UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF WATER FLOATING NANO TURBINE

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Automotive Technology) with Honours

By

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DECLARATION

I hereby, declared this report entitled "Development of Water Floating Nano Turbine" is the results of my own research except as cited in references.

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Author's Name	:	Muhammad Aizuddin Bin Abd Rahman
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APPROVAL

This report is submitted to the Faculty of Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive Technology) with Honors. The member of the supervisory is as follow:

………………………………

(Project Supervisor)

ABSTRAK

Turbin adalah satu alat untuk menghasilkan sumber tenaga baharu. Jika tenaga konvensional tidak dapat menghasilkan bekalan kepada yang memerlukan, turbin akan membantu kepada mereka yang memerlukan untuk menghasilkan sumber elektrik untuk kegunaan harian. Penukaran tenaga dari sumber semula jadi melibatkan beberapa proses, mengeluarkan tenaga kinetik dari air dan penukaran tenaga kepada tenaga mekanikal.

ABSTRACT

Turbine is a device to produces a renewable source. If the conventional energy is unable to supply the needs, then a turbine assists to generate an electrical source for daily routine. The conversion of energy from the natural sources involves several processes, extracting kinetic energy from the water and convert it into mechanical energy.

DEDICATION

To my beloved parents

Mr. Abd Rahman Bin A Rashid and Mdm. Nor Rashidah Binti Moain

Who raised me to become a useful person, helping person and a successful person in a world and here after.

ACKNOWLEDGEMENT

I would like to express my deepest appreciation to whose provided me the possibility to complete this report. A special gratitude I give to my supervisor of Bachelor's Degree Project, Mr. Ir. Mohamad Hafiz Harun, whose contribution in stimulating suggestions and encouragement, helped me to coordinate my Bachelor's Degree Project especially in writing a report and conducting an experiment. My appreciation to my families and friends for their supports and blessing.

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LIST OF ABBREVIATIONS, SYMBOLS, AND NOMENCLATURE

UTeM	-	Universiti Teknikal Malaysia Melaka
CATIA	-	Computer Aided Three-Dimensional Interactive Application
CAD	-	Computer Aided Design
CAE	-	Computer Aided Engineering
PVC	-	Polyvinyl Chloride
VOM	-	Volt-Ohm Meter
V	-	Unit of Voltage (Volt)
s	-	speed / velocity of the water (m/s)
R	-	radius of turbine wheel (m)
N	-	Number of Revolution per Minute (RPM)
P	-	Pressure (Pa)
ρ	-	Water Density (kg/m^3)
g	-	Gravitational Force (m/s^2)
h	-	Height of water level (m)

CHAPTER 1

INTRODUCTION

1.1 Introduction

Electricity is one of the most important for living things to do their daily routine. From the electricity, all the private companies in the world can provide their products to the people who are needed to fulfill their daily routine. All the electrical appliances are required to operate its machine using electricity. Without any electricity, all the electrical appliances could not be operated.

Residential current usage increased every year causing by the summer season occurred in certain country affected by El-Nino. Even worse, certain residential and industries areas are always facing electricity blacked out while doing their daily routine. Another point is the people who are using smart phone are unable to charging their device as well as no electricity in their residential area or during camping.

From the natural sources, such as river, stream and ocean can generate the electricity without any problems and harmful to the people and it can reduce the usage of electric tariff of certain residential area and industries area. The conversion of energy from the natural sources to useful energy involves several steps, draw out kinetic energy from the water and transform to a form of mechanical energy at the rotor axis and process of the changing into functional energy

To make the turbine operate in good condition, it is consisting of aerodynamic and it is related from the design that we have been choose or decide. For an example, if the stream is in closure space, the aerodynamic would be very low and if the stream doesn't have any end, the aerodynamic of stream would be high.

1.2 Problem Statement

Certain residential area will face a problem which is blacked out and electrical trip during rainy season so some resident facing a difficulty regarding charging a smart phone. It also happens for outdoor activity such as hiking, camping etc.; they are facing a problem of smart phone battery drain and do not have any sources of electricity to charge their smart phone.

Therefore, this study is to help the residents and hikers on supplying electricity when there is no electricity in residential area and during hiking activities.

1.3 Objective

The objectives of this research are stated below:

1. To identify the speed of drain water.
2. To design the hydro turbine to harvest energy from water flow sources.
3. To identify the maximum voltage that can be generated by the turbine from the stream flow.

1.4 Scopes

This project will be limited to these aspects:

1. The Dassault Systèmes CATIA and SolidWorks.
2. Potential of stream flow to spin the turbine.
3. The turbine design that highly generate voltage.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This study will provide review from previous research in order to make a large scope of water turbine and hydroelectric, obtain any turbine problems, generates new ideas and concept.

2.1 History of Hydropower

Hydropower, the vitality created from moving water, is one of the most seasoned renewable vitality sources and the aggregate worldwide electric power capacity of hydropower, including extensive hydropower, small hydropower, and ocean power, was approximately 820 GW in 2005, which represented very nearly 20% of the renewable energies. (Ren21, Renewable global status report, 2006)

Small hydropower systems have been progressively utilized as an option vitality source so that a small system is installed in small rivers or streams with little environmental effect. In this way, such small hydropower systems do not require a dam to be built.

