# Tap Water Electric Generator for Mobile Charging and LED Lights

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*Abstract*— Our project entitled "GENERATING ELECTRICITY USING TAP WATER". This is being used in households and outdoors for generating electricity of 5V D.C. current which is sufficient to glow an led lamp. It is arranged with an USB port for charging mobile phones. It consists of a D.C. generator whose shaft is connected to the central axis of the turbine. The water from the tap is drawn through a nozzle and concentrated on the turbine blades so that the turbine begins to rotate and thus the electricity is produced. Here we have a 5V battery to store the produced electricity during the flow of water and used when it is required. The inlet water through the nozzle will come out through the outlet at the downward side of the turbine casing. The nozzle is kept at the top of the turbine casing so the water from the tap can be drawn easily. The nozzle used here can be easily attached to any kind of tap in all houses and in outdoors. The minimum amount of pressure required to rotate the turbine is 103 Kpa. The turbine used here is Kaplan Turbine.

***Key words:*** Electricity, Water, Mobile Charger, Generator

## I. INTRODUCTION

This project (GENERATING ELECTRICITY USING TAP WATER) is a new invention as this clarifies all the relevant features which is dreamet by all people who couldn't get electricity for their basic needs.

As this having USB port this project is perfectly suitable for mobile phone charging. These project consist of a battery so the generated electricity can be stored in this battery and used when it is required.

Many villages in India doesn't has electricity facility but in that kind of villages the water is supplied to the people through the pipes and which can be collected in the container or buckets using tap only so this project can be used in this areas.

In this places their is no light in the night time so by this project the current is generated using the water and stored in battery so in night time it can be also used as street lights. The voltage produced in this project is right enough to lightup an LED pannel so that the light is enough to eye visible on streets.

This equipment is very less in weight and size so it can be easily transmitted from one place to another place and its very easy to fit on any tap because the nozzle is made in such kind.

Here in this project we are using a diode since the electricity stored in the battery doesnot reversed to the generator so their is no loss of electricity. It is very less in price so all the people in the world can use this project.

As we have used water proofed equipments in this project the equipments doesn't get corroded and we have used plastic as the major material in our project so that the weight of the setup is very low. Its just an extra attachment that is attached in the tap for generating electric current.

The voltage that can be obtained from this project is 5V which is sufficiently enough to light up an led buld and also which is sufficient to charge the mobile phones and many more thinks can be done using this project. Also small kind of multimedia devices can be operated this project so it is more usefull for and it is also a alternate method for saving the electricity.

### *A. Description of Components used in Project*

#### *1) D.C. GENERATOR*

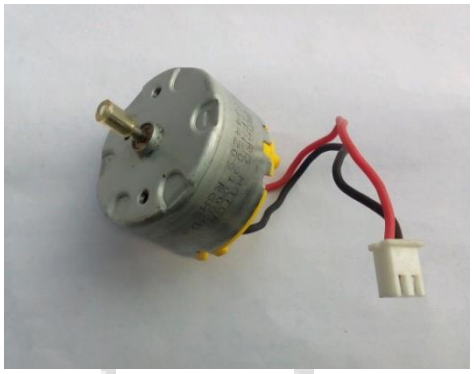


Fig 1.1: 12V D.C. Generator

A generator is a device that converts mechanical energy to electrical energy for use in an external circuit. Sources of mechanical energy include steam turbines, gas turbines, water turbines, internal combustion engines and even hand cranks. The first electromagnetic generator, the Faraday disk, was built in 1831 by British scientist Michael Faraday. Generators provide nearly all of the power for electric power grids.

The reverse conversion of electrical energy into mechanical energy is done by an electric motor, and motors and generators have many similarities. Many motors can be mechanically driven to generate electricity and frequently make acceptable manual generators.

A coil of wire rotating in a magnetic field produces a current which changes direction with each 180° rotation

## II. CONSTRUCTION OF DC GENERATOR

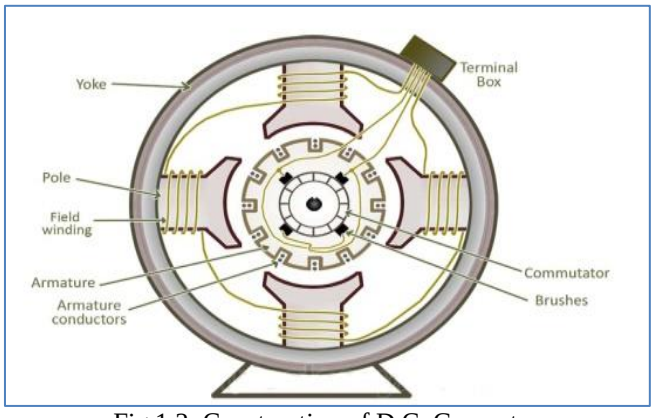



Fig 1.2: Construction of D.C. Generator

The above figure shows the constructional details of a simple DC Generator. A DC machine consists two basic parts; stator and rotor. Basic constructional parts of a DC machine are described below.

