very low speed; at this speed any type of armature or dynamo cannot generate required voltage. Thereby the motor used in this project work is built in with reduction gear mechanism, hence inner shaft of the motor rotates at high speed.

In this concept when this shaft is coupled to a dynamo, the kinetic energy will be converted into electric energy. The voltage generated by the motor will be regulated and is connected to a LED to indicate the energy is generated when the mechanism when it is pressed due to the train weight. As it is a prototype module, low rating power devices are used and for real applications high power devices must be used.



CHAPTER – 1

INTRODUCTION

As the availability of conventional energy declines, there is need to find alternate energy sources. All most all the state electricity departments in our country, they are unable to supply the power according to the demand. The power produced by these companies is not even sufficient for domestic utilities; in such critical situation it is very difficult to divert the energy for other public needs. There by an alternative source must be discovered. Many people propose for solar energy, but it is going to be a costliest affair, moreover availability of solar energy is poor particularly in rainy and winter seasons, as a result it is not dependable. Hence an alternative cheapest method must be determined for few applications; consequently this project work has been taken up, which is aimed to generate electricity from the train track mechanism when the train passes over it.

Out of the many alternative energy resources, this technology described in this project report is the ultimate source of all known forms of energy. It is clear, safe, and free, does not pollute the environment and thus will be an extremely viable alternative in the days to come. As our population is increasing day by day, the frequency of the trains has also increased relatively compared to the past, there by the new tracks are also being constructed for meeting the requirements. As the trains are running one after another continuously on the tracks, the virtual bump mechanism laid beneath the track generates nonstop energy, which can be stored and utilized for the requirements. Here the concept is to convert the mechanical energy in to electric energy.

The prototype module is constructed with low power rating electrical devices; this is aimed to prove the concept practically. To charge the battery, the mechanism must be activated continuously if connected in the output. To activate the mechanism human efforts are required, because it is a prototype module & it cannot be used for real applications, therefore running train over this mechanism is not possible.

1.1 Literature Review

The energy produced by this system is almost infinite potential and free availability, represents a non-polluting and endless energy source, which can be developed to meet the energy needs to some extent. To estimate the energy potential at particular place, where this kind of railway track mechanism is to be installed, detailed information about the traffic density must be collected properly, if non stop traffic flow is expected, there this system can be used for efficient results.

An electrical power generation system comprises a variable DC generator as power source that generates energy when the train passes over the railway track. The electrical power generation system is configured to generate electric power via movements of the rail. The power source is used in the form of a generator to prime the variable movement that effectively generates the priming energy of the power source by extracting energy from the passing vehicle.

Traditionally, operation data related to railroad traffic and railroad assets is gathered at manned junctions, such as a rail yard or a rail depot. By way of example, railroad workers often inspect rails for damage and loading conditions. As yet another example, railroad workers often inspect and inventory the incoming and outgoing railcars, to manage and facilitate the flow of traffic on a railroad network. However, railroad networks often span thousands of miles and traverse through sparsely populated and remote regions.

Unfortunately, traditional automated devices generally obtain operating power from an external power source, which is not generally available in remote areas. That is, the automated device receives operating power that is generated at a remote location and that is delivered over a power grid, and coupling the grid to the device can be a costly proposition, especially in remote areas. In certain instance, local power sources, such as batteries, have been employed. In any event, even if a local or external power source is provided, these



power sources may not provide a cost effective mechanism for producing sufficient levels of power.

Therefore, there is need for a system and method for improving electric power generation with respect to rail systems. The present technique relates generally to rail based devices and, more specifically, to an energy co-generation device for generating electric power in response to vehicular traffic on a rail. In accordance with one exemplary embodiment, the present technique provides an electric power cogeneration system for use with a railroad network.

The system includes a power source, such as a power generation device or an external power source. The power cogeneration system includes a DC motor that acts as a generator or a dynamo mechanically coupled train track mechanism. The mechanical energy of the biasing device is converted into electrical energy for the system. In accordance with another exemplary aspect of the present technique, a method of co-generating power via a vehicle travelling on a rail is provided. When the train moves over this mechanism, due to the weight exerted the DC motor shaft will be rotated which in turn, this displacement of the motor rotation co -generation of electrical energy from the kinetic and potential energy of the vehicle on the rail.

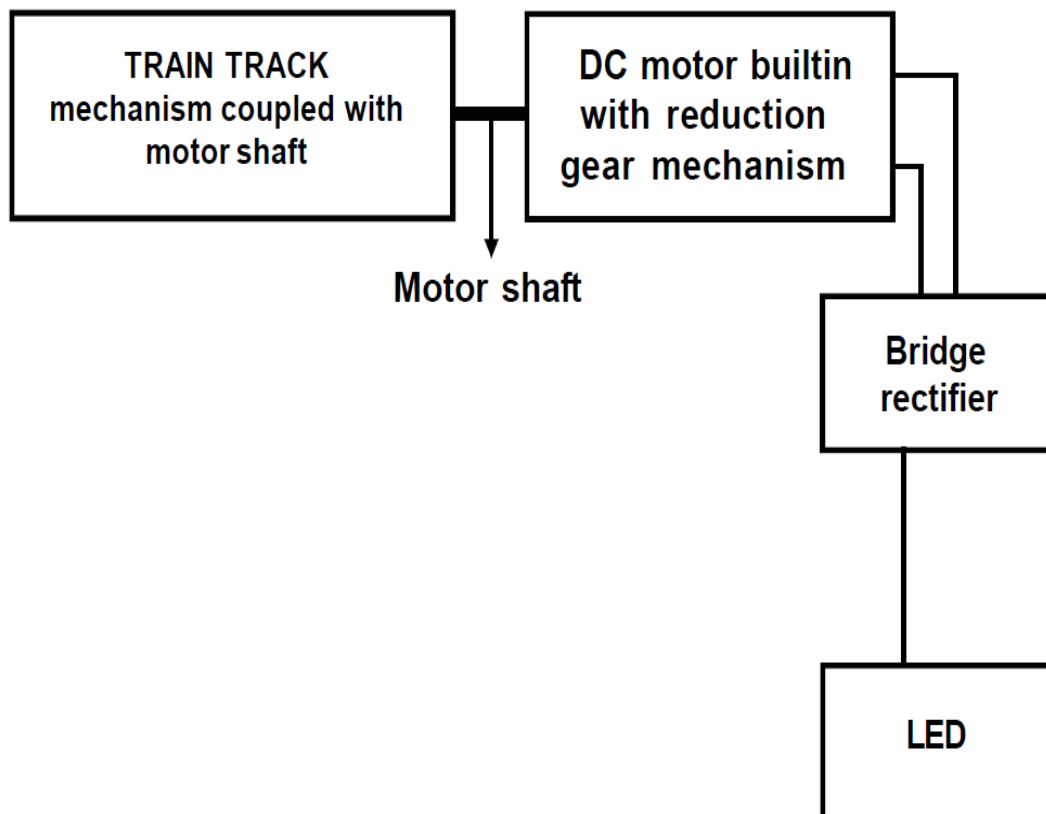
1.2 Objective of the Project

To produce clean and reliable energy from railway tracks. It is important to note that improving the efficiency of energy use is not the same as reducing the consumption of energy. Consumption may increase if greater efficiency prompts more use (more end benefit) or new uses of electricity. A particularly important example of the latter is the increased use of railway tracks. The references to generating electricity are mentioned below exclude such end use effects.

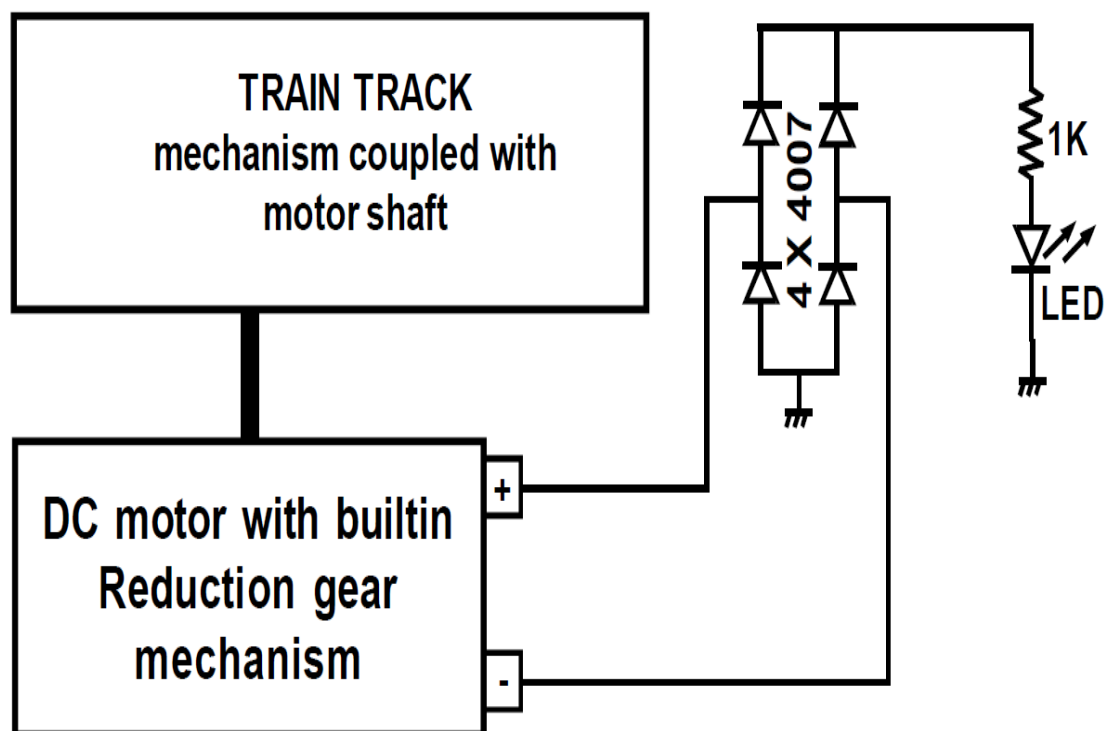
CHAPTER – 2

BLOCK & CIRCUIT DIAGRAMS & FUNCTIONAL DESCRIPTION OF THE PROJECT

2.1 BLOCK DIAGRAM:



2.2 CIRCUIT DIAGRAM:



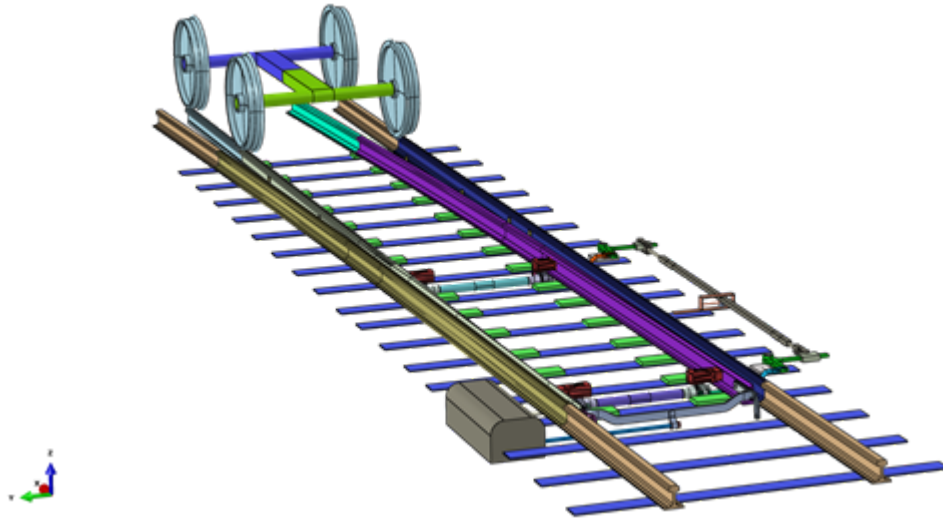
2.3 Train track mechanism:

The description as per the block & circuit diagrams shown in the next chapter is explained in section wise, the following is the description.

The mechanical structure that contains four legs system is considered as motion converter, the mechanical motion created by the train passing over the track is converted into the electrical energy, there by it is called as motion converter. In general any motion converter that generates electricity by applying some force will be constructed by implementing electro-mechanical techniques. In this regard here a simple spring loaded type mechanism is designed, whenever some force is applied manually to its surface, the mechanism will be pulled down by which the chain drive system rotates the motor shaft through its pinion.