Water turbines can be characterized by the kind of generator used, or the water assets in the installed place. The mostly used generally is a water-heat turbine system, and this makes the turbine rotate by changing the potential energy of the water into kinetic energy. The advantage of this turbine is high efficiency, however the cost of constructing a dam or waterway is high and causing significant environmental problems. Water stream turbines are rotated by the force of the river or the ocean current. These turbines are essentially like wind turbines underwater, except that the density of water is 800 times greater than air. There are two types of water stream turbines; horizontal axis turbines and vertical axis turbines.

2.2 History of Turbine

The idea of using naturally moving water or air to help do work is an ancient. Water wheels and windmills are the best models of ancient mankind's ability to apprehension some of nature's energy and put it to work. The water wheel, occasionally called a 'noria', used for collecting water from a flowing source to irrigation was used around the 5th century B.C.

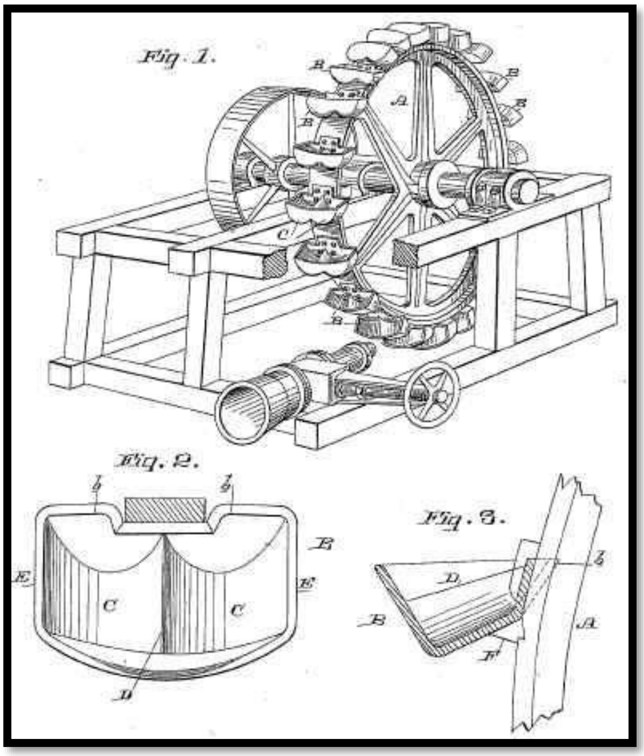

Figure 2.0: Early development of water turbine with buckets.

Around the 2nd century B.C, watermill devices were created and it originally used for grinding grains. Hydroelectric power was slow to develop and with the later steam engine designation, the growth in hydroelectric power technology was hinder.

The word turbine was presented by Claudin Burdin, a French engineer in the mid-19th century and is acquired from the Latin language, “spinning” or a “vortex”. The dominating contrast between early water turbines and water wheels is a water winding component which movements’ energy to a spinning rotor.

The most punctual known water turbines date to the Roman Empire with two helix-turbine mill locales on 3rd or early 4th century A.D. The horizontal water wheel with calculated cutting edges was installed at the base of a water-filled, circular shaft. The water from the mill-race entered the pit digressively, making a winding water segment which made the completely submerged wheel act like a genuine turbine. (Wilson, 1995). Fausto Veranzio in his book Machinae Novae (1595) depicted a vertical axis with a rotor is like a Francis turbine. (C Rossi; F Russo, Ancient Engineers’ Invention, 2009).

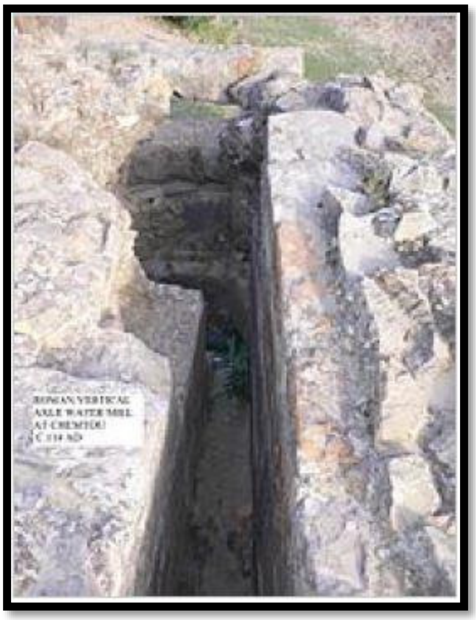

Figure 2.1: Roman turbine mill at Chemtou, Tunisia. The tangential water inflow of the millrace made the submerged horizontal when in the shaft turn like a true turbine. (Wilson, 1995)

Segner wheel was developed by Johann Segner, the mid-18th century reactive water turbine in Kingdom of Hungary. It had a horizontal axis and was a predecessor to modern water turbines. In the 18th century Dr. Barker developed a similar reaction hydraulic turbine that became popular as a lecture-hall demonstration.