1) Yoke: The outer frame of a dc machine is called as yoke. It is made up of cast iron or steel. It not only provides mechanical strength to the whole assembly but also carries the magnetic flux produced by the field winding.
2) Poles and pole shoes: Poles are joined to the yoke with the help of bolts or welding. They carry field winding and pole shoes are fastened to them. Pole shoes serve two purposes; (i) they support field coils and (ii) spread out the flux in air gap uniformly.
3) Field winding: They are usually made of copper. Field coils are former wound and placed on each pole and are connected in series. They are wound in such a way that, when energized, they form alternate North and South poles.

Fig. 1.3 : Armature core (rotor)

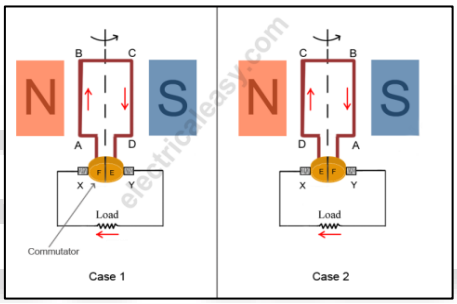
4) Armature core: Armature core is the rotor of the machine. It is cylindrical in shape with slots to carry armature winding. The armature is built up of thin laminated circular steel disks for reducing eddy current losses. It may be provided with air ducts for the axial air flow for cooling purposes. Armature is keyed to the shaft.
5) Armature winding: It is usually a former wound copper coil which rests in armature slots. The armature conductors are insulated from each other and also from the armature core. Armature winding can be wound by one of the two methods; lap winding or wave winding. Double layer lap or wave windings are generally used. A double layer winding means that each armature slot will carry two different coils.
6) Commutator and brushes: Physical connection to the armature winding is made through a commutator-brush arrangement. The function of a commutator, in a dc generator, is to collect the current generated in armature conductors. Whereas, in case of a dc motor, commutator helps in providing current to the armature conductors. A commutator consists of a set of copper segments which are insulated from each other. The number of segments is equal to the number of armature coils. Each segment is connected to an armature coil and the commutator is keyed to the shaft. Brushes are usually made from carbon or graphite. They rest on commutator segments and slide on the segments when the commutator rotates keeping the physical contact to collect or supply the current.

Fig. 1.4: Commutator

*A. Working Principle Of A DC Generator:*

*B. 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.*

*Need of a Split ring commutator:*




According to Fleming's right hand rule, the direction of induced current changes whenever the direction of motion of the conductor changes. Let's consider an armature rotating clockwise and a conductor at the left is moving upward. When the armature completes a half rotation, the direction of motion of that particular conductor will be reversed to downward. Hence, the direction of current in every armature conductor will be alternating. If you look at the above figure, you will know how the direction of the induced current is alternating in an armature conductor. But with a split ring commutator, connections of the armature conductors also gets reversed when the current reversal occurs. And therefore, we get unidirectional current at the terminals.

*1) Convergent Nozzle*

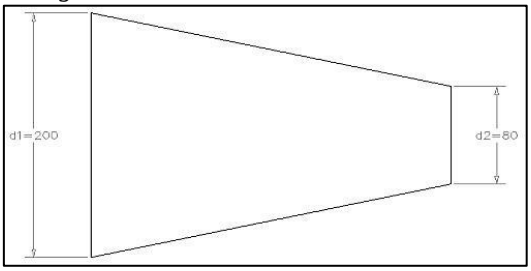



Fig. 1.5: Convergent Nozzle

Nozzle is a duct of varying cross-sectional area in which the velocity increases with the corresponding drop in

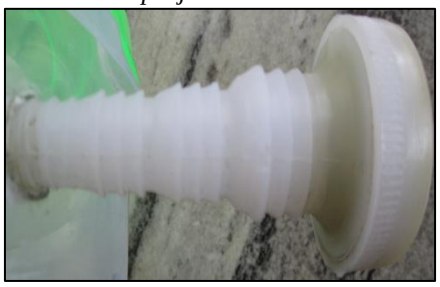
 

pressure. Its main function is to produce a jet of stream with high velocity. For example, nozzles are used in steam turbines, water turbines, in jet engines, rocket motors, flow measurement and many other applications.

