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Design & Fabrication of Footpath Power Generation

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Abstract--- *In this project we are generating electrical power as non-conventional method by simply walking or running. Non-conventional energy system is very essential at this time to our nation. Non-conventional energy using foot step needs no fuel input power to generate the electrical power. In this project the simple drive mechanism such as rack and pinion assembly and chain drive mechanism is used for generating power by utilization of force which is obtained during the walking on road path is converted in to electrical energy with the help of mechanical systems. The generated power is stored by means of battery and this is used for activating the connected loads. This is one of the compact and efficient system for generating electricity which can be easily installed in many regions.*

Keywords--- *Design & Fabrication, Footpath Power Generation, Source of Heat Energy, Ancient Times.*

I. INTRODUCTION OF POWER GENERATION

Power generations is two types

1. Conventional
2. Non-conventional

II. CONVENTIONAL POWER GENERATION

In ancient times, wood was the most common source of heat energy. The energy of flowing water and wind was also used for limited activities. Can you think of some of these uses? The exploitation of coal as a source of energy made the industrial revolution possible. Increasing industrialization has led to a better quality of life all over the world. It has also caused the global demand for energy to grow at a tremendous rate. The growing demand for energy was largely met by the fossil fuels – coal and petroleum. Our technologies were also developed for using these energy sources. But these fuels were formed over millions of years ago and there are only limited reserves. The fossil fuels are non-renewable sources of energy, so we need to conserve them. If we were to continue consuming these sources at such alarming rates, we would soon run out of energy! In order to avoid this, alternate sources of energy were explored. But we continue to be largely dependent on fossil fuels for most of our energy requirements. Burning fossil fuels has other disadvantages too. We learnt in Class IX about the air pollution caused by burning of coal or petroleum products.

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The oxides of carbon, nitrogen and Sulphur that are released on burning fossil fuels are acidic oxides. These lead to acid rain which affects our water and soil resources. In addition to the problem of air pollution, recall the green-house effect of gases like carbon dioxide. The pollution caused by burning fossil fuels can be somewhat reduced by increasing the efficiency of the combustion process and using various techniques to reduce the escape of harmful gases and ashes into the surroundings. Besides being used directly for various purposes – in gas stoves and vehicles, do you know fossil fuels are the major fuels used for generating electricity? Let us produce some electricity at our own small plant in the class and see what goes into producing our favorite form of energy

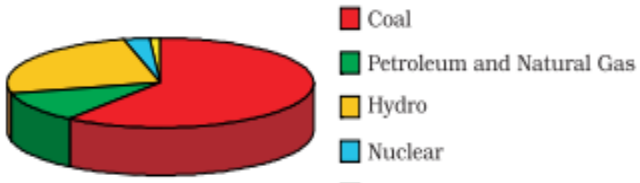

Figure 2.1
Pie-chart showing the major sources of energy for our requirements in India

Thermal Power Plant

Large amount of fossil fuels is burnt every day in power stations to heat up water to produce steam which further runs the turbine to generate electricity. The transmission of electricity is more efficient than transporting coal or petroleum over the same distance. Therefore, many thermal power plants are set up near coal or oil fields. The term thermal power plant is used since fuel is burnt to produce heat energy which is converted into electrical energy.

Hydro Power Plants

Another traditional source of energy was the kinetic energy of flowing water or the potential energy of water at a height. Hydro power plants convert the potential energy of falling water into electricity. Since there are very few water-falls which could be used as a source of potential energy, hydro power plants are associated with dams. In the last century, a large number of dams were built all over the world. As we can see from Fig. 2.1, a quarter of our energy requirement in India is met by hydro power plants. In order to produce hydel electricity, high-rise dams are constructed on the river to obstruct the flow of water and thereby collect water in larger reservoirs. The water level rises and in this process the kinetic energy of flowing water gets transformed into potential energy. The water from the high level in the dam is carried through pipes, to the turbine, at the bottom of the dam (Fig. 14.3). Since the water in the reservoir would be refilled each time it rains (hydro power is a renewable source of energy) we would not have to worry about hydroelectricity sources getting used up the way fossil fuels would get finished one day. But, constructions of big dams have certain problems associated with it. The dams can be constructed only in a limited number of places, preferably in hilly terrains. Large areas of agricultural land and human habitation are to be sacrificed as they get submerged. Large eco-systems are destroyed when submerged under the water in dams. The vegetation which is submerged rots under anaerobic conditions and gives rise to large amounts of methane which is

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also a green-house gas. It creates the problem of satisfactory rehabilitation of displaced people. Opposition to the construction of Tehri Dam on the river Ganga and Sardar Sarovar project on the river Narmada are due to such problems.

We already know that conventional power generation methods impact environment and human life such as global warming, greenhouse effect, ozone depletion, decreasing the human life span. So we changed to alternative sources or renewable sources or non-conventional energy sources.

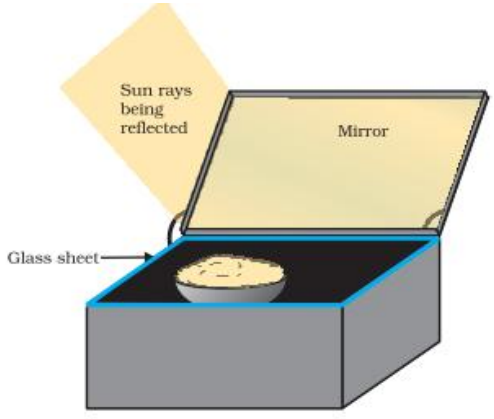
III. NON-CONVENTIONAL POWER GENERATIONS

With technological progress, our demand for energy increases day by day. Our life-styles are also changing, we use machines to do more and more of our tasks. Our basic requirements are also increasing as industrialization improves our living standards. As our demand for energy increases, we need to look for more and more sources of energy. We could develop the technology to use the available or known sources of energy more efficiently and also look to new sources of energy. Any new source of energy we seek to exploit would need specific devices developed with that source in mind. We shall now look at some of the latest sources of energy that we seek to tap, and the technology designed to capture and store energy from that source.

Solar Energy

The Sun has been radiating an enormous amount of energy at the present rate for nearly 5 billion years and will continue radiating at that rate for about 5 billion years more. Only a small part of solar energy reaches the outer layer of the earth's atmosphere. Nearly half of it is absorbed while passing through the atmosphere and the rest reaches the earth's surface.