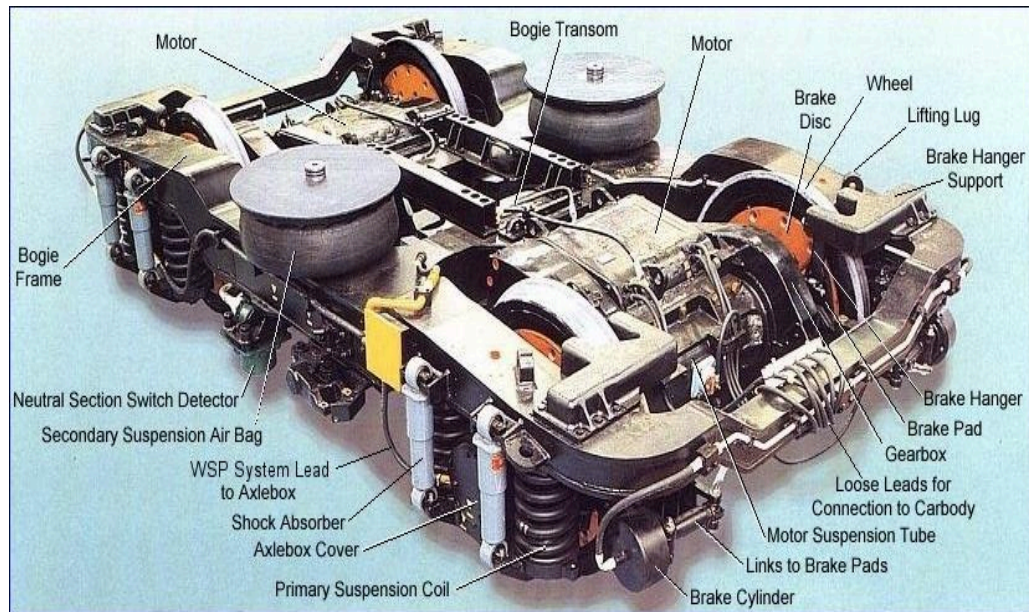
It works on the principle of simple physics i.e. in practical it works on the principle that when a moving train passes through this set up, the kinetic energy of vehicle will cause roller to rotate which will further rotate transmission shaft and hence the generator armature (i.e. acting as prime mover to run generator).

The electrical device used to generate electricity is a simple DC motor; this motor shaft is coupled with the moving mechanism. A small pinion with fewer teeth is synchronized with the chain, when the mechanism is pulled down, this motor rotates in clock wise, similarly when the mechanism is released, due to its spring action it moves to its home position. In this condition, the motor rotates in anti-clock wise. There by the motor rotates in both directions, is that when the train moves over the track, the motor rotates in both directions and generates energy in the form of two peak levels.



The mechanical structure is constructed with square type of steel pipes, the bump mechanism is constructed with inclined plates, when the plates come down, and this in turn rotates a geared shaft loaded with recoil springs. The output of this shaft is coupled to a dynamo to convert kinetic energy into electricity. This the basic principle involved in it.

The advantage of selecting reduction gear mechanism motor is, though the external shaft rotates at low speed and depending up on the gear ratio, the internal shaft will be rotated at high speed. This is essential here; otherwise if the shaft speed is low, the armature may not produce any energy. Rotary motion can be transferred from one shaft to another by a pair of rolling gears. Depending up on the ratio of final shaft speed number gears are arranged in group and are called as gear trains, these gear trains are mechanisms which are widely used either to increase or to decrease the final shaft speed. When the speed is increased torque will be reduced, where as if the speed is decreased torque will be increased, this is the general phenomena for normal DC motor. In general these toothed gear wheels are coupled in between two parallel shafts. When two gears are in mesh, the larger gear wheel is often called as crown wheel and the smaller one is called as pinion.



The disc/wheel coupled with simple chain can be called as driven gear. For example, if the driven wheel is 50 times bigger than the driving gear (pinion), then driving gear must make 50 revolutions to rotate the wheel for one revolution. This type of gear train is referred to as a speed reducer. To avoid wheel slipping, here chain driving system is implemented. Chain drives operate with a constant ratio, due to the positive interaction between the chain and pinion, there is no slipping. The driving sprocket (a tooth on the rim of a wheel) and the driven sprocket each have a number of teeth designed to match the size and pitch of the chain. Lubrication is an important factor in chain drive

2.4 SPRING

A spring is an elastic object used to store mechanical energy. Springs are usually made out of spring steel. There are a large number of spring designs; in everyday usage the term often refers to coil spring.



Small springs can be wound from pre-hardened stock, while larger ones are made from annealed steel and hardened after fabrication. Some non-ferrous metals are also used including phosphor bronze and titanium for parts requiring corrosion resistance and beryllium copper for springs carrying electrical current (because of its low electrical resistance).

When a coil spring is compressed or stretched slightly from rest, the force it exerts is approximately proportional to its change in length (this approximation breaks down for larger deflections). The rate or spring constant of a spring is the change in the force it exerts, divided by the change in deflection of the spring. That is, it is the gradient of the force versus deflection curve. An extension or compression spring has units of force divided by distance, for example lbf/in or N/m. Torsion springs have units of torque divided by angle, such as N·m/rad or ft·lbf/degree. The inverse of spring rate is compliance, that is: if a spring has a rate of 10 N/mm, it has a compliance of 0.1 mm/N. The stiffness (or rate) of springs in parallel is additive, as is the compliance of springs in series.

A coil spring, also known as a helical spring, is a mechanical device, which is typically used to store energy due to resilience and subsequently release it, to absorb shock, or to maintain a force

Between contacting surfaces. They are made of an elastic material formed into the shape of a helix which returns to its natural length when unloaded.

One type of coil spring is a torsion spring material of the spring acts in torsion when the spring is compressed or extended. The quality of spring is judged from the energy it can absorb. The spring which is capable of absorbing the greatest amount of energy for the given stress is the best one. Metal coil springs are made by winding a wire around a shaped former - a cylinder is used to form cylindrical coil springs

2.4.1 **Spring capacity** - Coil springs can bear up to 50 tons (per pc.)

2.4.2 **Raw material** - Any suitable quality spring steel or as directed

2.5 **Helical spring on railway tracks:**



A helical spring is defined as an elastic body, whose function is to distort when loaded and to recover its original shape when the load is removed.

The helical springs are made up of a wire coiled in the form of a helix and are primarily intended for compressive or tensile loads. The cross-section of the wire from which the spring is made may be circular, square or rectangular. Helical compression springs have applications to resist applied compression forces or in the push mode, store energy to provide the "push". Different forms of compression springs are produced.

The helical springs are said to be closely coiled when the spring wire is coiled so close that the plane containing each turn is nearly at right angles to the axis of the helix and the wire is subjected to torsion. In other words, in a closely coiled helical spring, the helix angle is very small, it is usually less than 10 degree. The major stresses produced in helical springs are shear stresses due to twisting. The load applied is parallel to or along the axis of the spring. In open coiled helical springs, the spring wire is coiled in such a way that there is a gap between the two consecutive turns, as a result of which the helix angle is large.

Terms used in Compression Springs:

The following terms used in connection with compression springs

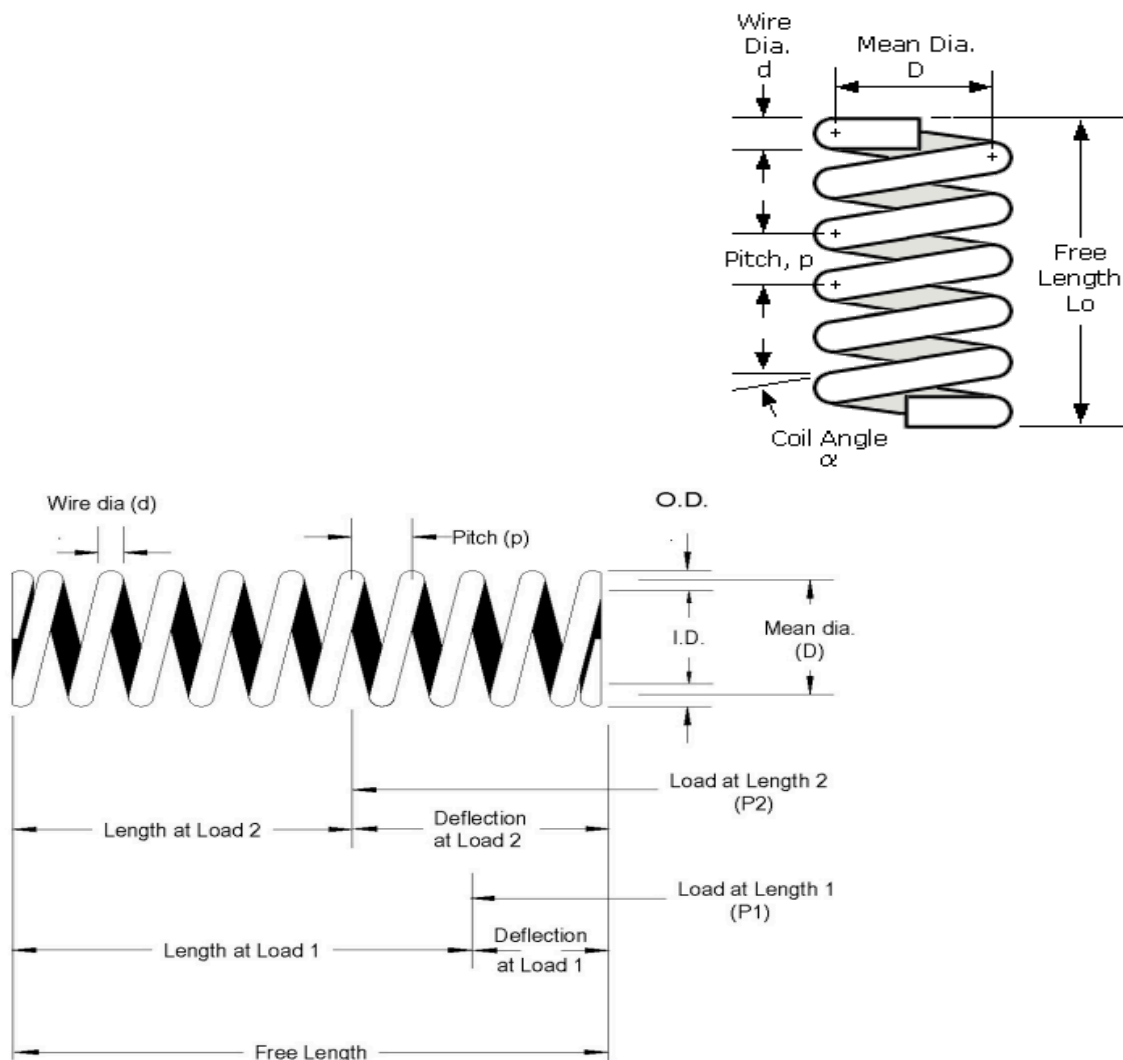
2.5.1 Solid length (L_s) - When the compression spring is compressed until the coils come in contact with each other, then the spring is said to be solid. The solid length of a spring is the product of total number of coils and the diameter of the wire.

2.5.2 Free length (L_o) - The free length of a compression spring is the length of the spring in the free or unloaded condition

2.5.3 Load (P) - The force applied to a spring that causes a deflection.

2.5.4 Deflection - Motion of spring ends or legs under the application or removal of an external load (P).

2.5.5 Wire Diameter (d) - The diameter of the wire that is wound into a helix.



2.5.6 Spring Index (C) - The ratio of mean coil diameter to wire diameter. A low index indicates a tightly wound spring (a relatively large wire size wound around a relatively small diameter mandrel giving a high rate).

$$C = \frac{D}{d}$$

2.5.7 Coil Diameter (D) - The mean diameter of the helix, i.e., $(D_{\text{outer}} + D_{\text{inner}})/2$.

2.5.8 Active Coils (N_a) - The number of coils which actually deform when the spring is loaded, as opposed to the inactive turns at each end which are in contact with the spring seat or base.

