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Fabrication of Self-Propelled Hydroelectric Power Generator

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ABSTRACT

The mini hydro turbine research aims to design and construct a hydroelectric power plant model that can generate electric power, which can be used at the domestic level to power electrical appliances. the alternator is made of a permanent magnet rotor and conducting coil windings on the stator connected to the turbine through a runner, and the feedback system for the continuous flow of water. The result shows that the construction of a mini hydro turbine plant is feasible and no major problems were apparent at the design and implementation stages of the mini hydro turbine power plant. Other renewable resources include geothermal, wave power, tidal power, wind power, and solar power. Hydroelectric power plants do not use up resources to create electricity nor do they pollute the air, land, or water, as other power plants may. Hydroelectric power has played an important part in the development of this Nation's electric power industry. Both small and large hydroelectric power developments were instrumental in the early expansion of the electric power industry.

KEYWORDS: *Hydroelectric Generator, Continuous flow of water, Self-propelled.*

1. INTRODUCTION

It has been possible to use water for good purposes for centuries. Ancient Greeks and Romans utilized water in comparable ways to modern industrial operations, including for the grinding of grain, irrigation of land through aqueducts, and medical uses. Modern hydropower, also known as hydroelectric power, has been used for over a century and is still a trustworthy source of clean electricity. As of 2019, hydropower produced 6.6% of the country's electricity, with hydropower accounting for the majority of the electrical mix in various states. In the Pacific Northwest, where Idaho, Oregon, and Washington all have sizable hydropower components in their electrical mixes, hydropower is heavily used. Even though hydropower is typically associated with the production of electricity, just 2% of the 90,000 dams in the US do so. In 1880, Michigan storefront was lit for the first time using contemporary hydroelectric power. Niagara Falls, New York, got street lighting in 1881. 2 While the first commercial power station for long-distance electricity carrying was established in California in 1893, both of these direct uses of hydropower were for local lighting. 3 To increase the amount of electricity generated by the

Housatonic River in Connecticut, the first pumped storage hydropower facility was constructed there in 1929.