A black surface absorbs more heat as compared to a white or a reflecting surface under identical conditions. Solar cookers (Fig.) and solar water heaters use this property in their working. Some solar cookers achieve a higher temperature by using mirrors to focus the rays of the Sun. Solar cookers are covered with a glass plate. Recall what we have learnt about the green-house effect. Does this explain why a glass plate is used?



Soalr Cooker

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It is easy to see that these devices are useful only at certain times during the day. This limitation of using solar energy is overcome by using solar cells that convert solar energy into electricity. A typical cell develops a voltage of 0.5–1 V and can produce about 0.7 W of electricity when exposed to the Sun. A large number of solar cells are, combined in an arrangement called solar cell panel (Fig. 14.7) that can deliver enough electricity for practical use. The principal advantages associated with solar cells are that they have no moving parts, require little maintenance and work quite satisfactorily without the use of any focusing device. Another advantage is that they can be set up in remote and inaccessible hamlets or very sparsely inhabited areas in which laying of a power transmission line may be expensive and not commercially viable. Silicon, which is used for making solar cells, is abundant in nature but availability of the special grade silicon for making solar cells is limited. The entire process of manufacture is still very expensive, silver used for interconnection of the cells in the panel further adds to the cost. In spite of the high cost and low efficiency, solar cells are used for many scientific and technological applications. The domestic use of solar cells is, however, limited due to its high cost.

Solar cell Panel

Energy from the Sea

1. Tidal Energy

Due to the gravitational pull of mainly the moon on the spinning earth, the level of water in the sea rises and falls. If you live near the sea or ever travel to some place near the sea, try and observe how the sea-level changes during the day. This phenomenon is called high and low tides and the difference in sea-levels gives us tidal energy. Tidal energy is harnessed by constructing a dam across a narrow opening to the sea. A turbine fixed at the opening of the dam converts tidal energy to electricity. As you can guess, the locations where such dams can be built are limited.

2. Wave Energy

Similarly, the kinetic energy possessed by huge waves near the seashore can be trapped in a similar manner to generate electricity. The waves are generated by strong winds blowing across the sea. Wave energy would be a viable proposition only where waves are very strong. A wide variety of devices have been developed to trap wave energy for rotation of turbine and production of electricity.

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Ocean Thermal Energy

The water at the surface of the sea or ocean is heated by the Sun while the water in deeper sections is relatively cold. This difference in temperature is exploited to obtain energy in ocean-thermal-energy conversion plants. These plants can operate if the temperature difference between the water at the surface and water at depths up to 2 km is 20 K (20°C) or more. The warm surface-water is used to boil a volatile liquid like ammonia. The vapors of the liquid are then used to run the turbine of generator. The cold water from the depth of the ocean is pumped up and condense vapor again to liquid. The energy potential from the sea (tidal energy, wave energy and ocean thermal energy) is quite large, but efficient commercial exploitation is difficult.

Geothermal Energy

Due to geological changes, molten rocks formed in the deeper hot regions of earth's crust are pushed upward and trapped in certain regions called 'hot spots'. When underground water comes in contact with the hot spot, steam is generated. Sometimes hot water from that region finds outlets at the surface. Such outlets are known as hot springs. The steam trapped in rocks is routed through a pipe to a turbine and used to generate electricity. The cost of production would not be much, but there are very few commercially viable sites where such energy can be exploited. There are number of power plants based on geothermal energy operational in New Zealand and United States of America.

Nuclear Energy

How is nuclear energy generated? In a process called nuclear fission, the nucleus of a heavy atom (such as uranium, plutonium or thorium), when bombarded with low-energy neutrons, can be split apart into lighter nuclei. When this is done, a tremendous amount of energy is released if the mass of the original nucleus is just a little more than the sum of the masses of the individual products. The fission of an atom of uranium, for example, produces 10 million times the energy produced by the combustion of an atom of carbon from coal. In a nuclear reactor designed for electric power generation, such nuclear 'fuel' can be part of a self-sustaining fission chain reaction that releases energy at a controlled rate. The released energy can be used to produce steam and further generate electricity.

In this point of concern, we are also following non-conventional energy method which is Foot path power generation, this is not an innovative but slightly modified.

We know about power generation from speed breaker and foot step power generation. These all are limited to some constraints. Foot step power means it will applicable only if there are stairs like apartments, schools, IT hubs, shopping malls. And power generation from speed breaker is only applicable if when there is speed breaker.

But our model is generating power if there is road. In India there are so many national highways and state highways.

The most common methodology of foot power generators includes

1. Foot step electric converter device (Mechanical method)
2. Footstep electricity generation using pavement
3. Footwear embedded harvesters

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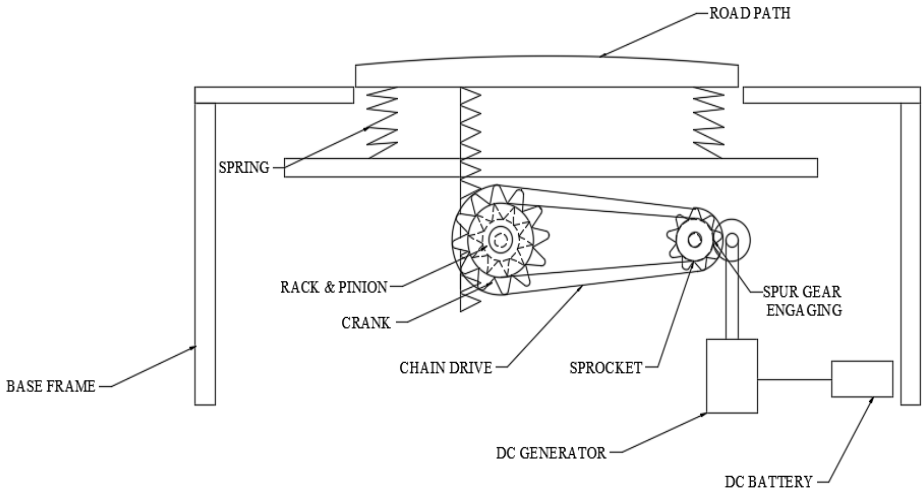
4. piezo electric shoe

Foot Step Electric Converter

This device, if embedded in the footpath, can convert foot impact energy into electrical form. The downward movement of the plate results in rotation of the shaft of an electrical alternator fitted in the device, to produce electrical energy electricity generated from these devices can be used for street lights.

This is a mechanical arrangement so efficiency is not so good and wear tear problem is there. The weight is less than 50kg then this device will not work [1-3].