2.5.9 Total Coils (N_t) - The number of coils or turns in the spring.



2.5.10 Pitch (p) - The distance from center to center of the wire in adjacent active coils

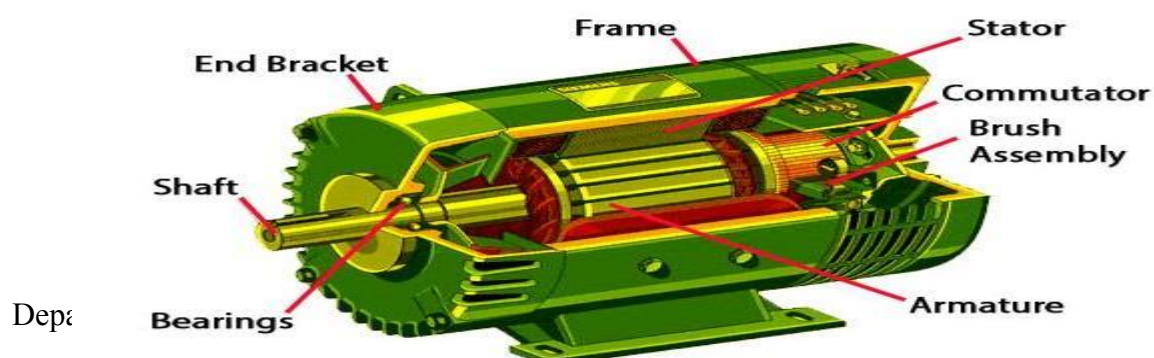
2.6 Source of voltage

A voltage source is a device that produces electricity by converting some other form of energy in to electrical energy. By its action the voltage source merely creates a potential difference or electromotive force between two terminals by building up opposite charges on these terminals. Here the motor used as dynamo generates some potential when its shaft is rotated. As this motor generates very few volts with little current, it cannot drive heavy loads. But in our trail run we found that it is producing nearly 30 milliamps current at 6V. This energy is sufficient to drive three LED's, therefore to find out weather this motor is generating energy or not, two LED's are connected across the source. When the motor shaft is rotated through the mechanism, these LED's glow's and indicates that the electric energy is generated.

The form of energy that is converted in to electrical energy here is called magnetic energy. One of the important sources of electrical power is the electromagnetic sources called generators. Generators are nothing but rotating machines which convert mechanical energy in to electrical energy with the help of magnetism. A conductor or set of conductors is rotated in a magnetic field and voltages are developed in the rotating conductor due to magnetic induction.

2.7 Electric motor that generates electrical energy

An electrical motor is a machine that converts electrical energy in to mechanical energy of rotation. It is the reverse of a generator which converts mechanical energy in to electrical energy. Here the same principle is implemented, there by the motor is converted as generator.



A DC motor consists of four main parts, i.e. armature, magnetic field, commutator, & brushes. A commutator consists of two semi-cylindrical pieces of conducting material separated by an insulating material. The brushes are made of soft conducting material that can easily slide on the commutator surface. Each half of the commutator rotates with the loop. Each brush presses against one segment of the commutator.

The brushes remain stationary while the commutator rotates. The brushes press against opposite segments of the commutator and every time the voltage reverses polarity, the brushes also switch from one segment to the other. This means that one brush always develops positive polarity and the other, negative polarity with respect to each other. Although the developed across the brushes will be fluctuating, it will always have the same polarity and is a DC fluctuating voltage. The variation in the voltage produced by a single rotating loop is called a ripple which makes the output unstable.

The armature is set in to rotation when a dc voltage from external source is applied across the brushes. The turning force produced in a motor is called torque and depends mainly on the strength of the magnetic field.

As described above, the dc motor used in the system generates electricity in the form of ripple when its shaft is rotated. The ripple produced by the motor cannot be used as it is for charging the battery or for the LED's directly, first it should be converted in to pure dc. Here a bridge rectifier circuit is constructed with four diodes and it is filtered using a capacitor. Now the dc voltage produced by the circuit is not stable, it varies according to the rotor speed, if the motor shaft is rotated at high speed more voltage will be developed, similarly if the speed is less, low voltage will be produced. Anyhow the current produced here is very less; so small LED's are connected in the output to indicate the energy is generated from the mechanism.



CHAPTER – 3

STRUCTURE AND MECHANISM

3.1 Structure and mechanism

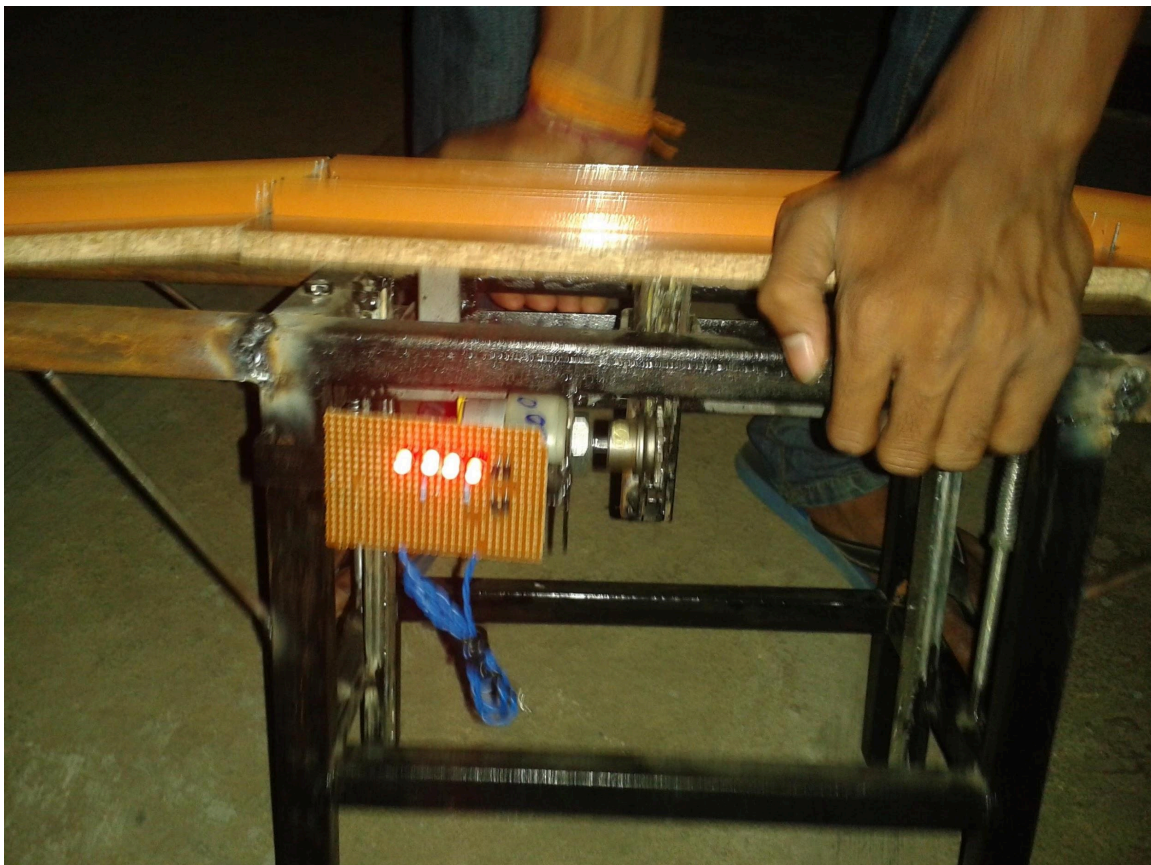
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CHAPTER – 4

TYPES OF GEARS, DRIVE MECHANISM AND ADVANTAGES, DISADVANTAGES OF DIFFERENT TYPES OF GEARS

4.1 Gear

A **gear** or **cogwheel** is a rotating machine part having cut *teeth*, or *cogs*, which *mesh* with another toothed part in order to transmit torque, in most cases with teeth on the one gear being of identical shape, and often also with that shape on the other gear. Two or more gears working in tandem are called a *transmission* and can produce a mechanical advantage through a gear ratio and thus may be considered a simple machine. Geared devices can change the speed, torque, and direction of a power source. The most common situation is for a gear to mesh with another gear; however, a gear can also mesh with a non-rotating toothed part, called a rack, thereby producing translation instead of rotation.

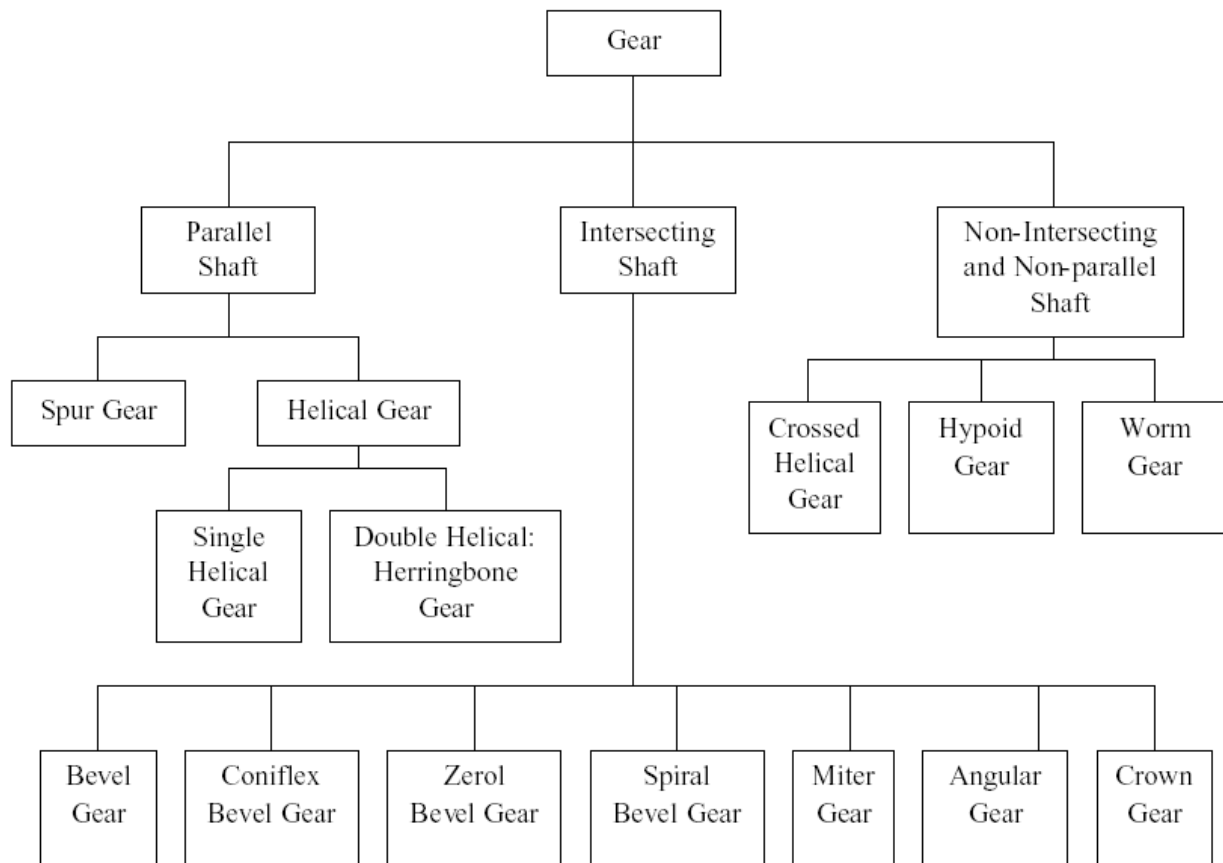
The gears in a transmission are analogous to the wheels in a crossed belt pulley system. An advantage of gears is that the teeth of a gear prevent slippage.

When two gears mesh, and one gear is bigger than the other (even though the size of the teeth must match), a mechanical advantage is produced, with the rotational speeds and the torques of the two gears differing in an inverse relationship.

In transmissions which offer multiple gear ratios, such as bicycles, motorcycles, and cars, the term gear, as in *first gear*, refers to a gear ratio rather than an actual physical gear. The term is used to describe similar devices even when the gear ratio is continuous rather than discrete, or when the device does not actually contain any gears, as in a continuously variable transmission.