2. LITERATURE REVIEW

Eknath L. Manjarekar et. al. [1] The document comprehensive information about hydropower plants, which are run by hydraulic ram pumps and are a better option for remote locations where they have not yet been transmitted. Using ram pump, by raising the water from low, you can raise the head of falling water are how the hydraulic ram pump operates. This hydropower system can be employed in remote locations with lower energy requirements. Components and power requirements are conveniently accessible produced to resemble a ram pump. Kanchan A. Patil et. al. [2] "Hydro energy is a clean and environmentally beneficial source of regenerating energy. This study aims to demonstrate new ideas regarding hydroelectricity produced by hydroelectric power plants. This prototype system can be used to generate electricity with a micro hydro power plant (MHP) at the Gandheli Campus of the MGM Institute because it is a rural area perched atop the South-Eastern hills of Aurangabad in order to prevent the occurrence of such a bleak future. Designing a micro hydro power plant for the MGM Gandheli campus is the goal of the study. At four separate sites, including the farm ponds and the main water inlet tank, a series of micro-hydroelectric power turbines can be erected. Rajiv Selvamet. al. [3] Permanent Motion Hydroelectric Generators are systems that generate electricity by harnessing the potential energy of falling water in two ways: first, for power generation, and second, for water recirculation. These types of systems can be extremely beneficial in rural areas where there is a lack infrastructure. There is a lack of electricity as well as a scarcity of water. This paper explains the design and construction of a hydroelectric generator and a hydraulic ram pump. The calculation of power produced, discharge, and ram pump efficiency is emphasized. The obtained results are validated using standard fluid mechanics calculations. Fiona S.A. Bracken et. al. [4] Small-scale hydropower is growing quickly in many nations as a result of policies that promote renewable energy and lessen dependency on fossil fuels. A significant risk to migrating biota is posed by the rapid growth in hydroelectric turbine development, particularly fish. Even though the Archimedes screw design of some turbines is thought to be reasonably fish-friendly, its potential effects on vulnerable lamprey species have not yet been studied. H Soewardi and E A Putra et. al. [5] One of the primary things that humans need to assist with daily tasks is electricity. The Indonesian government wants to see 1,500 kWh of power consumed per person by 2025.The greatest renewable energy source in Indonesia is hydroelectric power plants. A portable generator is one of the many types of hydroelectric power equipment used in Indonesia. K. Rajasuthan et. al. [6] The traditional bladed hydro turbines are still in use at all hydroelectric power stations. The production and upkeep of these conventional turbines is quite difficult. The solution to this issue is to create a bladeless turbine with a tolerable efficiency. This center-petal turbine lacks any blades. The fluid's boundary layer effect and centripetal force to power the turbine. This turbine's rotational motion can be either clockwise or anticlockwise. Ayush Singh Chauhan et. al. [7] We are aware that all engineering or composite materials have certain physical, magnetic, electrical, manufacturing, and chemical qualities. We also know that these materials can have different effects on the environment depending on whether they are dangerous or not. P. Viswabharathy et. al. [8] The revolving shaft or rotor of the Pelton Turbine is mounted with a circular disc. Buckets, or cup-shaped blades, are evenly spaced around the circumference of this circular disc. The placement of the nozzles around the wheel of the Pelton Turbine is such that the water jet that emerges from each nozzle is perpendicular to the circumference of the wheel. The splitters, which are positioned in the centre of the buckets, are where the high-speed water jets from the nozzles impact the buckets before being separated into two equal streams. These streams enter the bucket along its inner curvature and exit it in the opposite direction of the incoming jet. The Pelton Wheel Turbine's high-speed water jets are created by expanding the high-pressure water through nozzles.to the pressure of the atmosphere. Any water body located at a certain height or streams of water running down hills can provide high pressure water. The Pelton Turbine's wheel blades experience an impulse due to the water stream's altered momentum (direction and speed). Aditya Agrawal et. al. [9] The world's constant need for more energy has put further strain on both renewable and non-renewable energy supplies. As is well known, there are more electrical appliances on the market than ever before. The moment is rapidly approaching when since the techniques and power are limited and the water level is continuously falling, we won't have enough electricity to operate these gadgets and create electricity. Bhargav & V. Ratna Kishore et. al. [10] A micro hydro turbine can be powered by the energy in the water flowing through the pipe. It is discovered that it is feasible to create electrical energy using the energy of pipe water. Finding out whether producing power with a cheap turbine is feasible is the driving force. The experimental setup includes a microturbine with a diameter of 135 mm linked to Using a 12-V DC generator, the results are validated using LEDs and resistors. The fundamental equations of fluid mechanics were used to present the theoretical calculations. Experimental and numerical findings from CFD simulation are used to verify the theoretical results.

3. METHODOLOGY

Hydroelectric power generation is a method of producing electricity from the kinetic energy of falling water. The basic methodology for hydro-electric power generation includes the following steps:

Collection of water: Water from a river or a dam is collected in a reservoir or a lake. The height of the water body is crucial for producing sufficient kinetic energy.

Diversion of water: A portion of the collected water is diverted through a canal or a pipe to a turbine.

Conversion of kinetic energy to mechanical energy: The flowing water imparts its kinetic energy to the turbine blades, causing the turbine to rotate. The rotation of the turbine is transferred to a generator, which converts the mechanical energy into electrical energy.

Generation of electricity: The generator produces alternating current (AC) electricity, which is then transformed into high-voltage direct current (DC) electricity through an electrical rectifier. The high-voltage DC electricity is then transformed back into AC electricity through an inverter.

Transmission of electricity: The generated electricity is transmitted to the electrical grid through high-voltage transmission lines.

It is important to note that the efficiency of hydroelectric power generation depends on several factors, including the height of the water body, the flow rate of the water, and the design of the turbine and generator. The environmental impact of hydroelectric power generation also needs to be considered, such as the potential for impacts on fish populations, changes in water flow patterns, and the creation of large reservoirs that can displace local communities.

Working Principle:

A hydroelectric power generator works by harnessing the energy of moving water to generate electricity. Here's how it works:

1) Water from a dam or reservoir is channeled into a pipe, called a penstock, and directed towards a turbine.
2) The kinetic energy of the flowing water turns the blades of the turbine, which is connected to a rotor. The rotor is a rotating component that has a series of permanent magnets.
3) As the rotor rotates, it generates a magnetic field that passes over the coils of wire in the generator. This movement of the magnetic field through the coils of wire generates an electrical current in the wire, which is then sent to a transformer.
4) The transformer increases the voltage of the electricity to a level that is suitable for transmission to homes and businesses. The electricity is then sent through power lines to be distributed to consumers.
5) After passing through the turbine, the water continues on its way and is returned to the river or reservoir. This process can be repeated many times a day, providing a constant source of renewable energy.
It's important to note that the efficiency of a hydroelectric power generator depends on the volume and height of the water that is available to generate electricity. The more water that is available, and the greater the height from which it falls, the more energy that can be generated.