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Footstep Electricity Generation Using Pavegen

The recycled rubber "PaveGen" paving slabs harvest kinetic energy from the impact of people stepping on them and instantly deliver tiny bursts of electricity to nearby appliances.

The slabs can also store energy for up to three days in an on-board battery, according to its creator. Paving slabs that convert energy from people's footsteps into electricity are set to help power Europe's largest urban mall, at the 2012 London Olympics site.

IV. 2-D MODEL OF FOOT PATH POWER GENERATION CONSTRUCTION AND WORKING PRINCIPLE

4.1 Construction

Our proposed model "FOOT PATH POWER GENERATION" need so many raw materials which are mentioned in above chapter.

For that materials first of all we purchased the raw materials based upon requirement and for that we've planned to how to buy. After bought we cut raw materials in required dimensions in precise manner by using hand wheel cutting machine. After that we've gone for some rough turning and finishing by using lathe and grinding machines. After that for assembly purpose we went for welding for permanent joint wherever we require and joined with rivets wherever we require rigidly fixed joints. Up to this, mechanical operations are over next we've given electrical connections to the model, from dc generator to battery, from battery to LED light.

Working Principle

Our proposed model foot path power generation consists of a special arrangement of path which is placed above some elevation to the normal road level as shown in figure. That few elevation is used to generate the power. So when walking on the road path that special arrangement will move up and down based on the force applying and removing. The pushing power is converted into electrical energy by proper driving arrangement. The rack & pinion, spring arrangement is fixed at bottom of the special road path. The spring is used to return the special road path arrangement in same position by releasing the load. The pinion shaft is connected to the supporter by end bearings as shown in fig. The larger sprocket also coupled with the pinion shaft, so that it is running the same speed of pinion. The larger sprocket is coupled to the small cycle sprocket with the help of chain (cycle). This larger sprocket is used to transfer the rotation force to the smaller sprocket. The smaller sprocket is running same direction for the forward and reverse direction of rotational movement of the larger sprocket. This action looks like a cycle pedaling action. By mounting a spur gear behind the smaller sprocket, which is coupled with dc generator. This spur gear also rotates with the speed of smaller sprocket and coupled with another spur gear which fixed to dc generator. By continuous engagement of two spur gears we can generate the electricity, which can be stored in dc battery.

4.2 Manufacturing Process

Manufacturing processes are the steps through which raw materials are transformed into a final product. The manufacturing process begins with the creation of the materials from which the design is made. These materials are then modified through manufacturing processes to become the required part.

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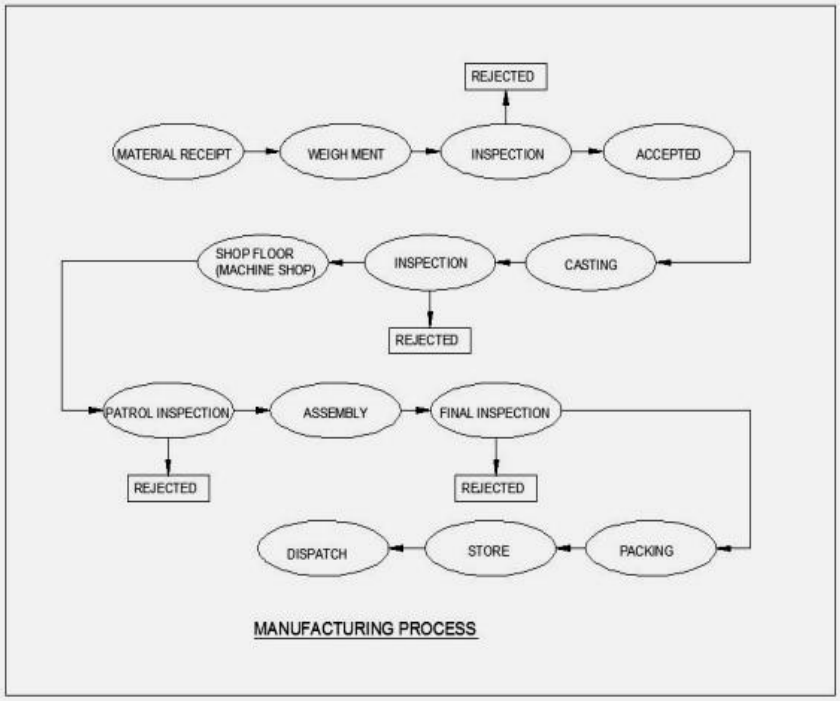
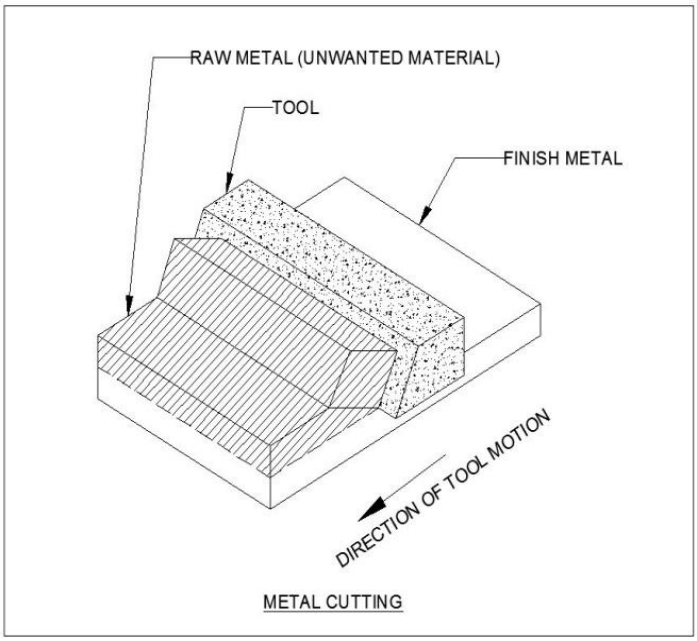
Manufacturing processes can include treating (such as heat treating or coating), machining, or reshaping the material. The manufacturing process also includes tests and checks for quality assurance during or after the manufacturing, and planning the production process prior to manufacturing.



4.2.1 Metal Cutting

Metal cutting or machining is the process of by removing unwanted material from a block of metal in the form of chips.