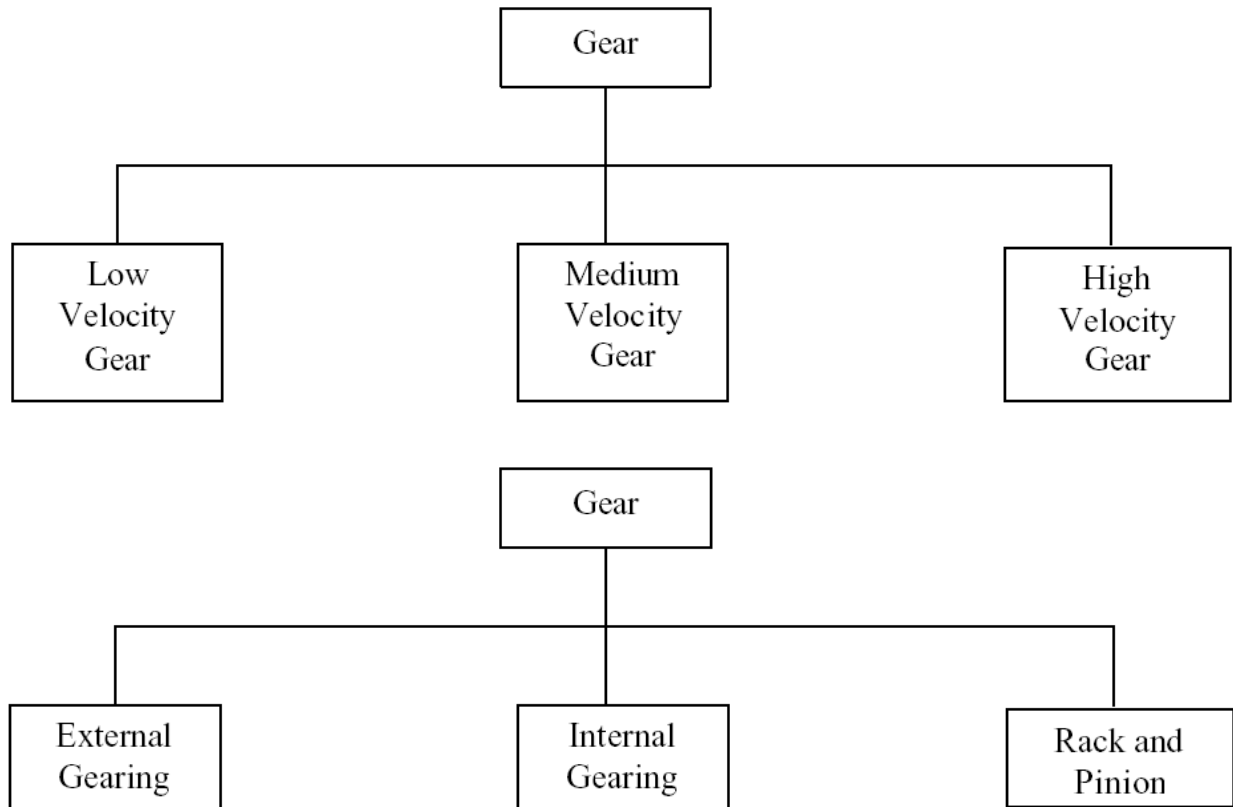
The earliest known reference to gears was circa A.D. 50 by Hero of Alexandria, but they can be traced back to the Greek mechanics of the Alexandrian school in the 3rd century

B.C. and were greatly developed by the Greek polymath Archimedes (287–212 B.C.). The Antikythera mechanism is an example of a very early and intricate geared device, designed to calculate astronomical positions. Its time of construction is now estimated between 150 and 100 BC.



4.2 Comparison with drive mechanisms

The definite velocity ratio which results from having teeth gives gears an advantage over other drives (such as traction drives and V-belts) in precision machines such as watches that depend upon an exact velocity ratio. In cases where driver and follower are proximal, gears also have an advantage over other drives in the reduced number of parts required; the downside is that gears are more expensive to manufacture and their lubrication requirements may impose a higher operating cost.

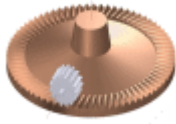


4.3 Different Types of Gears

There are many different types of gears. For the purposes of this section we will focus on different gear geometry and not different quality, materials, etc...

Each type of gear has its own purpose as well as unique advantages and disadvantages.

Types Of Gears		
Gear Type	Description	Photo

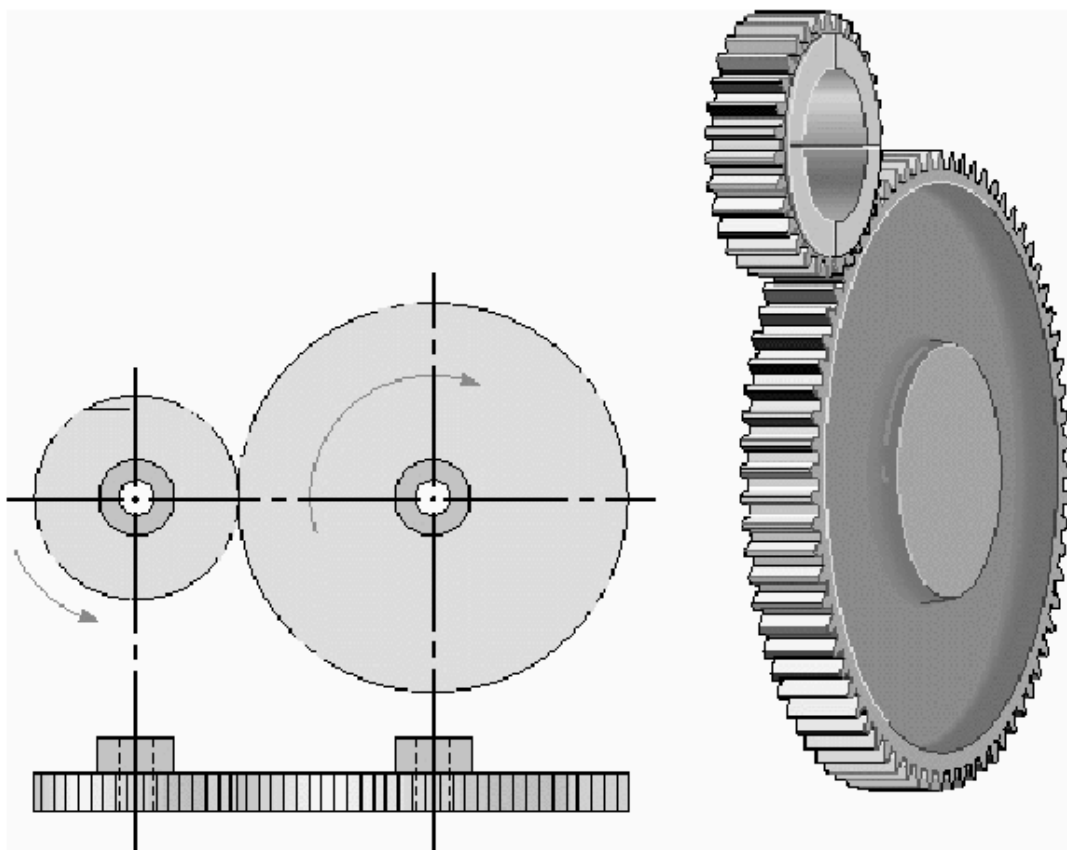
Spur Gears	Spur gears are by far the most common type of gear and with the exceptions of the "cog" the type of gear that has been around the longest. Spur gears have teeth that run perpendicular to the face of the gear.	
Bevel Miter Gears	Bevel gears are used mostly in situations that require power to be transmitted at right angles (or applications that are not parallel). Bevel gears can have different angles of application but tend to be 90°.	
Worm Gears	Worm gears are used to transmit power at 90° and where high reductions are required. The worm resembles a thread that rides in concaved or helical teeth.	
Racks	A rack is basically a straight gear used to transmit power and motion in a linear movement.	
Face Gears	Face gears transmit power at (usually) right angles in a circular motion. Face gears are not very common in industrial application.	
Sprockets	Sprockets are used to run chains or belts. They are typically used in conveyor systems.	

4.4 Spur Gears

General: Spur gears are the most commonly used gear type. They are characterized by teeth which are perpendicular to the face of the gear. Spur gears are by far the most commonly available, and are generally the least expensive.

Limitations: Spur gears generally cannot be used when a direction change between the two shafts is required.

Advantages: Spur gears are easy to find, inexpensive, and efficient.



SPUR GEAR

4.5 Helical Gears

General: Helical gears are similar to the spur gear except that the teeth are at an angle to the shaft, rather than parallel to it as in a spur gear. The resulting teeth are longer than the teeth on a spur gear of equivalent pitch diameter. The longer teeth cause helical gears to have the following differences from spur gears of the same size:

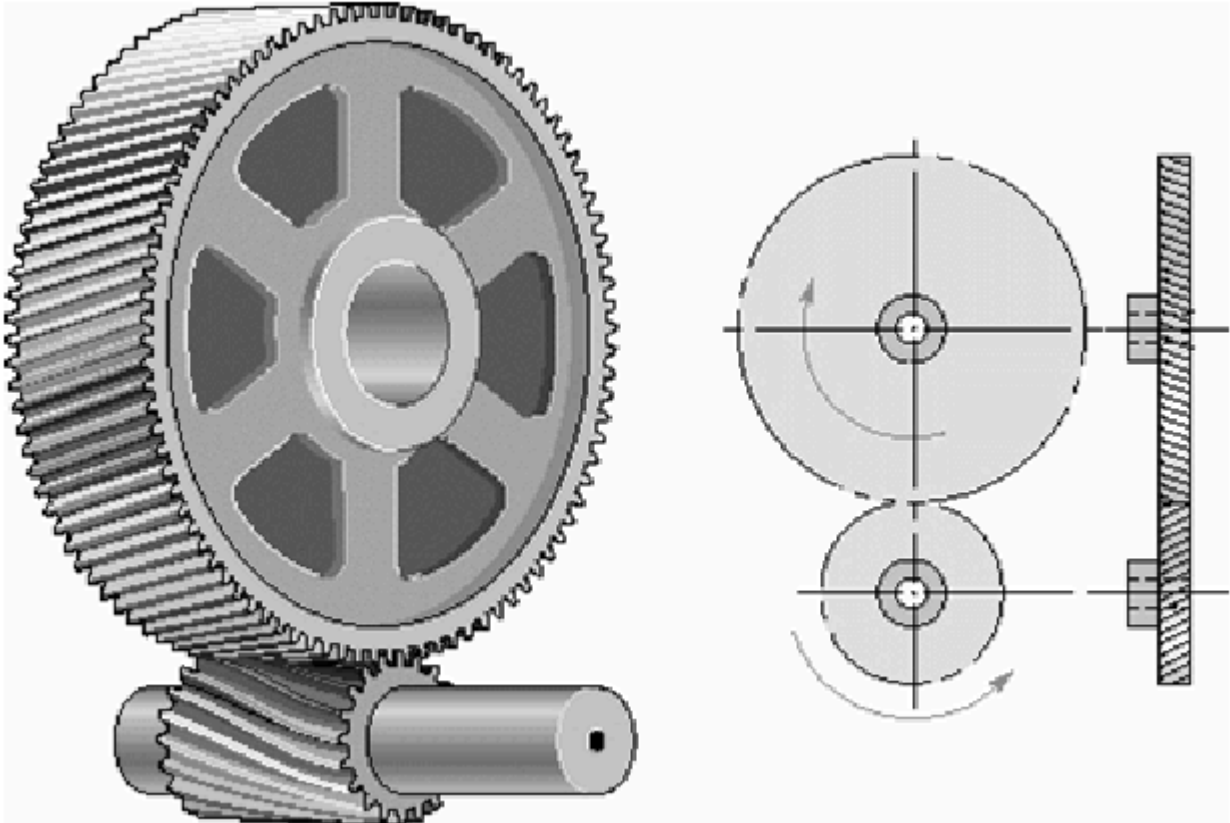
- Tooth strength is greater because the teeth are longer,
- Greater surface contact on the teeth allows a helical gear to carry more load than a spur gear
- The longer surface of contact reduces the efficiency of a helical gear relative to a spur gear

Helical gears may be used to mesh two shafts that are not parallel, although they are still primarily used in parallel shaft applications. A special application in which helical gears are used is a crossed gear mesh, in which the two shafts are perpendicular to each other:

The basic descriptive geometry for a helical gear is essentially the same as that of the spur gear, except that the helix angle must be added as a parameter.

Limitations: Helical gears have the major disadvantage that they are expensive and much more difficult to find. Helical gears are also slightly less efficient than a spur gear of the same size.

Advantages: Helical gears can be used on non parallel and even perpendicular shafts, and can carry higher loads than can spur gears.