Fabrication:

The construction of the hydroelectric power generator is done by using following components:

1. 12V DC Generator (1600 rpm)
2. 12V DC Generator (1000 rpm)
3. 12V Transformer
4. Switch
5. 12V Pump
6. Propellers

12V DC GENERATORS:

The DC Generators are used to produce the electricity. Two generators are used which are 1600rpm and 1000rpm. Which produce direct current. These are shown in fig 1,2.

Fig 1: 12V DC Generator (1600 rpm)

Fig 2: 12V DC Generator (1000 rpm)

12V TRANSFORMER:

The transformer is used to convert DC current to AC current. It is shown in fig 3.

Fig 3: 12V Transformer

SWITCH:

The switch is used to ON and OFF the current passage. It is shown in fig 4.

Fig 4: Switch

12V PUMP:

The (12v pump) is used to circulate the water from bottom to top of the propeller to strike the water on the two blades. It is shown in fig 5.

Fig 5: 12V Pump

PROPELLERS:

The propellers are acts as turbine and it converts kinetic energy into mechanical energy. The material used for propeller blades are 'poly vinyl chloride' which is light in weight. It is shown in fig 6.

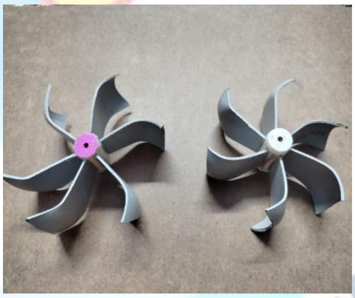

Fig 6: Propellers

CALCULATIONS:

POTENTIAL ENERGY :

Potential energy is the energy that an object possesses due to its position or State. It is the energy that an object has the ability to release or convert into other Forms of energy, such as kinetic energy, heat, or light, as a result of a change in its Position or state.PE = m * g * h

KINETIC ENERGY :

Kinetic energy is the energy that an object possesses due to its motion. It is Defined as the amount of energy required to bring an object from rest to a given Velocity.KE = 0.5 * m * v^2

PRESSURE ENERGY :

Pressure energy, also known as pressure-volume (P-V) work, is the energy that Is stored in a system due to the pressure and volume of a fluid or gas. It is the energy That is transferred from a system to its surroundings or vice versa when the volume Of the system changes due to a change in pressure.P-V work = -P * ΔV

MECHANICAL ENERGY :

Mechanical energy is the sum of an object's kinetic energy and its potential Energy. It is a scalar quantity that represents the amount of work that can be done by An object due to its motion and position.ME = KE + PE

ELECTRICAL ENERGY :

Electrical energy is the energy that is transferred through electrical circuits. It Is the energy that is associated with electric charges in motion, and it is a form of Energy that can be easily converted into other forms of energy, such as heat, light,Or mechanical energy.E = V * I * t

FORMULA USED

Hydroelectrical power generator works on the principle of converting potential energy into Kinetic energy into mechanical energy into electrical energy.The output power of a hydro-electric power generator can be calculated using the following

Formula:

P = ϱ * g * Q * h

Where:

P is the output power in watts (W)

P is the density of water, typically 1000 kg/m^3

g is the acceleration due to gravity, approximately 9.81 m/s^2

Q is the flow rate of water in cubic meters per second (m^3/s)

H is the head, or height difference, in meters (m) between the surface of the water at the intake and The outlet of the generator.

P = ϱ * g * Q * h

Where, Q = m^3/sec

We are able to get 100ml of water per sec

Therefore, Q =0.1m^3/sec

H = Head difference (h1-h2)

H = 10cm-9cm

H = 1cm=0.01m

P = 1000*9.81*0.1*0.01

P = 9.81W

4. RESULTS AND DISCUSSIONS :

Hydroelectric Power generators use the power of falling or flowing water to generate electricity. The basic components of a Hydroelectric power generator include a dam or a water source, a turbine, a generator, and a transmission system.