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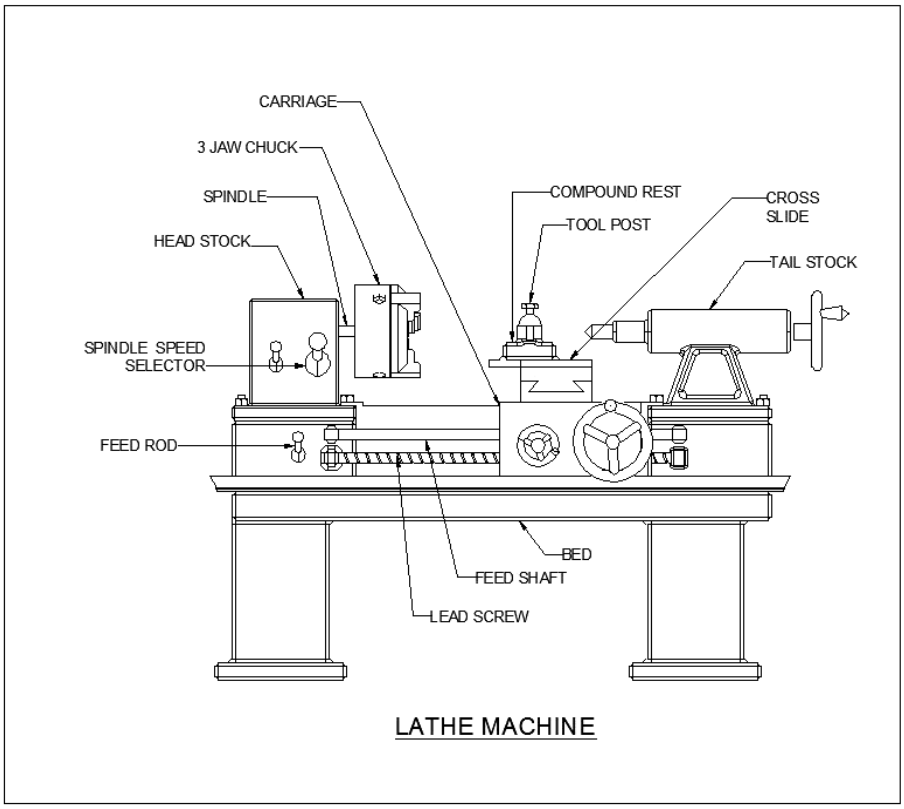
Cutting processes work by causing fracture of the material that is processed. Usually, the portion that is fractured away is in small sized pieces, called chips. Common cutting processes include sawing, shaping (or planning), broaching, drilling, grinding, turning and milling. Although the actual machines, tools and processes for cutting look very different from each other, the basic mechanism for causing the fracture can be understood by just a simple model called for orthogonal cutting.



LATHE MACHINE

In all machining processes, the work piece is a shape that can entirely cover the final part shape. The objective is to cut away the excess material and obtain the final part. This cutting usually requires to be completed in several steps – in each step, the part is held in a fixture, and the exposed portion can be accessed by the tool to machine in that portion. Common fixtures include vise, clamps, 3-jaw or 4-jaw chucks, etc. Each position of holding the part is called a setup. One or more cutting operation may be performed, using one or more cutting tools, in each setup. To switch from one setup to the next, we must release the part from the previous fixture, change the fixture on the machine, clamp the part in the new position on the new fixture, set the coordinates of the machine tool with respect to the new location of the part, and finally start the machining operations for this setup.

Therefore, setup changes are time-consuming and expensive, and so we should try to do the entire cutting process in a minimum number of setups; the task of determining the sequence of the individual operations, grouping them into (a minimum number of) setups, and determination of the fixture used for each setup, is called process planning.

These notes will be organized in three sections:

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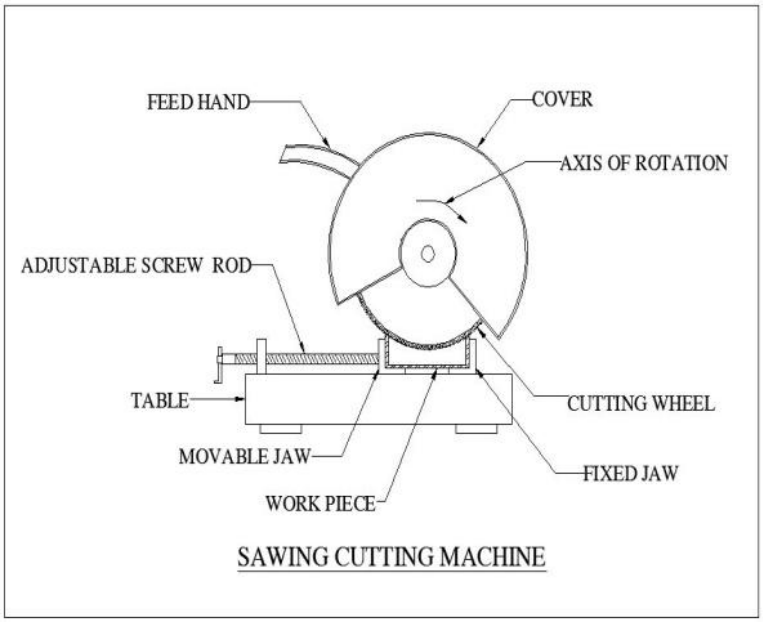
(i) Introduction to the processes,

(ii) The orthogonal cutting model and tool life optimization and

(iii) Process planning and machining planning for milling.

4.2.2 Sawing

Cold saws are saws that make use of a circular saw blade to cut through various types of metal, including sheet metal. The name of the saw has to do with the action that takes place during the cutting process, which manages to keep both the metal and the blade from becoming too hot. A cold saw is powered with electricity and is usually a stationary type of saw machine rather than a portable type of saw.



The circular saw blades used with a cold saw are often constructed of high speed steel. Steel blades of this type are resistant to wear even under daily usage. The end result is that it is possible to complete a number of cutting projects before there is a need to replace the blade. High speed steel blades are especially useful when the saws are used for cutting through thicker sections of metal.

Along with the high speed steel blades, a cold saw may also be equipped with a blade that is tipped with tungsten carbide. This type of blade construction also helps to resist wear and tear. One major difference is that tungsten tipped blades can be re-sharpened from time to time, extending the life of the blade. This type of blade is a good fit for use with sheet metal and other metallic components that are relatively thin in design.

4.2.3 Welding

Welding is a process for joining similar metals. Welding joins metals by melting and fusing **1,** the base metals being joined and **2,** the filler metal applied. Welding employs pinpointed, localized heat input. Most welding involves ferrous-based metals such as steel and stainless steel. Weld joints are usually stronger than or as strong as the base metals being joined.