HELICAL GEAR

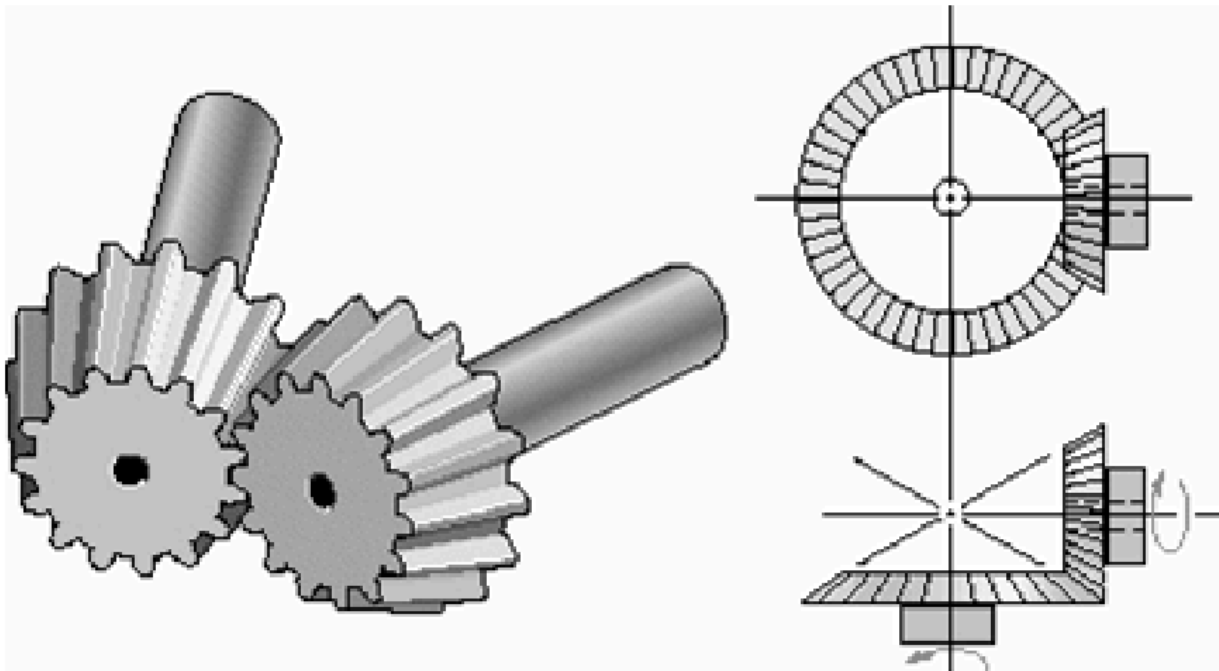
4.6 Bevel Gears

General: Bevel gears are primarily used to transfer power between intersecting shafts. The teeth of these gears are formed on a conical surface. Standard bevel gears have teeth which are cut straight and are all parallel to the line pointing to the apex of the cone on which the teeth are based. Spiral bevel gears are also available which have teeth that form arcs. Hypocycloid bevel gears are a special type of spiral gear that will allow nonintersecting, non-parallel shafts to mesh. Straight tool bevel gears are generally considered the best choice for systems with speeds lower than 1000 feet per minute: they commonly become noisy above this point.

One of the most common applications of bevel gears is the bevel gear differential,

Limitations: Limited availability cannot be used for parallel shafts, can become noisy at high speeds.

Advantages: Excellent choice for intersecting shaft systems.



BEVEL GEAR

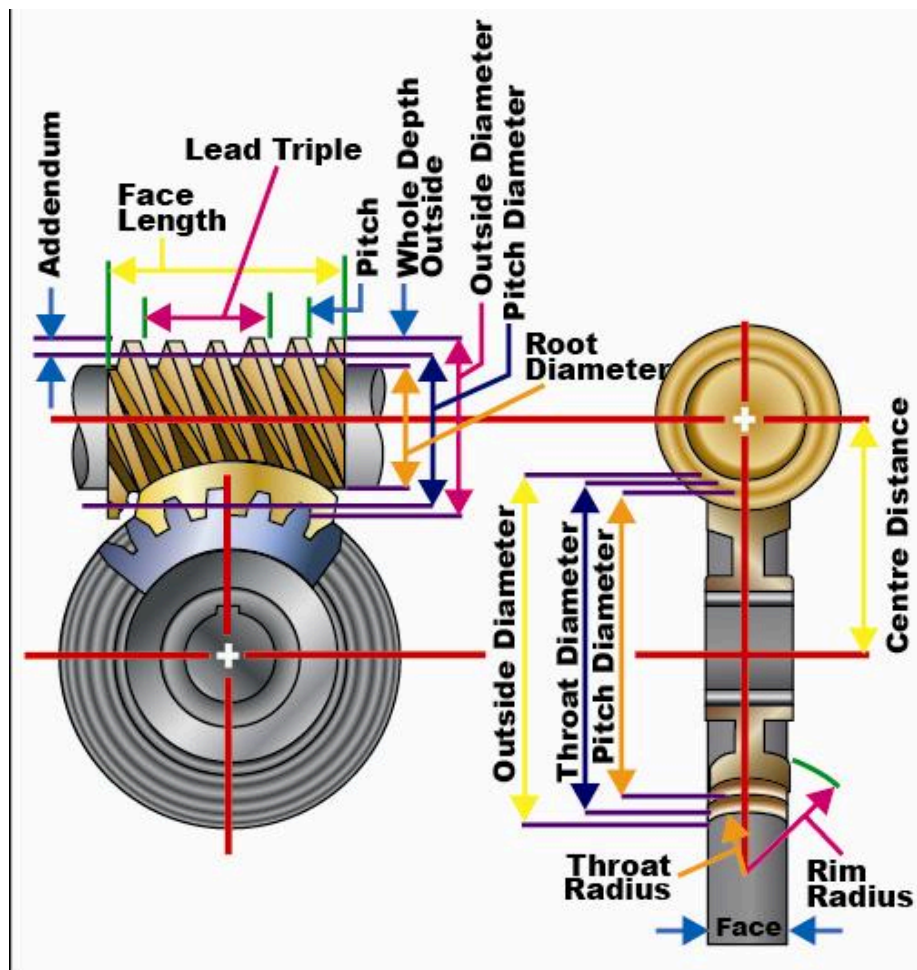
4.7 Worm Gears

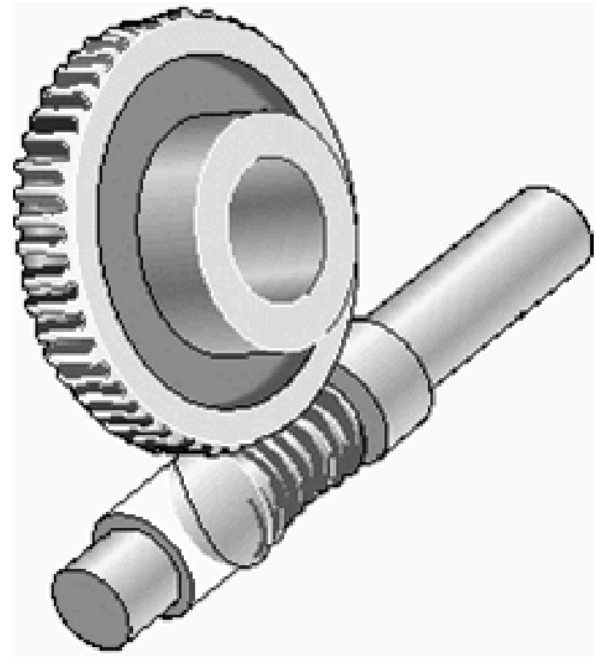
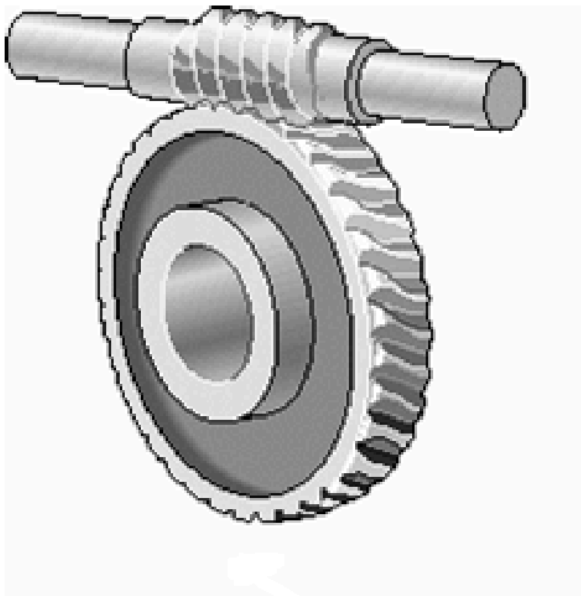
General: Worm gears are special gears that resemble screws, and can be used to drive spur gears or helical gears. Worm gears, like helical gears, allow two non-intersecting 'skew' shafts to mesh. Normally, the two shafts are at right angles to each other. A worm gear is equivalent to a V-type screw thread. Another way of looking at a worm gear is that it is a helical gear with a very high helix angle.

Worm gears are normally used when a high gear ratio is desired, or again when the shafts are perpendicular to each other. One very important feature of worm gear meshes that is often of use is their *irreversibility*: when a worm gear is turned, the meshing spur gear will turn, but turning the spur gear will not turn the worm gear. The resulting mesh is 'self locking', and is useful in ratcheting mechanisms.

Limitations: Low efficiency. The worm drives the drive gear primarily with slipping motion, thus there are high friction losses.

Advantages: Will tolerate large loads and high speed ratios. Meshes are self locking (which can be either an advantage or a disadvantage).





4.8 Racks (straight gears)

General: Racks are straight gears that are used to convert rotational motion to translational motion by means of a gear mesh. (They are in theory a gear with an infinite pitch diameter). In theory, the torque and angular velocity of the pinion gear are related to the Force and the velocity of the rack by the radius of the pinion gear, as is shown below:

Perhaps the most well-known application of a rack is the rack and pinion steering system used on many cars in the past.

Limitations: Limited usefulness, difficult to find.

Advantages: The only gearing component that converts rotational motion to translational motion. Efficiently transmits power. Generally offers better precision than other conversion methods.

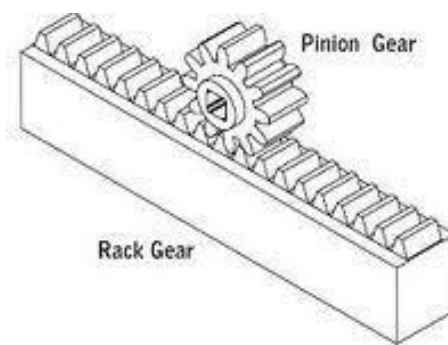
4.9 Racks (straight gears) & Pinion Mechanism

General: Racks are straight gears that are used to convert rotational motion to translational motion by means of a gear mesh. (They are in theory a gear with an infinite pitch diameter). In theory, the torque and angular velocity of the pinion gear are related to the Force and the velocity of the rack by the radius of the pinion gear, as is shown below:

Perhaps the most well-known application of a rack is the rack and pinion steering system used on many cars in the past.

Limitations: Limited usefulness, difficult to find.

Advantages: The only gearing component that converts rotational motion to translational motion. Efficiently transmits power. Generally offers better precision than other conversion methods.



A rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack"; rotational motion applied to the pinion causes the rack to move, thereby translating the rotational motion of the pinion into the linear motion of the rack.

For example, in a rack railway, the rotation of a pinion mounted on a locomotive or a railcar engages a rack between the rails and forces a train up a steep slope.

For every pair of conjugate involute profile, there is a basic rack. This basic rack is the profile of the conjugate gear of infinite pitch radius.^[1] (I.e. a toothed straight edge.)

A generating rack is a rack outline used to indicate tooth details and dimensions for the design of a generating tool, such as a hob or a gear shaper cutter.

Applications

Rack and pinion combinations are often used as part of a simple linear actuator, where the rotation of a shaft powered by hand or by a motor is converted to linear motion.

The rack carries the full load of the actuator directly and so the driving pinion is usually small, so that the gear ratio reduces the torque required. This force, thus torque, may still be substantial and so it is common for there to be a reduction gear immediately before this by either a gear or worm gear reduction. Rack gears have a higher ratio, thus require a greater driving torque, than screw actuators.

Steering

A rack and pinion is commonly found in the steering mechanism of cars or other wheeled, steered vehicles. Rack and pinion provides a less efficient mechanical advantage than other mechanisms such as recirculating ball, but less backlash and greater feedback, or steering "feel". The mechanism may be power-assisted, usually by hydraulic or electrical means.

The use of a variable rack (still using a normal pinion) was invented by Arthur Ernest Bishop, in the 1970s, so as to improve vehicle response and steering "feel," especially at high speeds. He also created a low cost press forging process to manufacture the racks, eliminating the need to machine the gear teeth.

4.10 Rack railways

Rack railways are mountain railways that use a rack built into the centre of the track and a pinion on their locomotives. This allows them to work on steep gradients, up to 1 in 2 (50%), far in excess of those a conventional railway relying on friction can achieve.