In convergent nozzles, the cross sectional area decreases from the inlet section to the outlet section.

The dimensions of the nozzle in our project are the inlet diameter d1=200mm and the outlet diameter d2=80mm.

*2) Nozzle used in this project*



*3) Kaplan Turbine*

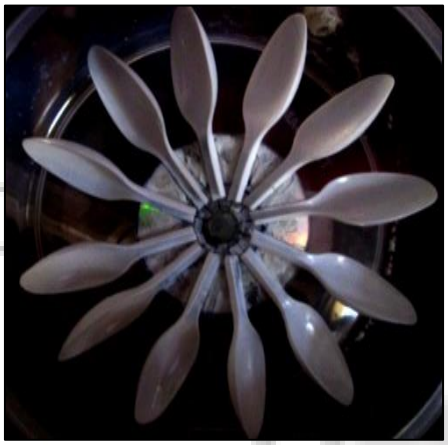


Fig. 1.6: Kaplan Turbine

Kaplan is also known as propeller turbine. Kaplan turbine is a propeller type water turbine along with the adjustable blades. Mainly it is designed for low head water applications. The Kaplan turbine consists of propeller type of blades which works reverse. By using shaft power displacing the water axially and creating axial thrust in the turbine. The water flows axially and it creates axial forces on the Kaplan turbine blades to produce generating shaft power. Due to the low water heads it allows the water flow at larger in the Kaplan turbine. With help of the guide vane the water enters. So the guide vanes are aligned to give the flow a suitable degree of swirl. The water flow from the guide vanes are passes through the curved structure which forces the radial flow to direction of axial. With a component of the swirl in the form of axial flow are applies forces on the blades of the rotor. Due to the force it loses both angular and linear momentum.

To generate substantial amount of power from small heads of water using Kaplan Turbine it is necessary to have large flow rates through the turbine. Kaplan Turbine is designed to accommodate the required large flow rates. Except the alignment of the blades the construction of the Kaplan Turbine is very much similar to that of the Francis Turbine. The overall path of flow of water through the Kaplan Turbine is from radial at the entrance to axial at the exit. Similar to the Francis Turbine, Kaplan Turbine also has a ring of fixed guide vanes at the inlet to the turbine. The effectiveness curve of Kaplan turbine remnants flat for over complete load range, It is extra dense in construction and smaller in size for similar power developed, Eddy fatalities are about eliminated.

*4) GEAR BOX IN D.C. GENERATOR*

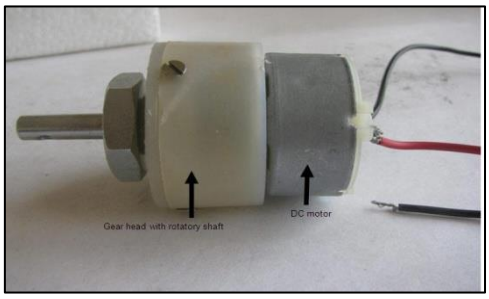



Fig. 1.7: Gear Box in D.C. Generator

Most modern gearboxes are used to increase torque while reducing the speed of a prime mover output shaft (e.g. a motor crankshaft). This means that the output shaft of a gearbox rotates at a slower rate than the input shaft, and this reduction in speed produces a mechanical advantage, increasing torque. Gearbox plays an important role in the system of power transmission. It is designed to speed and torque conversion by providing a source of rotational energy to another device with the gear ratios. A gear generator simplifies combining a generator with a gear reducer system.Gears are used with generator to increase the generator speed while decreasing the output torque. A complete assembly that performs a specific function in a larger machine.

*5) BATTERY*


Fig. 1.8: Battery

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work. Battery life can be extended by storing the batteries at a low temperature, rechargeable batteries can hold their charge much longer, depending upon type.

a) Specification of battery in our project
Output voltage : 5V D.C.
Output current : 500 mah
Type of battery : Lead-Acid Rechargable battery
Charging voltage : 5V - 7.5V D.C.