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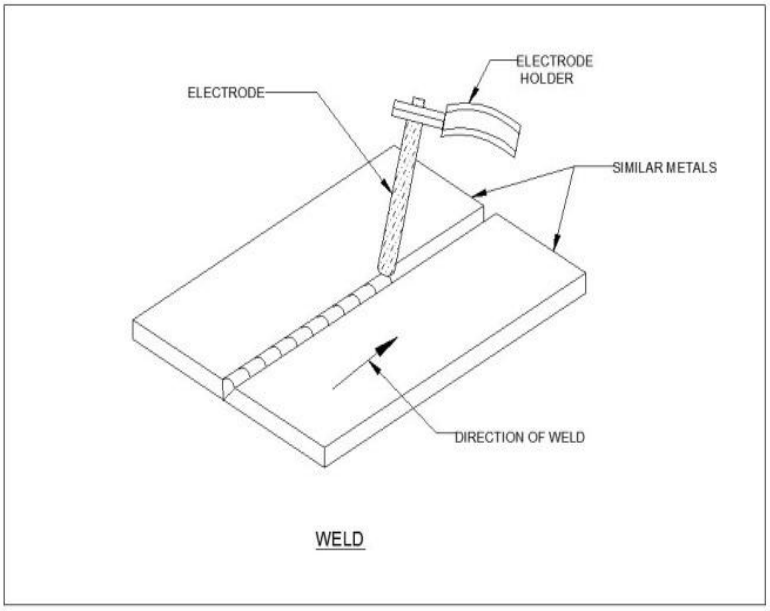
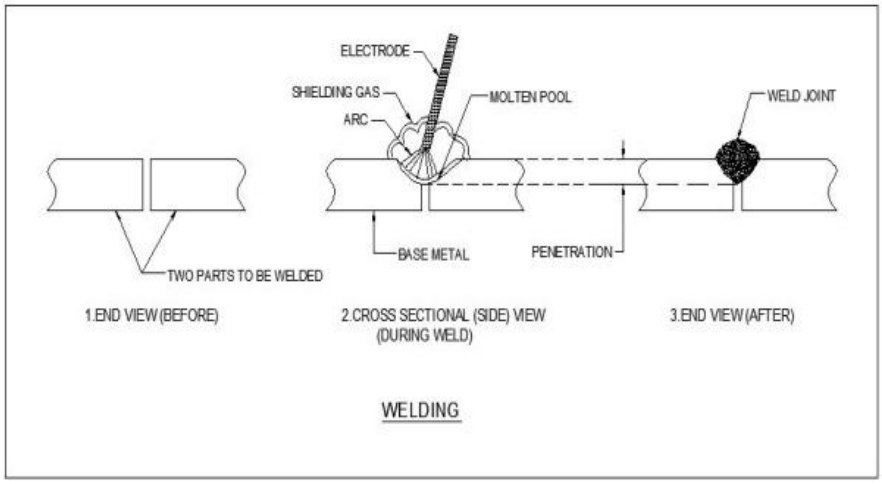


Welding is used for making permanent joints. It is used in the manufacture of automobile bodies, aircraft frames, railway wagons, machine frames, structural works, tanks, furniture, boilers, general repair work and ship building.

A. Operation

Several welding processes are based on heating with an electric arc, only a few are considered here, starting with the oldest, simple arc welding, also known as shielded metal arc welding (SMAW) or stick welding.

In this process an electrical machine (which may be DC or AC, but nowadays is usually AC) supplies current to an electrode holder which carries an electrode which is normally coated with a mixture of chemicals or flux. An earth cable connects the work piece to the welding machine to provide a return path for the current. The weld is initiated by tapping ('striking') the tip of the electrode against the work piece which initiates an electric arc. The high temperature generated (about 6000^{o}C) almost instantly produces a molten pool and the end of the electrode continuously melts into this pool and forms the joint.



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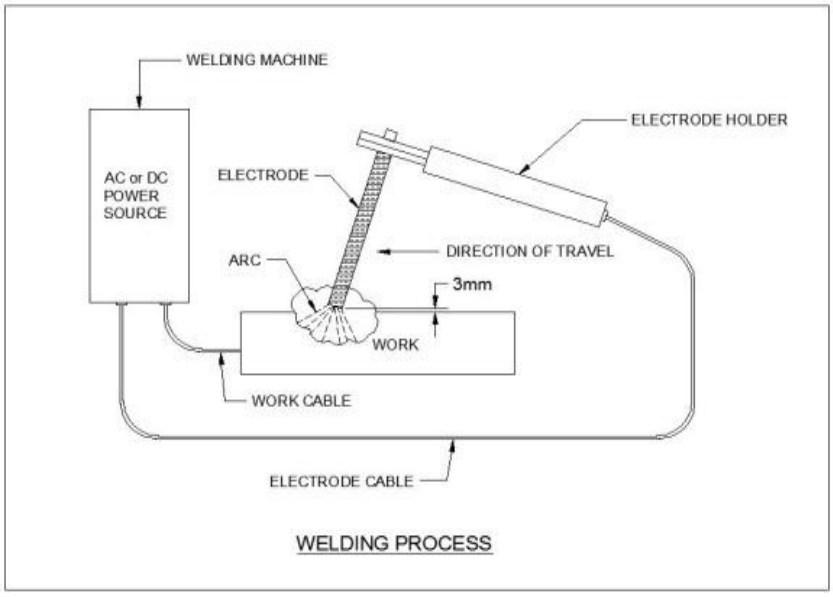
The operator needs to control the gap between the electrode tip and the work piece while moving the electrode along the joint.



WELDING PROCESS

In the shielded metal arc welding process (SMAW) the 'stick' electrode is covered with an extruded coating of flux. The heat of the arc melts the flux which generates a gaseous shield to keep air away from the molten pool and also flux ingredients react with unwanted impurities such as surface oxides, creating a slag which floats to the surface of the weld pool. This forms a crust which protects the weld while it is cooling. When the weld is cold the slag is chipped off.

Description of Components Required

The components required for fabricating the system is described in detail in the following sessions

- Rack and pinion arrangement
- MS Plate
- Chain drive and sprocket
- Spur gear
- Bearing
- Spring
- Shaft
- DC Generator
- DC Battery

Rack and Pinion Arrangement

Rack and pinion animations rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. The circular pinion engages teeth on a linear “gear” bar–the rack. Rotational motion applied to the pinion will cause the rack to move to the side, up to the limit of its travel.