Although the extra grip of the rack system is obviously important for climbing, it has perhaps a more important use in also allowing controlled braking on these steep lines and for being much less affected by snow or ice on the rails

4.11 Spur Gear:

Advantages

- They offer constant velocity ratio
- Spur gears are highly reliable
- Spur gears are simplest, hence easiest to design and manufacture
- A spur gear is more efficient if you compare it with helical gear of same size
- Spur gear teeth are parallel to its axis. Hence, spur gear train does not produce axial thrust. So the gear shafts can be mounted easily using ball bearings.
- They can be used to transmit large amount of power (of the order of 50,000 kW)

Disadvantages

- Spur gear are slow-speed gears
- Gear teeth experience a large amount of stress
- They cannot transfer power between non-parallel shafts
- They cannot be used for long distance power transmission.
- Spur gears produce a lot of noise when operating at high speeds.
- when compared with other types of gears, they are not as strong as them

4.12 Helical Gear

Advantages

- The angled teeth engage more gradually than do spur gear teeth causing them to run more smoothly and quietly
- Helical gears are highly durable and are ideal for high load applications.
- At any given time their load is distributed over several teeth, resulting in less wear

- Can transmit motion and power between either parallel or right angle shafts

Disadvantages

- An obvious disadvantage of the helical gears is a resultant thrust along the axis of the gear, which needs to be accommodated by appropriate thrust bearings, and a greater degree of sliding friction between the meshing teeth, often addressed with additives in the lubricant. Thus we can say that helical gears cause losses due to the unique geometry along the axis of the helical gear's shaft.
- Efficiency of helical gear is less because helical gear trains have sliding contacts between the teeth which in turns produce axial thrust of gear shafts and generate more heat. So, more power loss and less efficiency

4.13 Bevel Gear

Advantages

- This gear makes it possible to change the operating angle.
- Differing of the number of teeth (effectively diameter) on each wheel allows mechanical advantage to be changed. By increasing or decreasing the ratio of teeth between the drive and driven wheels one may change the ratio of rotations between the two, meaning that the rotational drive and torque of the second wheel can be changed in relation to the first, with speed increasing and torque decreasing, or speed decreasing and torque increasing.

Disadvantages

- One wheel of such gear is designed to work with its complementary wheel and no other.
- Must be precisely mounted.
- The shafts' bearings must be capable of supporting significant forces.

4.14 Worm Wheel

Advantages

- Worm gear drives operate silently and smoothly.
- They are self-locking.
- They occupy less space.
- They have good meshing effectiveness.
- They can be used for reducing speed and increasing torque.
- High velocity ratio of the order of 100 can be obtained in a single step

Disadvantages

- Worm gear materials are expensive.
- Worm drives have high power losses
- A disadvantage is the potential for considerable sliding action, leading to low efficiency
- They produce a lot of heat.

4.15 Rack and Pinion

Advantages

- Cheap
- Compact
- Robust
- Easiest way to convert rotation motion into linear motion

- Rack and pinion gives easier and more compact control over the vehicle

Disadvantages

- Since being the most ancient, the wheel is also the most convenient and somewhat more extensive in terms of energy too. Due to the apparent friction, you would already have guessed just how much of the power being input gives in terms of output, a lot of the force applied to the mechanism is burned up in overcoming friction, to be more precise somewhat around 80% of the overall force is burned to overcome one.
- The rack and pinion can only work with certain levels of friction. Too high a friction and the mechanism will be subject to wear more than usual and will require more force to operate.
- The most adverse disadvantage of rack and pinion would also be due to the inherent friction.

CHAPTER – 5

FABRICATION OF THE MACHINE AND TYPES OF WELDING, CLASSIFICATIONS

There are few types of fabrication methods are done on the machine. They are:

- Arc cutting.
- Welding.
- Drilling.
- Grinding.



- Turning.

5.1 FURTHER OPERATION

- Cleaning.
- Assembling.

5.2 MACHINING OPERATIONS:

In this project it is used to cut the raw material such as plates, rod. This is done by arc cutting machine.

5.2.1 DRILLING:

Drilling is used to produce holes in objects. In this project the square type pipe required the holes for making rake assembly. These holes are done by vertical type drilling machine.

5.2.2 FINE GRINDING:

It is nothing but a grinding process, which is done as smooth with fine grains. It is done by convention grinding machine.

5.2.3 WELDING:

It is the process, which is used to join two, is more similar materials as well as dissimilar materials. This is done by gas welding process.

5.2.4 TURNING:

It is used in this project to make the groove on the both sides of top cover plate. This is done by conventional lathe.



5.3 FURTHER OPERATIONS:

5.3.1 CLEANING

It is the operation to clean the all machined parts without burrs, dust and chip formals. By meaning the parts they are brightened and good looking.

5.3.2 ASSEMBLING

It is the operation, its deals with the assembling of various parts produced by above operations.

5.4 Types of welding and its classifications

Welding is a process of joining two metal pieces by the application of heat. Welding is the least expensive process and widely used now a days in fabrication. Welding joints different metals with the help of a number of processes in which heat is supplied either electrically or by mean of a gas torch. Different welding processes are used in the manufacturing of Auto mobiles bodies, structural work, tanks, and general machine repair work. In the industries, welding is used in refineries and pipe line fabrication. It may be called a secondary manufacturing process.

There are about 35 different welding and brazing process and several soldering methods, in use by the industry today. There are various ways of classifying the welding for example, they may be classified on the basis of source of heat (flames, arc etc.)

In general various welding processes are classified as follows.

5.4.1 Gas Welding



- (a): Air Acetylene
- (b): Oxy Acetylene
- (c): Oxy Hydrogen Welding

5.4.2 Arc Welding

- (a): Carbon Arc welding
- (b): Plasma Arc welding
- (c): Shield Metal Arc Welding
- (d): T.I.G. (Tungsten Inert Gas Welding)
- (e): M.I.G. (Metal Inert Gas Welding)

5.4.3 Resistance Welding:

- (a): Spot welding
- (b): Seam welding
- (c): Projection welding
- (d): Resistance Butt welding
- (e): Flash Butt welding

5.4.4 Solid State Welding:

- (a): Cold welding
- (b): Diffusion welding
- (c): Forge welding
- (d): Fabrication welding
- (e): Hot pressure welding
- (f): Roll welding

5.4.5 Thermo Chemical Welding

(a): Thermit welding

(b): Atomic welding

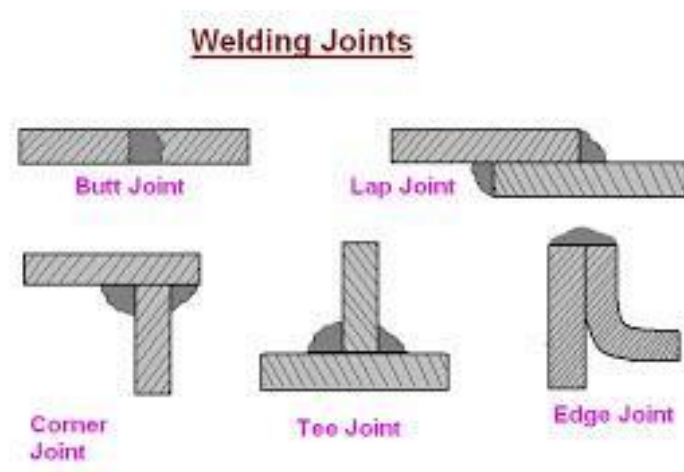
5.4.6 Radiant Energy Welding

(a): Electric Beam Welding

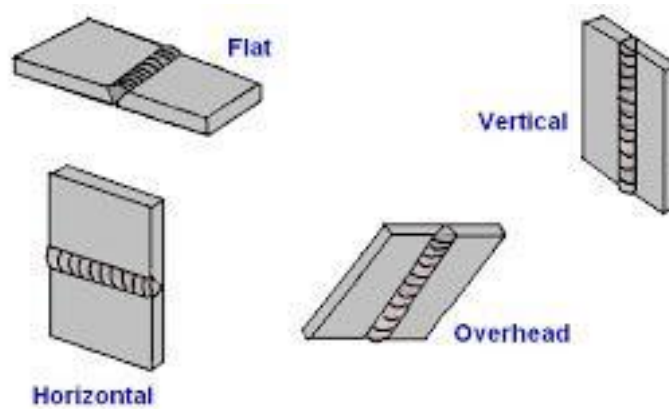
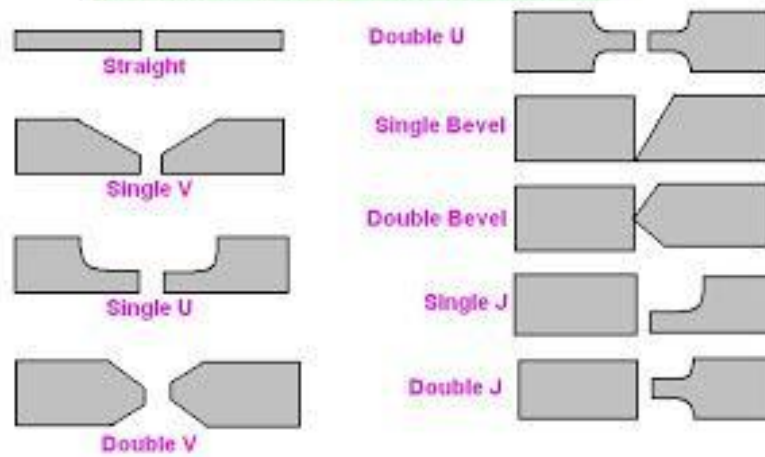
(b): Laser Beam Welding

5.5 Welding Joints

Different types of welding joints are classified as Butt, Lap, Corner, Tee and edge joints which are shown in figure

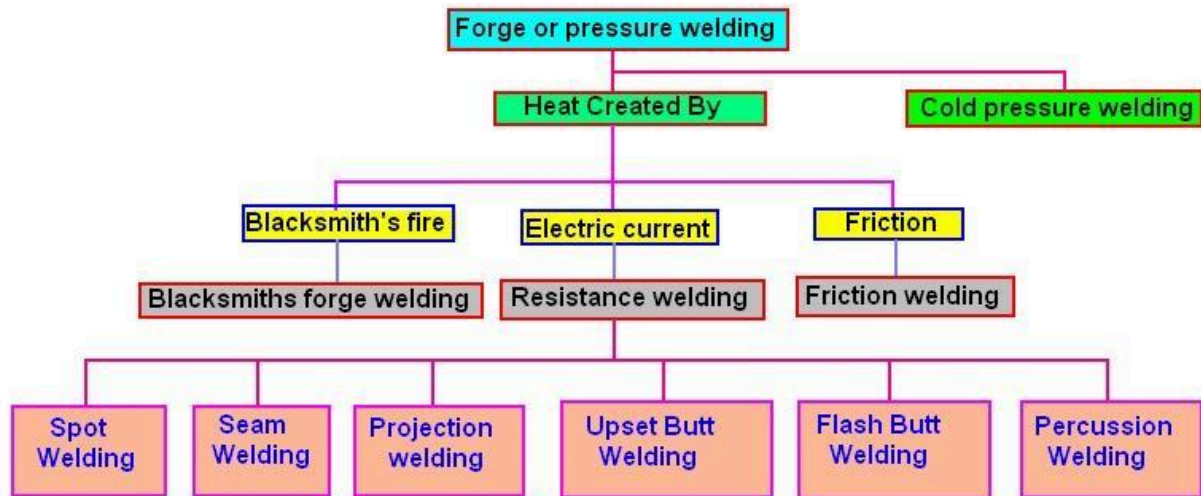


Butt Joint Edge Preparation Method

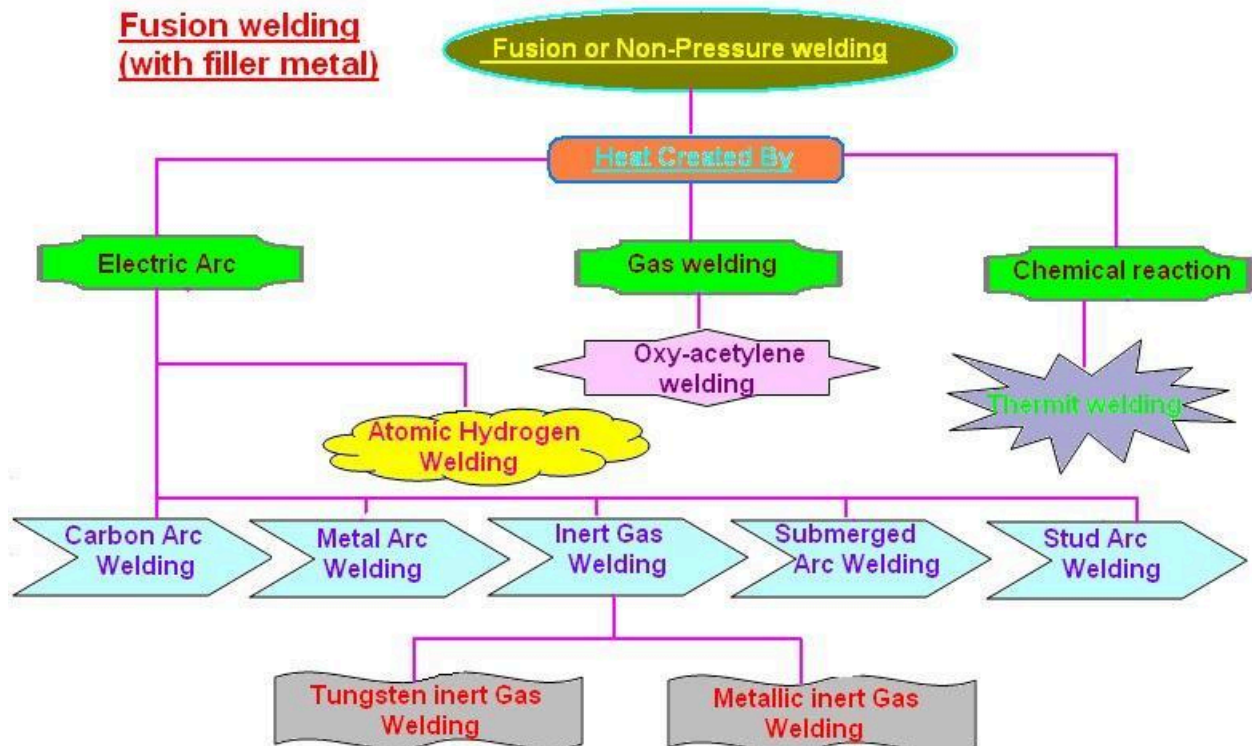


Welding Positions

1: Forge or Pressure Welding (without additional filler metal)