Therefore at the end of the project we are getting 9.81W of power without any power input.

Fig 7: Final Construction of The Project

5. CONCLUSION:

In conclusion, a hydroelectric power generator is a clean and renewable energy source that harnesses the energy from falling or flowing water to generate electricity. This type of generator is considered one of the most efficient ways to produce electricity, and it has many benefits, such as reducing dependence on fossil fuels, decreasing greenhouse gas emissions, and providing a reliable source of energy. Additionally, hydroelectric power plants can provide multiple benefits to communities, such as job creation, water management, and recreation opportunities. However, building large hydroelectric power plants can also have negative impacts, such as disrupting ecosystems and affecting local communities, so careful planning and consideration is necessary. Despite its challenges, hydroelectric power continues to play an important role in meeting energy demand, and it has a bright future in the global energy mix.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Eknath L. Manjarekar, Hrishikesh L. Mahadik, Shubham S. Sangelkar are proposed "A FREE HYDRO POWER ENERGY GENERATION SYSTEM BY USING HYDRAULIC RAMPUMP" International Research Journal of Engineering and Technology (IRJET), Volume: 07 Issue: 09 | Sep 2020.

[2] Kanchan A. Patil, S.Y, Prof . Kishor Talanikar, Prof. Sanjay Patil are propesed"ELECTRICITY GENERATION FROM MICRO HYDRO POWER PLANT AT MGM GANDHELI CAMPUS" International Journal of Applied Engineering Research, ISSN 0973-4562 Volume 14, Number 13 (2019)pp. 3048-3052,

[3] Rajiv Selvam, Mohammed Shajahan Omar, Vishal Mohanan Jyotsna, Chaganti Sainath are proposed "FABRICATION OF PERPETUAL MOTION HYDRO ELECTRIC POWER GENERATOR" International Research Journal On Advanced Science Hub, Volume 01 Issue 01 May 2019, e-ISSN: 2583-4376.

[4] Fiona S.A. Bracken and Martyn C. Lucas are proposed "POTENTIAL IMPACTS OF SMALL-SCALE HYDROELECTRIC POWER GENERATION ON DOWN STREAM MOVING LAMPREYS" Durham Research Online, 31 March 2016, http://dx.doi.org/10.1002/rra.2596

[5] H Soewardi and E A Putra are proposed "DEVELOPING A PORTABLE HYDRO ELECTRIC GENERATIOR USING AXIOMATIC DESIGN METHOD" International Conference on Coastal and Ocean Engineering (ICCOE 2018), IOP Conf. Series: Earth and Environmental Science 171 (2018) 012034 doi:10.1088/1755-1315/171/1/012034.

[6] K. Rajasuthan, M. Palpandi are proposed "FABRICATION OF HYDRO OPERATED BLADELESS TURBINE WITH POWER GENERATION International Journal of Engineering Sciences & Research Techynology, ISSN: 2277-9655, Impact Factor: 5.164, CODEN: IJESS7, DOI: 10.5281/zenodo.1241402.

[7] Ayush Singh Chauhan, Gagan Bansal, Hritik Chauhan n Dhiraj Kumar are proposed "APPLICATION OF COMPOSITE MATERIAL IN HYDRO POWER TURBINE BLADE DEVELOPMENT" National Conference on Technological Challenges of Hydro-Turbine and Alternate Sources of Energy.

[8] P. Viswabharathy, J. Kayalvizhi, G. Vennila, S. Revathy "FABRICATION OF HYDRO POWER PLANT" International Journal of Novel Research and Development,(IJNRD) | Volume 2, Issue 9, | ISSN: 2456-4184, pp no: September 2017.

[9] Aditya Agrawal, Aditya Sharma, Harsha Yadav are proposed "HYDRO ELECTRICITY GENERATION BY THE RECYCLING OF WATER" International Journal Of Energy Research, ISSN: 2349-4336(online), Volume 2, Issue 3, www.stmjournals.com.

[10] Bhargav & V. Ratna Kishore , S. P. Anbuudayasankar , K. Balaji "Power generation by high head water in a building using micro hydro turbine—a greener approach" Environ Sci Pollut Res DOI 10.1007/s11356-015-5317-6.