*6) USB SOCKET*

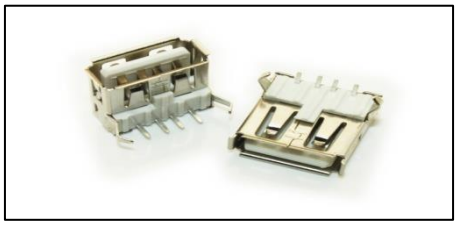
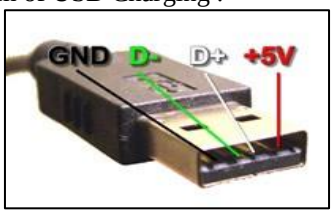


Fig. 1.9: USB Socket

Most of the Mobile Phone battery is rated 3.6 volts at 1000 to 1300 mAh. These battery packs have 3 NiMh or Lithium cells having 1.2 volt rating. Usually the battery pack requires 4.5 volts and 300-500 mA current for fast charging. But low current charging is better to increase the efficiency of the battery. The circuit described here provides 4.7 regulated voltage and sufficient current for the slow charging of the mobile phone. If the polarity is incorrect, it will destroy the cellphone battery. So take extreme care.

Circuit Diagram of USB Charging :




*7) DIODE*

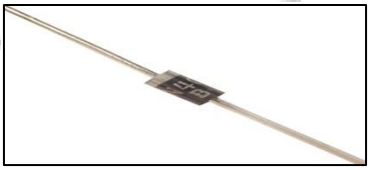


Fig. 1.10: Diode (IN4007)

A diode is a device which only allows unidirectional flow of current if operated within a rated specified voltage level. A diode only blocks current in the reverse direction while the reverse voltage is within a limited range otherwise reverse barrier breaks and the voltage at which this breakdown occurs is called reverse breakdown voltage. The diode acts as a valve in the electronic and electrical circuit. A P-N junction is the simplest form of the diode which behaves as ideally short circuit when it is in forward biased and behaves as ideally open circuit when it is in the reverse biased. Beside simple PN junction diodes, there are different types of diodes although the fundamental principles are more or less same. So a particular arrangement of diodes can convert AC to pulsating DC, and hence, it is sometimes also called as a rectifier. The name diode is derived from "di-ode" which means a device having two electrodes.

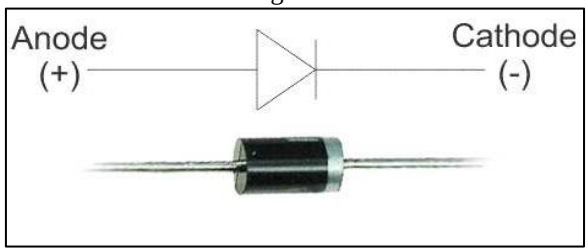



Fig. 1.11: Diode Terminals

*8) Turbine Casing*

A turbine is a turbomachine with at least one moving part called a rotor assembly, which is a shaft or drum with blades attached. Moving fluid acts on the blades so that they move and impart rotational energy to the rotor. Early turbine examples are windmills and waterwheels.

A turbine is a rotary mechanical device that extracts energy from a fluid flow and converts it into useful work. The work produced by a turbine can be used for generating electrical power when combined with a generator or producing thrust, as in the case of jet engines. A turbine is a turbomachine with at least one moving part called a rotor assembly, which is a shaft or drum with blades attached. Moving fluid acts on the blades so that they move and impart rotational energy to the rotor. Early turbine examples are windmills and waterwheels.

Gas, steam, and water turbines have a casing around the blades that contains and controls the working fluid. Turbines can have very high power density.

*9) CONNECTING WIRES*

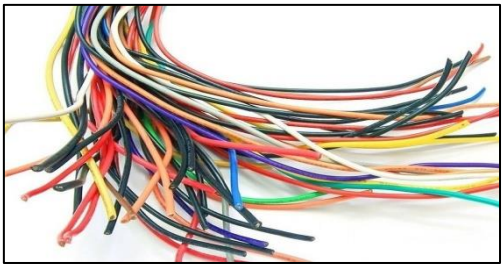


Fig. 1.12: Connecting wires

A wire is a single, usually cylindrical, flexible strand or rod of metal. Wires are used to bear mechanical loads or electricity and telecommunications signals. Wire is commonly formed by drawing the metal through a hole in a die or draw plate. Wire gauges come in various standard sizes, as expressed in terms of a gauge number. The term wire is also used more loosely to refer to a bundle of such strands, as in "multistranded wire", which is more correctly termed a wire rope in mechanics, or a cable in electricity.