Fusion welding (with filler metal)



5.6 Arc Welding and its different processes

This the welding done in the project work. The arc welding is a fusion welding process in which the welding heat is obtained from an electric arc struck between the work(or base metal) and an electrode. The temperature of the heat produced by the electric arc is of the order of 6000°C to 7000°C. Both the direct current (D.C) and alternating current (A.C) may be used for arc welding, but the direct current is preferred for most purposes. When the work is connected to the positive terminal of the D.C welding machine and the negative terminal to an electrode holder, the welding set up is said to have straight polarity. On the other hand, when work is connected to negative and the electrode to a positive terminal, then the welding set up is said to have reversed polarity. The straight polarity is preferable for some welds while for other welds reversed polarity should be used.

Following are the two types of arc welding depending upon the type of electrode:

5.6.1 Un shielded arc welding:

When a large electrode or filler rod is used for welding, it is said to be un- shielded arc welding.

5.6.2 Shielded arc welding:

When the welding rods coated with fluxing material are used, then it is called shielded arc welding.

5.7 Arc welding Processes

The following are the various welding processes commonly used in engineering practice.

5.7.1 Carbon arc welding:

In carbon arc welding, the welding heat is obtained from an electric arc between a carbon electrode and the work. In welding heavy plants, the additional metal is deposited in the weld from a filler rod.

5.7.2 Metal arc welding:

In metal arc welding, the arc is produced between the metal electrode (also called filler rod) and the work piece. During the welding process, the metal electrode is melted by the heat of the arc and fused with the work piece. The temperature produced by the heat is about 2400°C to 2700°C .

5.7.3 Metallic inert gas (MIG) Arc welding:

In MIG welding, the electrode is consumable; the filler metal is deposited by the arc which is completely surrounded by an inert gas.

5.7.4 Tungsten inert gas (TIG) arc welding:

In TIG welding, the heat is produced from an arc between the non consumable tungsten electrode and the work piece. The welding zone is shielded by an atmosphere of inert gas (such as helium or argon) supplied from a suitable source. The direct current with a straight polarity is used for welding copper alloys and stainless steel. Whereas the reversed polarity is used for magnesium. The alternating current is more versatile in welding for steel, cast iron, aluminum and magnesium.

5.7.5 Atomic hydrogen welding:

In atomic hydrogen welding, the arc is obtained between two tungsten electrodes (non consumable) while a stream of hydrogen passes by the arc and envelopes the welding zone.

5.7.6 Stud arc welding:

It is a direct current arc welding process, and is used for welding metal studs to the flat metal surfaces.

5.7.7 Submerged arc welding

In submerged welding, the arc is produced between a bare metal electrode and the work piece. The submerged arc welding is mostly done on low carbon and alloy steels, but it may be used on many of the non-ferrous metals.

5.7.8 Thermite welding

In this welding, a mixture of iron oxide and aluminum known as thermit, is used. The mixture is ignited only at a temperature of about 1500°C . A major advantage of the thermit welding is that all parts of the weld section are molten at the same time and the weld cools almost uniformly. This results in a minimum problem with internal residual stresses. The thermit welding is often used in joining iron and steel parts that are too large to be manufactured, such as rails, trucks frames, locomotive frames, other large sections used on steam and rail road's, for stern frames, rubber frames etc. In steel mills, Thermit electric welding is employed to replace broken gear teeth, to weld new necks on rolls and pinions and to repair broken shears.



CHAPTER – 6

GENERATING ELECTRICITY THROUGH STEPUP MECHANISM

An amateur innovator in Guwahati has developed a simple contraption that can generate power when a vehicle passes over a speed breaker. KanakGogoi, a small time businessman, has developed a mechanism to generate power by converting the potential energy generated by a vehicle going up on a speed breaker into kinetic energy. The innovation has caught the eye of the Indian Institute of Technology (IIT), Guwahati, which will fund a pilot project to generate electricity from speed-breakers.

6.1 The idea is basic physics.

Gogoi has welded five-meter-long metal plates into the speed-breaker instead of the conventional bitumen-and-stone-chip rumble strip. The plates are movable and inclined with the help of a spring-loaded hydraulic system. The fulcrum-attached plates are pushed down when a vehicle moves over them and bounce back to original position as it passes.

“When the vehicle moves over the inclined plates, it gains height resulting in increase in potential energy, which is wasted in a conventional rumble strip,” Gogoi says. “When the plates come down, they crank a lever fitted to a ratchet-wheel type mechanism. This in turn rotates a geared shaft loaded with recoil springs. The output of this shaft is coupled to a dynamo to convert kinetic energy into electricity,” he explains.

IIT Guwahati has evaluated the machine and recommended it to the Assam ministry of power for large scale funding. A K Das, a professor at iit’s design department says it is a ‘very viable proposition’ to harness thousands of mega watts of electricity untapped across the country every day.

“A vehicle weighing 1,000 kg going up a height of 10 cm on such a rumble strip produces

approximately 0.98 kilowatt power. So one such speed-breaker on a busy highway, where about 100 vehicles pass every minute, about one kilo watt of electricity can be produced every single minute. The figure will be huge at the end of the day,” he said. The Assam power ministry is expected to back the iit pilot project. Das says a storage module like an inverter will have to be fitted to each such rumble strip to store this electricity. The cost of electricity generation and storage per mega watt from speed-breakers will be nearly Rs 1 crore as opposed to about Rs 8 crore in thermal or hydro power stations.

6.2 How do these Speed Bumps/Ramps work?

Simplicity is the solution to all the problems. That saying might have influenced the designer of the speed bumps, as the construction of these speed bumps can't get much simpler.

The mechanism consists of a ramp, which has a series of silver colored panels. These panels are placed inside a pad, which is almost flush to the road. The panels are so arranged that they can be compressed and then spring back to the same position after the vehicle has passed over. When a steady stream of traffic passes over the speed bump, the panel moves in an up and down motion which moves a mechanical system fixed under the road. The mechanical system is connected to a motor, which moves due to the oscillatory motion and is thus used to generate energy. It has been proved that if there is a steady stream of traffic moving over the ramp then it can produce around 10-36 KW of power. Also, only 4 ramps are needed to light a road up to a distance of one mile. If the amount of traffic is high, 10 ramps can generate power equal to that produced by a wind turbine. These ramps have already been put to use in London and Japan, and at least a dozen countries are already planning to introduce them in the near future.

Speed bumps have long been the bane of motorists' lives, but these will capture the kinetic energy of vehicles. Peter Hughes from London, the designer behind the idea, said: "They are speed bumps, but they are not like conventional speed bumps. They don't damage your car or waste petrol when you drive over them - and they have the added advantage that they produce energy free of charge." An engineer who formerly advised the United Nations on renewable energy sources, Hughes added: "If it the energy wasn't harnessed by the speed bumps, it would go to waste."



The construction cost of ramps varies depending on size - consist of a series of panels set in a pad virtually flush to the road. As the traffic passes over it, the panels go up and down, setting a cog in motion under the road. This then turns a motor, which produces mechanical energy. A steady stream of traffic passing over the bump can generate 10-36kW of power.

"With a steady flow of traffic, four of the ramps used as speed bumps would be enough to power all the street lights, traffic lights and road signs for a mile-long stretch of street. The ramp is silent, comfortable and safe for vehicles. It is not only green energy; it is free energy, once you have paid for the capital cost of the equipment," said Hughes. "The full potential of this is absolutely enormous." Hughes claims that 10 ramps could generate the same power as one wind turbine. The "electro-kinetic road ramp" system can either be raised to act as a speed bump or laid flat, so that drivers don't realize they are passing over it.

Speed humps were introduced in the UK in 1981. There are an estimated 30,000 in London and at least that number in the rest of the country. Conventional speed bumps cost about £2,000 each.

A nightclub opened in Rotterdam in the Netherlands last year that is run partly on energy generated by people dancing. Last year, it was also reported that pedestrians' footsteps could be used to power lighting at shopping centers.

The Motioned Powered Speed Bump is a novel method of generating energy from the weight and movement of cars over them. The speed bumps look more like a flat metal plate than a traditional concrete speed bump. The metal bumps have long thin pedals running across the top, which is pressed down as a car moves over the speed bump. The movement of these pedals turns gears inside the bump, which generates around 2,000W of electricity per car!



CHAPTER – 7

ELECTRIC MOTORS – AN OVER VIEW

Electric motors, both ac & dc motors, come in many shapes and sizes. Some are standardized electric motors for general-purpose applications. Other electric motors are intended for specific tasks. In any case, electric motors should be selected to satisfy the dynamic requirements of the machines on which they are applied without exceeding rated electric motor temperature. Thus, the first and most important step in electric motor selection is determining load characteristics -- torque and speed versus time. Electric motor selection is also based on mission goals, power available, and cost.

Starting and running torque are the first parameters to consider when sizing electric motors. Starting torque requirements for electric motors can vary from a small percentage of full-load to a value several times full-load torque. Starting torque varies because of a change in load conditions or the mechanical nature of the machine, which the electric motor is installed in. The latter could be caused by the lubricant, wear of moving parts, or other reasons.

Electric motors feature torque supplied to the driven machine, which must be more than that required from start to full speed. The greater the electric motor's reserve torque, the more rapid the acceleration. Electric motor drive systems that use gear reducers have parts that rotate at different speeds. To calculate acceleration torque required for these electric motors, rotating components must be reduced to a common base. The part inertias are usually converted to their equivalent value at the drive shaft. Equivalent inertia W_{2K22} of the load only is found from:

$$W_{2K22} = (W_{1K12}) (N_1/N_2)^2$$

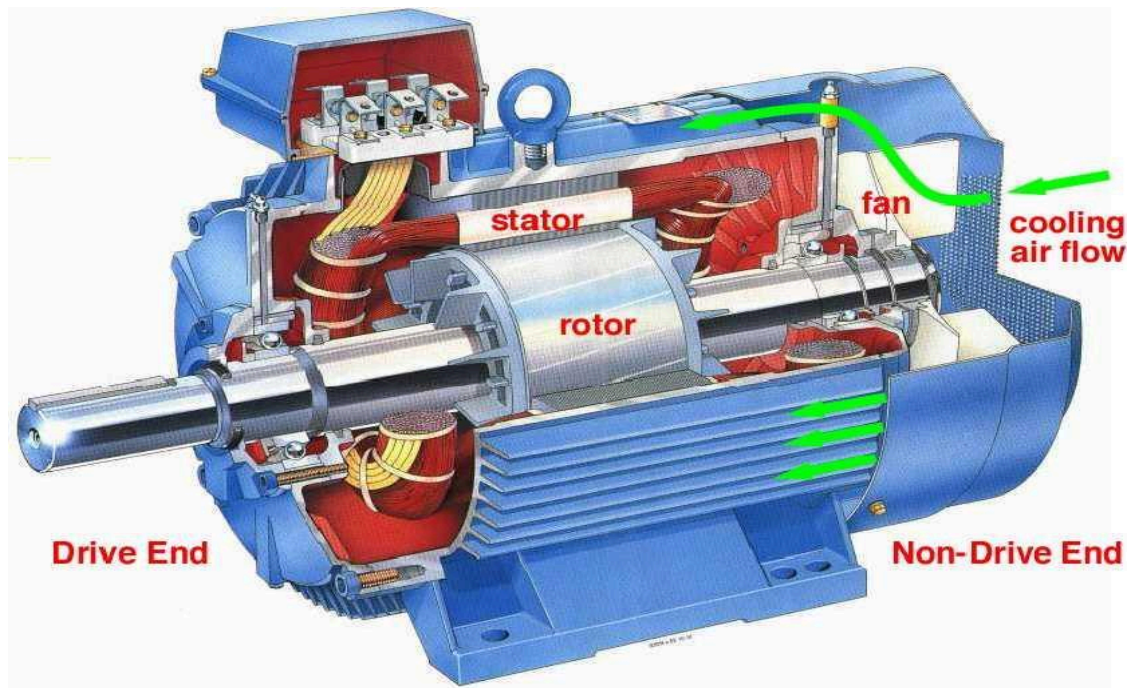
Where W_{1K21} = load inertia in lb-ft², N_1 = load speed in rpm, and N_2 = electric motor speed in rpm.