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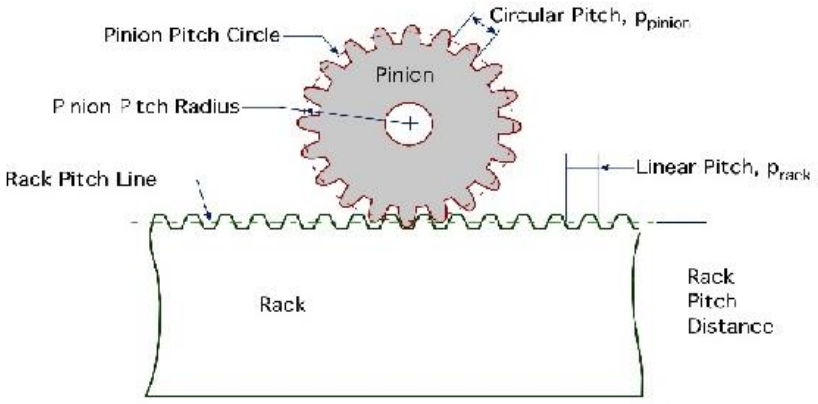
For example, in a rack railway, the rotation of a pinion mounted on a locomotive or a rail car engages a rack between the rails and pulls a train along a steep slope.

A rack is a gear whose pitch diameter is infinite, resulting in a straight line pitch circle.

Involute of a very large base circle approaches a straight line.

Used to convert rotary motion to straight line motion.

Used in machine tools.



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.

Specifications of Pinion Gear

Material	: Cast-Iron
Outside diameter	: 76mm
Circular pitch	: 4.9mm
Tooth depth	: 3.385mm
Module	: 1.7mm
Pressure angle	: 21°
Pitch circle diameter	: 77mm
Addendum	: 1.5mm
Dedendum	: 1.875mm
Circular tooth Thickness	: 2.365mm
Fillet radius	: 0.46mm
Clearance	: 0.385mm

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Specifications of Rack

Material	: Cast Iron
Module	: 1.6mm
Cross-section	: 77×26mm

Ms Plate

In our project we are using MS Plate as Special arrangement of foot path. This is the main component of our proposed model. By up and down movement of this only we are generating the power.

Why Mild Steel

Why steel, in particular simply because, in my humble opinion, it is the greatest material mankind has for construction. It is cheap, strong, readily available, easily cut, joined, and formed. Wood can be light and stiff, but not very strong.

The best aluminum is strong and light, but very difficult to join. Titanium is superb in terms of strength to weight ratio and stiffness but it's incredibly expensive, difficult to obtain, and even more difficult and expensive to machine properly. There's no way you're ever going to perform a battery-welded-fix on a part made from 7075-T6 aluminum or titanium.

In the end we come back to steel from mild carbon to some of the more exotic alloy steels pound for pound it is the most righteous material available for our needs. Where does steel come from? Steel is not a naturally occurring substance - it is entirely manmade. Steel is chiefly a combination of two naturally occurring elements: iron and carbon (along with small amounts of other elements - depending on the steel in question).

Material	-	Mild steel
Size	-	60*45cm
Thickness	-	4mm
Quantity	-	1

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Sprocket and Chain Drive

Sprocket

Sprocket is the major component of this system because it is power transmitting device. It gets power from the chain drive and makes this system to work. It is the device which transmits the linear motion of meshing chain drive into rotary motion by means of the tooth found on it. The sprocket with ball bearings is said to be free wheel.

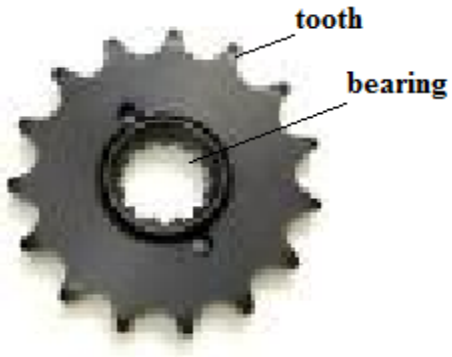

Fig: Sprocket with bearing

Since it is a free wheel it allows the toothed part to rotate free from central portion in a direction. Hence this type of sprocket is used as the rear power transmission device in by cycle that makes the wheel to rotate and also allows toothed area to rotate in anticlockwise when pedaled anticlockwise direction. This action of sprocket allows attached lifting lever to adjust freely automatically or manually when it does not engages with pushing lever properly.

Since the sprocket transmit the power from chain drive, it should have the capability to withstand the heavy loads of engine. So to withstand those impacts on toothed area, it is made of high carbon steel. The ball bearings are made up of high chromium steel. Hence all these material gives following properties for sprocket.

- Heavy duty
- Smooth running
- Tempered
- Long life

Hence the sprocket is considered as heart of this system Fig: Sprocket with nomenclature.

Chain Drive

Chain drives are a means of transmitting power like gears, shafts and belt drives

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Characteristics

- High axial stiffness
- Low bending stiffness
- High efficiency
- Relatively cheap

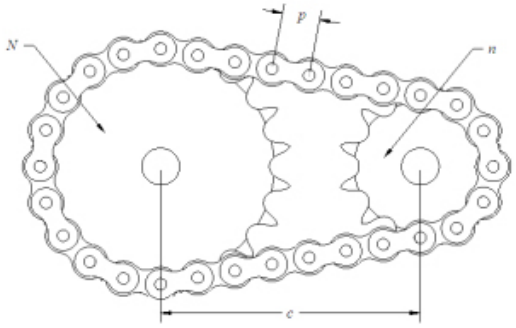
Chain Drive Design Calculation

- Chain length and center distance
- Chain must contain even integer number of links
- Hence cannot pick an arbitrary center distance and chain pitch
- Nearest chain lengths (in pitches) for a contemplated_center distance, C_C, are calculated by empirical formulae like (for a two sprocket system:

L = N1+N2/2 + 2Cc/p + (N2-N1) ^2/4pi^2Cc

Where N_1 and N_2 are the numbers of teeth on sprockets and P is the chain pitch

Roller Chain Definition



Inertial Force in Chain

- In addition to the tension required to transmit power, chain tension
- also provides centripetal force to move links around sprockets
- The extra inertial force, Fcf, is given by:

F = mr ^2w ^2

Specification of Axle

Specification of Sprocket

Material	*High Carbon Steel*
Pitch	12.7mm
Width	30mm
Teeth	16
Balls	High carbon high chromium steel balls

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Material	*Mild Steel*
Shape	Cylindrical rod
Length	50mm
Diameter	13mm
Inner diameter of supporting axle	15 mm
Outer diameter of supporting axle	17mm
Length	30mm
Thickness	3mm

Spur Gear Arrangement

Apply principles learned into actual design and selection of spur gear systems.