Wire comes in solid core, stranded, or braided forms. Although usually circular in cross-section, wire can be made in square, hexagonal, flattened rectangular, or other cross-sections, either for decorative purposes, or for technical purposes such as high-efficiency voice coils in loudspeakers. Edge-wound coil springs, such as the Slinky toy, are made of special flattened wire. The more individual wire strands in a wire bundle, the more flexible, kink-resistant, break-resistant, and stronger the wire becomes. However, more strands increases manufacturing complexity and cost.

*10) ON/OFF SWITCH*

Fig. 1.13: ON/OFF Switch

In electrical engineering, a switch is an electrical component that can "make" or "break" an electrical circuit, interrupting the current or diverting it from one conductor to another. The mechanism of a switch removes or restores the conducting path in a circuit when it is operated. It may be operated manually, for example, a light switch or a keyboard

button, may be operated by a moving object such as a door, or may be operated by some sensing element for pressure, temperature or flow. In building wiring, light switches are installed at convenient locations to control lighting and occasionally other circuits. By use of multiple-pole switches, multiway switching control of a lamp can be obtained from two or more places, such as the ends of a corridor or stairwell. A wireless light switch allows remote control of lamps for convenience; some lamps include a touch switch which electronically controls the lamp if touched anywhere. In public buildings several types of vandal resistant switches are used to prevent unauthorized use.

a) LED LIGHT

Fig. 1.14: Led Lamp

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode, which emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 $mm^2$ ) and integrated optical components may be used to shape the radiation pattern.

Appearing as practical electronic components in 1962,[7] the earliest LEDs emitted low-intensity infrared light. Infrared LEDs are still frequently used as transmitting elements in remote-control circuits, such as those in remote controls for a wide variety of consumer electronics. The first visible-light LEDs were also of low intensity and limited to red. Modern LEDs are available across the visible, ultraviolet, and infrared wavelengths, with very high brightness.

Early LEDs were often used as indicator lamps for electronic devices, replacing small incandescent bulbs. They were soon packaged into numeric readouts in the form of seven-segment displays and were commonly seen in digital clocks. Recent developments in LEDs permit them to be used in environmental and task lighting. LEDs have allowed new displays and sensors to be developed, while their high switching rates are also used in advanced communications technology.

## III. OBJECTIVES AND METHODOLOGY

### *A. Existing Methodology:*

#### *1) Electricity Generating methods*

a) Conventional (dams)

Most hydroelectric power comes from the potential energy of dammed water driving a water turbine and generator. The power extracted from the water depends on the volume and on the difference in height between the source and the water's outflow. This height difference is called the head. A large pipe (the "penstock") delivers water from the reservoir to the turbine.

Fig. 1.15: Conventional (dams)

b) Pumped-storage

This method produces electricity to supply high peak demands by moving water between reservoirs at different elevations. At times of low electrical demand, the excess generation capacity is used to pump water into the higher reservoir. When the demand becomes greater, water is released back into the lower reservoir through a turbine. Pumped-storage schemes currently provide the most commercially important means of large-scale grid energy storage and improve the daily capacity factor of the generation system. Pumped storage is not an energy source, and appears as a negative number in listings.

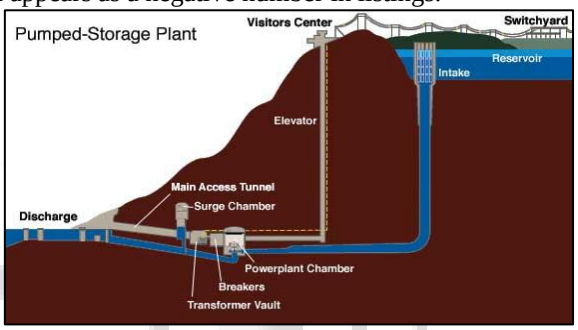



Fig. 1.16: Pumped-storage

c) Run-of-the-river

Run-of-the-river hydroelectric stations are those with small or no reservoir capacity, so that only the water coming from upstream is available for generation at that moment, and any oversupply must pass unused. A constant supply of water from a lake or existing reservoir upstream is a significant advantage in choosing sites for run-of-the-river. In the United States, run of the river hydropower could potentially provide 60,000 megawatts (80,000,000 hp) (about 13.7% of total use in 2011 if continuously available).