Electric motors have bodies, which have a straight-line motion are often connected to rotating driving units by rack-and-pinion, cable, or cam mechanisms.

For these electric motor parts, the equivalent WK2 is found from.

$$WK2 = W(S/2\pi N)^2$$

Where W = load weight, S = translation speed in fpm, π is pi, and N = rotational speed in rpm.



7.1 Electric Motors - Acceleration time:

Acceleration time for electric motors is directly proportional to total inertia and inversely proportional to the electric motor torque. For electric motors with constant acceleration torque, acceleration time is: where $WK2$ = rotational inertia in lb-ft², $(N2 - N1)$ = the speed difference, and Tx = acceleration torque in lb-ft. For translating bodies, acceleration time is: where W = weight of the load in lb, $(S2 - S1)$ = the translation speed difference and Fx = translation force in lb.

An approximation method is necessary to find the electric motor's acceleration time if acceleration torque is not linear during speed increase. The quickest method is to break up the speed versus torque curves of the electric motor and the driven machine into segments and

calculate acceleration time for each segment. Accurate electric motor acceleration times usually result.

7.2 Electric Motors - Power rating:

Electric motors offer the horsepower required to drive a machine, which is typically referred to as electric motor load. The most common equation for power based electric motors on torque and rotational speed is: $hp = (\text{torque} \times \text{rpm}) / 5,250$.

If the electric motor's load is not constant and follows a definite cycle, a horsepower versus time curve for the driven machine is helpful. From this curve both peak and rms the electric motor's horsepower can be determined. Rms load horsepower indicates the necessary continuous electric motor rating. Peak load horsepower is not necessarily an indication of the required electric motor rating. However, when a peak load is maintained for a period of time, electric motors feature a rating, which usually should not be less than peak load horsepower.

7.3 Duty cycle - Electric Motors:

Continuous steady-running loads over long periods are demonstrated by fans and blowers. On the other hand, electric motors installed in machines with flywheels may have wide variations in running loads. Often, electric motors use flywheels to supply the energy to do the work, and the electric motor does nothing but restore lost energy to the flywheel. Therefore, choosing the proper electric motor also depends on whether the load is steady, varies, follows a repetitive cycle of variation, or has pulsating torque or shocks.

For example, electric motors that run continuously in fans and blowers for hours or days may be selected on the basis of continuous load. But electric motors located in devices like automatically controlled compressors and pumps start a number of times per hour. And electric motors in some machine tools start and stop many times per minute.

Duty cycle is a fixed repetitive load pattern over a given period of time which is expressed as the ratio of on-time to cycle period. When operating cycle is such that electric motors operate at idle or a reduced load for more than 25% of the time, duty cycle becomes a factor in sizing electric motors. Also, energy required to start electric motors (that is,

accelerating the inertia of the electric motor as well as the driven load) is much higher than for steady-state operation, so frequent starting could overheat the electric motor.

For most electric motors (except squirrel-cage electric motors during acceleration and plugging) current is almost directly proportional to developed torque. At constant speed, torque is proportional to horsepower. For accelerating loads and overloads on electric motors that have considerable droop, equivalent horsepower is used as the load factor. The next step in sizing the electric motor is to examine the electric motor's performance curves to see if the electric motor has enough starting torque to overcome machine static friction, to accelerate the load to full running speed, and to handle maximum overload.

7.4 Electric Motors - Efficiency:

Small universal electric motors have an efficiency of about 30%, while 95% efficiencies are common for three-phase machines. In less-efficient electric motors, the amount of power wasted can be reduced by more careful application and improved electric motor design.

Electric motor's feature an efficiency level, which also depends on actual electric motor load versus rated load, being greatest near rated load and falling off rapidly for under and overload conditions.

8 DC MOTORS

Permanent magnet DC motor responds to both voltage and current. The steady state voltage across a motor determines the motor's running speed, and the current through its armature windings determines the torque. Apply a voltage and the motor will start running in one direction; reverse the polarity and the direction will be reversed. If you apply a load to the motor shaft, it will draw more current, if the power supply does not able to provide enough current, the voltage will drop and the speed of the motor will be reduced. However, if the power supply can maintain voltage while supplying the current, the motor will run at the same speed. In general, you can control the speed by applying the appropriate voltage, while

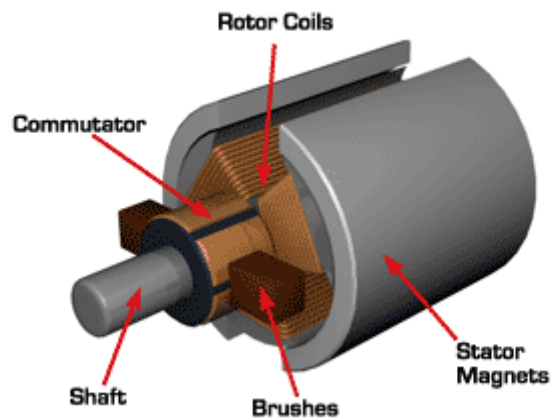


torque is controlled by current. In most cases, DC motors are powered up by using fixed DC power supply, therefore; it is more efficient to use a chopping circuit.

Consider what happens when a voltage applied to a motor's windings is rapidly turned ON and OFF in such a way that the frequency of the pulses produced remains constant, but the width of the ON pulse is varied. This is known as Pulse Width Modulation (PWM). Current only flows through the motor during the ON portion of the PWM waveform. If the frequency of the PWM input is high enough, the mechanical inertia of the motor cannot react to the ripple wave; instead, the motor behaves as if the current were the DC average of the ripple wave. Therefore, by changing the width of pulse, we can control the motor speed.

At the most basic level, electric motors exist to convert electrical energy into mechanical energy. This is done by way of two interacting magnetic fields -- one stationary, and another attached to a part that can move. A number of types of electric motors exist, but most BEAM bots use DC motors in some form or another. DC motors have the potential for very high torque capabilities (although this is generally a function of the physical size of the motor), are easy to miniaturize, and can be "throttled" via adjusting their supply voltage. DC motors are also not only the simplest, but the oldest electric motors.

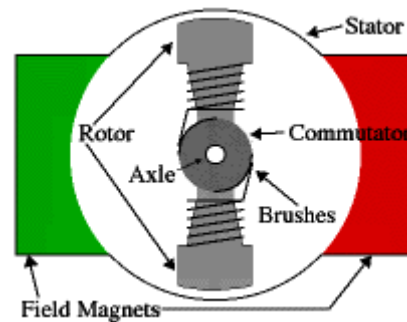
The basic principles of electromagnetic induction were discovered in the early 1800's by Forested, Gauss, and Faraday. By 1820, Hans Christian Forested and Andre Marie Ampere had discovered that an electric current produces a magnetic field. The next 15 years saw a flurry of cross-Atlantic experimentation and innovation, leading finally to a simple DC rotary motor. A number of men were involved in the work, so proper credit for the first DC motor is really a function of just how broadly you choose to define the word "motor



8.1 Principles of operation

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

Let's start by looking at a simple 2-pole DC electric motor (here dark black represents a magnet or winding with a "North" polarization, while light colour represents a magnet or winding with a "South" polarization).

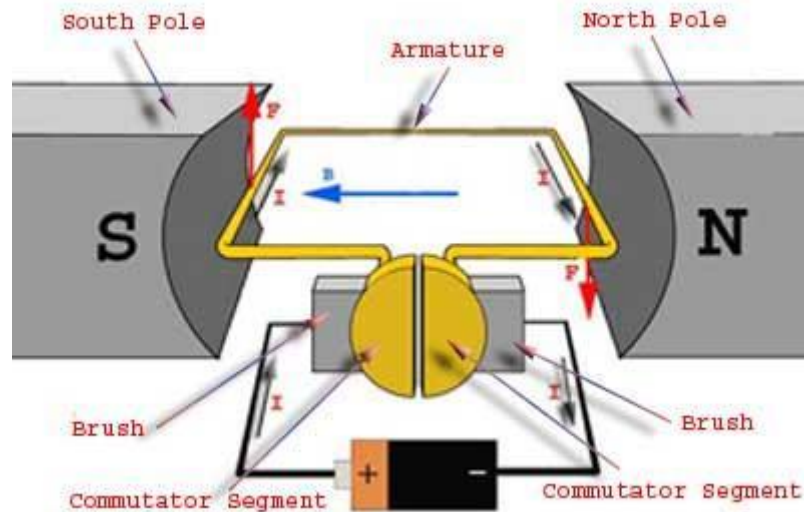


Every DC motor has six basic parts -- axle, rotor (a.k.a., armature), stator, commutator, field magnet's, and brushes. In most common DC motors, the external magnetic field is produced by high-strength permanent magnets. The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor (together with the axle and attached commutator) rotates with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator. The above diagram shows a common motor layout -- with the rotor inside the stator (field) magnets.

The geometry of the brushes, commutator contacts, and rotor windings are such that when power is applied, the polarities of the energized winding and the stator magnet(s) are misaligned, and the rotor will rotate until it is almost aligned with the stator's field magnets. As the rotor reaches alignment, the brushes move to the next commutator contacts, and energize the next winding. Given our example two-pole motor, the rotation reverses the direction of current through the rotor winding, leading to a "flip" of the rotor's magnetic field, driving it to continue rotating.

In real life, though, DC motors will always have more than two poles (three is a very common number). In particular, this avoids "dead spots" in the commutator. You can imagine how with our example two-pole motor, if the rotor is exactly at the middle of its rotation (perfectly aligned with the field magnets): it will get "stuck" there. Meanwhile, with a two-pole motor, there is a moment where the commutator shorts out the power supply (i.e., both brushes touch both commutator contacts simultaneously). This would be bad for the

power supply, waste energy, and damage motor components as well. Yet another disadvantage of such a simple motor is that it would exhibit a high amount of torque "ripple" (the amount of torque it could produce is cyclic with the position of the rotor).





CHAPTER – 9

CONCLUSIONS

The project work is designed & developed successfully, for the demonstration purpose a proto type module is constructed with lower ratings of devices, & results are found to be satisfactory. As it is a demo module it can not be used for real applications, but the concept is near to the real working system, to make it more realistic, higher rating power generator with suitable gear mechanism is essential to produce more energy.

This concept falls under the subject of non-conventional energy resources, out of the many alternative energy resources one dependable source is solar energy, but it is quite costliest affair. Therefore alternative cheapest source is to generate electricity from speed breaker. This technology proven here is the ultimate inexpensive source of all known forms of energy. When it is implemented practically, depending up on the traffic flow, the rail may produce tens of kilowatts power every day, this power can be utilized for many applications. One important advantage of producing energy through this technology is that it does not pollute the environment. Hence these mechanisms can be altered with this technology, thereby some of the requirements can be fulfilled through this generated energy.



REFERENCES

As the technology is simple & it doesn't contain any critical logic, uncomplicated circuit is designed to charge the battery. Similarly the street light is automated with another simple circuit designed with timer chip. There fore we have not gone through many references, regarding mechanical construction we referred few books related to mechatronics. The following are the books.

1. Mechatronics and measurement systems - By: DAVID G. ALCIATORE And MICHAEL B. HISTAND
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