Calculate forces on teeth of spur gears, including impact forces associated with velocity and clearances.

Determine allowable force on gear teeth, including the factors necessary due to angle of involute of tooth shape and materials selected for gears.

Design actual gear systems, including specifying materials, manufacturing accuracy, and other factors necessary for complete spur gear design.

Understand and determine necessary surface hardness of gears to minimize or prevent surface wear.

Understand how lubrication can cushion the impact on gearing systems and cool them.

Select standard gears available from stocking manufacturers or distributors.

Specifications for standard gear teeth

Item	Full depth & pitches coarser than 20		Full depth & pitches finer than 20	14½° full depth
Pressure angle	20°	25°	20°	14½°
Addendum (in.)	1.0/P	1.0/P	1.0/P	1/P
Dedendum (in.)	1.250/P	1.250/P	1.2/P + 0.002	1.157/P

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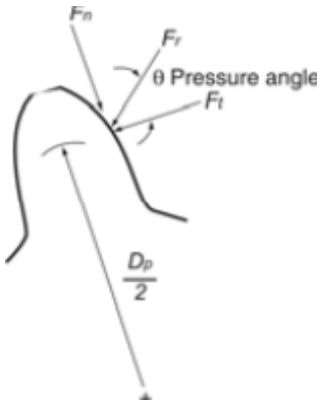

Forces on spur gear teeth

•Ft = Transmitted force

•Fn = Normal force or separating force

•Fr = Resultant force

• θ= pressure angle

•Fn= Ft tan θ

Fr = Ft/ cos θ

Forces on spur gear teeth

Power, P= T n/63,000

• Torque, T = Ft r and r = Dp/2

• Combining the above we can write

Ft= T 2/ D p

20-tooth, 8 pitch, 1-inch-wide, 20° pinion transmits 5 hp at 1725 rpm to a 60-tooth gear.

Determine driving force, separating force, and maximum force that would act on mounting shafts.

P = Tn / 63,000

T = 63,000P/n

T = (63,000)5 / 1725 = **183 in-lb**

−Find pitch circle:

Dp= Np / Pd

Dp= 20 teeth / 8 teeth/in diameter

Dp= 2.5 in (Material Used for Spur Gear Is CAST IRON)

Bearing

A bearing is a machine element that constrains relative motion and reduces friction between moving parts to only the desired motion. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts.

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Many bearings also facilitate the desired motion as much as possible, such as by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.

Bearing No. 6202 (Data book page.no 4.13)

Outer Diameter of Bearing (D) = 35 mm

Thickness of Bearing (B) = 12 mm

Inner Diameter of the Bearing (d) = 15 mm

r_1 = Corner radii on shaft and housing

r_1= 1(From design data book)

Maximum Speed = 14,000 rpm (From design data book)

Mean Diameter (d_m) = (D + d) / 2

= (35 + 15) / 2

d_m = 25 mm

Return Spring

Definition for Spring

Springs are elastic bodies (generally metal) that can be twisted, pulled, or stretched by some force. They can return to their original shape when the force is released. In other words, it is also termed as a resilient member.

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

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

Specification of Spring

Material : Mild steel

Diameter : 5 to 8 cm

Coil diameter : 0.75 to 0.95 cm

Pitch : 2cm

Height :15 to 18 cm

Shaft

A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power. The various members such as pulleys and gears are mounted on it.

Types

They are mainly classified into two types.

Transmission shafts are used to transmit power between the source and the machine absorbing power; e.g. counter shafts and line shafts.

Machine shafts are the integral part of the machine itself; e.g. crankshaft.

Materials

The material used for ordinary shafts is mild steel. When high strength is required, an alloy steel such as nickel, nickel-chromium or chromium-vanadium steel is used.

Shafts are generally formed by hot rolling and finished to size by cold drawing or turning and grinding.

Shaft diameter: 15mm

Material: Mild steel

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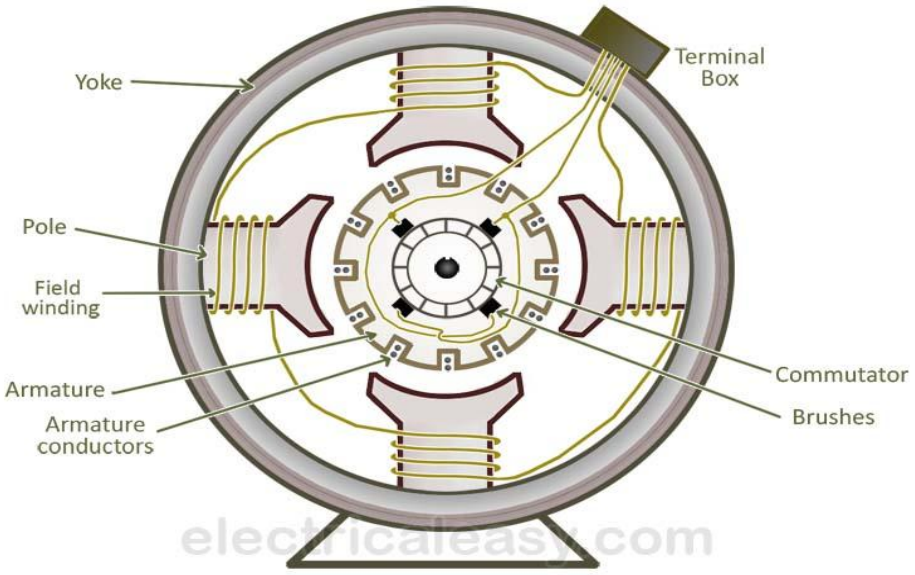
DC Generator

A dc generator is an electrical machine which converts mechanical energy into **direct current electricity**. This energy conversion is based on the principle of production of dynamically induced emf.

Construction of A DC Machine

Note: A DC generator can be used as a DC motor without any constructional changes and vice versa is also possible. Thus, a DC generator or a DC motor can be broadly termed as a DC machine. These basic constructional details are also valid for the construction of a DC motor. Hence, let's call this point as construction of a DC machine instead of just 'construction of a dc generator'.