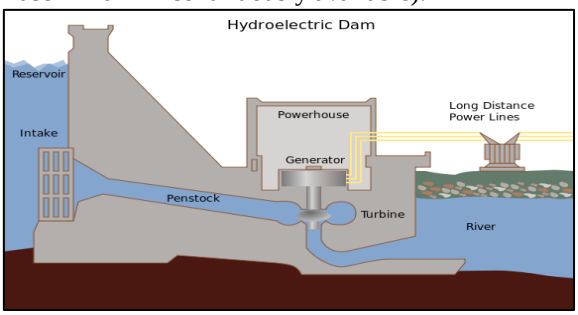



Fig. 1.17: Hydroelectric Dam

d) Tide

A tidal power station makes use of the daily rise and fall of ocean water due to tides; such sources are highly predictable, and if conditions permit construction of reservoirs, can also be dispatchable to generate power during high demand periods. Less common types of hydro

schemes use water's kinetic energy or undammed sources such as undershot water wheels. Tidal power is viable in a relatively small number of locations around the world. In Great Britain, there are eight sites that could be developed, which have the potential to generate 20% of the electricity used in 2012.

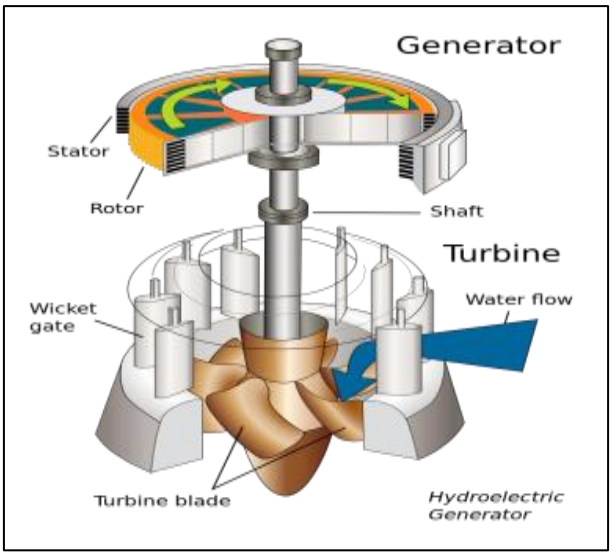



Fig. 1.18: A Typical Tubrine and Generator

## IV. METHODOLOGY OF THE PROJECT

Initially, In this project we have used water as the major source for generating the electricity. Here we capture the energy of falling water from tap to generate electricity. A turbine converts the kinetic energy of the falling water to mechanical energy. Then a generator converts the mechanical energy from turbine into electrical energy.

## V. WORK DONE

- Tap is the usual component; we are all using in our houses and also in streets to deliver the water which flows through the pipe.
- So our project is an special attachment which can be attached to the end of the tap.
- The major components of our project are explained above.
- Initialy, the first step of our project is nozzle which is the main component of this project.
- And the second thing is turbine casing which is the circular box made upof plastic which hold all the other components of the project and which is provided with an outlet hole for water outlet.
- The third step is a turbine whose central axis is connected to the shaft of the generator so that when the turbine rotates the shaft of the generator also rotates along with it so the electricity is produced.
- when the tap is turned on the water enters to the turbine caasing through the nozzle attached to the tap and the water is concentrated on the turbine blades so that the turbine beigns to rotate.
- The amount of electricity produced in this project is 5V D.C. which is stored in a 5V battery for future use. Here in this circuit a diode is use to break the circuit since the current does not come back to the generator.
- From the battery the electricity is supplied to the USB port for mobile phone charging. And on other hand the electricity is supplied to the led lamp which is provided with an ON/OFF switch.
- User can switch ON the light when it is required and USB is plug and play type.
- The above steps are all the working principle of this project.

## VI. WORKING MODEL

Fig. 4.1: Working Model of Project

## VII. ADVANTAGES

- The cost is very low.
- Its very less in size.
- It can be used in all types of taps.
- The inlet water is obtained as the outlet without getting damaged.
- The battery storage capacity is high.
- The battery used here is long lasting.
- Doesnot requires any external power.

## VIII. APPLICATIONS

- It is used as a mobile phone charger.
- It is used as a emergency lights during power cuts.
- It can be used in Homes.
- It can be also used as street lights.
- Using the USB connecter Small kind of multimedia devices can be operated such as mp3 players, USB speakers, etc.

## IX. RESULT AND CONCLUSION

Our project entitled "GENERATING ELECTRICITY USING TAP WATER". This is being used in households and outdoors for generating electricity of 5V D.C. current and stored in the battery is succesfully fabricated and the result of the project is obtained as suggested in the abstract.

## X. RESULT

- Output voltage : 5V D.C.
- Output current : 500 mah

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