Working Principle of A DC Generator

According to Faraday's laws of electromagnetic induction, whenever a conductor is placed in a varying magnetic field (OR a conductor is moved in a magnetic field), an emf (electromotive force) gets induced in the conductor. The magnitude of induced emf can be calculated from the emf equation of dc generator. If the conductor is provided with the closed path, the induced current will circulate within the path. In a DC generator, field coils produce an electromagnetic field and the armature conductors are rotated into the field. Thus, an electromagnetically induced emf is generated in the armature conductors. The direction of induced current is given by Fleming's right hand rule.

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Types of DC Generator

DC generators can be classified in two main categories, viz;

(i) Separately excited and

(ii) Self-excited.

(i) **Separately excited**: In this type, field coils are energized from an independent external DC source. (ii) **Self excited**: In this type, field coils are energized from the current produced by the generator itself. Initial emf generation is due to residual magnetism in field poles. The generated emf causes a part of current to flow in the field coils, thus strengthening the field flux and thereby increasing emf generation. Self-excited dc generators can further be divided into three types:

(a) Series wound - field winding in series with armature winding
(b) Shunt wound - field winding in parallel with armature winding
(c) Compound wound - combination of series and shunt winding

DC Motor capacity : 12V

Unloading : 130rpm

Loading : 90rpm

Battery

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact, for small units with output less than one kilowatt.

Batteries seem to be the only technically and economically available storage means. Since both the photo-voltaic system and batteries are high in capital costs. It is necessary that the overall system be optimized with respect to available energy and local demand pattern. To be economically attractive the storage of solar electricity requires a battery with a particular combination of properties:

(1) Low cost

(2) Long life

(3) High reliability

(4) High overall efficiency

(5) Low discharge

(6) Minimum maintenance

(A) Ampere hour efficiency

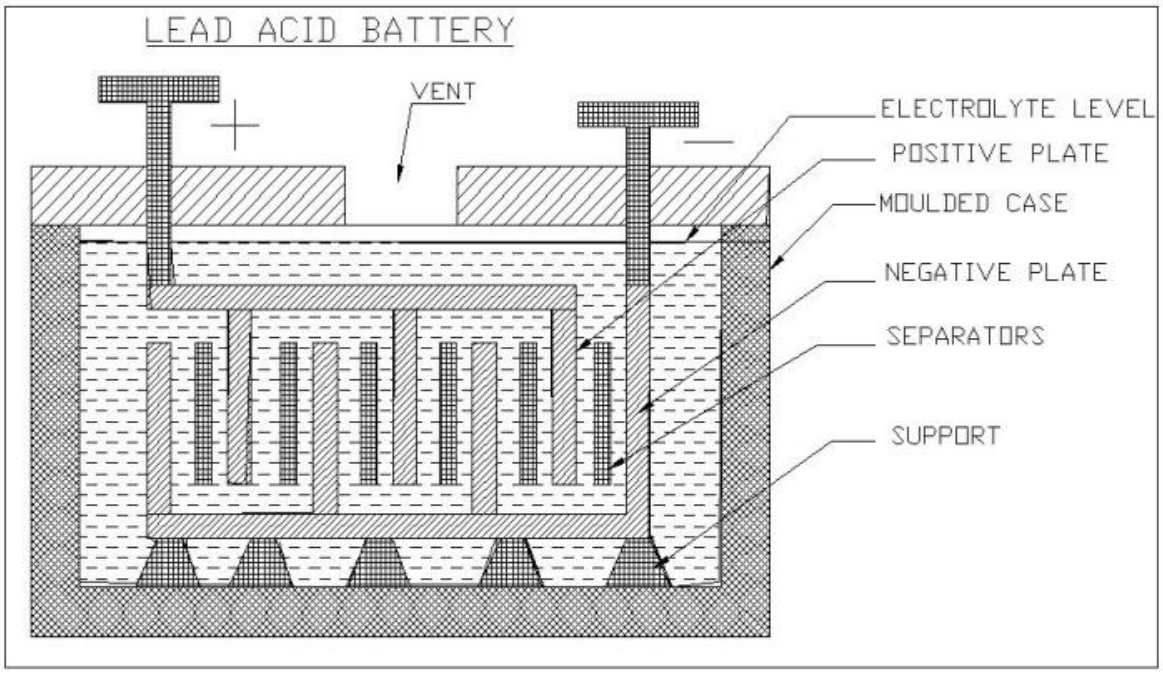
(B) Watt hour efficiency

We use lead acid battery for storing the electrical energy from the solar panel for lighting the street and so about the lead acid cells are explained below.

Lead-acid Wet Cell

Where high values of load current are necessary, the lead-acid cell is the type most commonly used. The electrolyte is a dilute solution of sulfuric acid (H_2 SO_4). In the application of battery power to start the engine in an auto mobile, for example, the load current to the starter motor is typically 200 to 400A. One cell has a nominal output of 2.1V, but lead-acid cells are often used in a series combination of three for a 6-V battery and six for a 12-V battery.

The lead acid cell type is a secondary cell or storage cell, which can be recharged. The charge and discharge cycle can be repeated many times to restore the output voltage, as long as the cell is in good physical condition. However, heat with excessive charge and discharge currents short ends the useful life to about 3 to 5 years for an automobile battery. Of the different types of secondary cells, the lead-acid type has the highest output voltage, which allows fewer cells for a specified battery voltage.



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Layout of Battery

Advantages and Disadvantages

Advantages

- Power generation is simply walking on the road path
- Power also generated by running or exercising on the road.
- No need fuel input
- This is a Non-conventional system
- Battery is used to store the generated power

Disadvantages

- Only applicable for the particular place.
- Mechanical moving parts is high
- Initial cost of this arrangement is high.
- Care should be taken for batteries

V. APPLICATIONS

Power generation using foot step can be used in most of the places such as

- colleges,
- schools,
- cinema theatres,
- Shopping complex and
- Many other buildings

VI. RESULT

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution and industries.

We are proud that we have completed the work with the limited time successfully. The **FOOT PATH POWER GENERATION** is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities.

In conclusion remarks of our project work, let us add a few more lines about our impression project work. Thus we have developed a **"FOOT PATH POWER GENERATION"** which helps to know how to achieve low cost automation. The application of pneumatics produces smooth operation. By using more techniques, they can be modified and developed according to the applications.

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