2.3 Types of water turbine

There are two types of water turbines which are Reaction turbines and Impulse turbines. The type of hydropower turbine selected project is based on the height of standing water – referred to as "head" – and the flow, or volume of water, at the site.

2.3.1 Impulse turbine

The impulse turbine or a drive turbine generally uses the water speed to move the runner and releases to atmospheric pressure. The water stream hits every basin on the runner and no suction on the drawback of the turbine, and the water streams out the base of the turbine lodging after hitting the runner. An impulse turbine mostly suitable for high head, low flow applications.

2.3.1.1 Pelton Wheel

This turbine invented by Lester Allan Pelton in the 1870s. This wheel produces energy from the moving water impulse, as opposed to water's dead weight like the traditional overshot water wheel. It is so many dissimilarities of impulse turbines existed prior to Pelton's design but less efficient than Pelton's design.

The uses of Pelton wheels are the favored turbine for hydropower, when accessible water source moderately high hydraulic head at low stream rates, where the Pelton wheel geometry is most appropriate and it different on sizes.

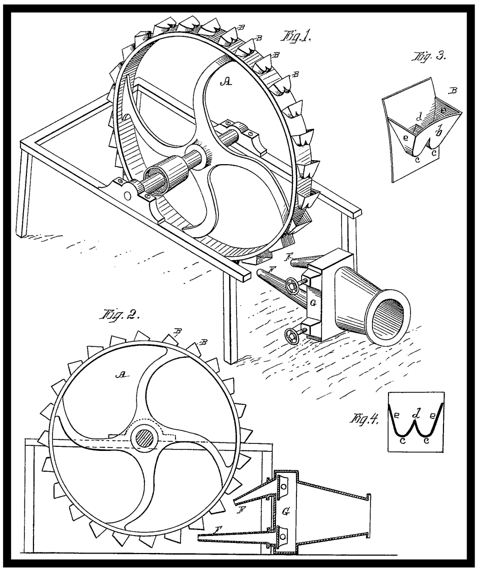

Figure 2.2: The original Pelton wheel turbine on October 1880

The functions of Pelton wheels are direct forceful nozzles, high-speed flow of water to a series of rotating spoon-shaped buckets, also known as impulse blades, which are mounted around the circumference of the rim of the rim wheel drive called runner. As the water jet influences contoured bucket-blades, the direction of water velocity changed to follow the bucket contours. Water impulse energy applies torque on the bucket-and-wheel system, spinning the wheel; the water stream itself does a “U-turn” and exits at the outer sides of the bucket, decelerated to a low velocity.

2.3.1.2 Cross-flow turbine

A cross-flow turbine is drum-shaped and utilizes an extended, rectangular-section spout coordinated against curved vanes on a cylindrically shaped runner. Different names were known as Bánki Michell turbine or Ossberger turbine (E. F. Lindsley, Water power for your home, 1977), is a water turbine imagined by the Australian Anthony Mitchell, the Hungarian Donát Bánki and the German Fritz Ossberger. Michell got licenses for his turbine design in 1903, and the manufacturing company Weymouth made it for many years.

Ossberger's first patent was conceded in 1933 ("Free Jet Turbine" 1922, Imperial Patent No. 361593 and the "Cross Flow Turbine" 1933, Imperial Patent No. 615445), and he fabricated this turbine as a standard product.

Crossflow turbines are normally worked as two turbines with various capacity and sharing the same shaft. The turbine wheels are the same diameter, but different lengths to haft different volumes at the same pressure. The wheels divided are often built with volumes in ratios of 1:2. The subdivided managing unit, the guide vane system in the turbine's upstream section, prepares flexible operation, with 33, 66 or 100% output, contingent on the flow. Low working expenses are acquired with the turbine's relatively simple construction.

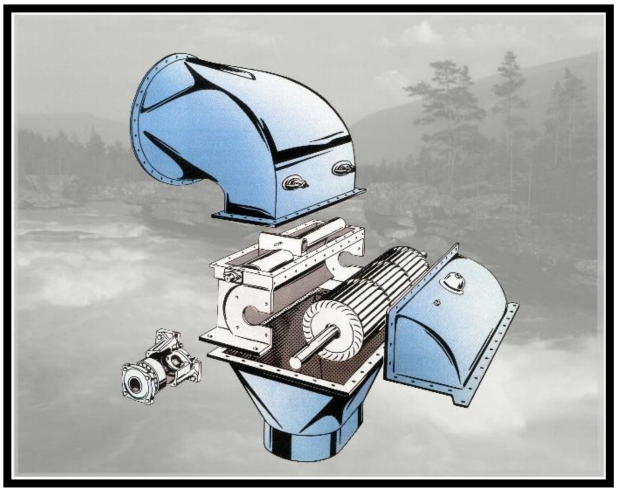

Figure 2.3: Ossberger turbine section

The turbine comprises of a barrel shaped water wheel or runner with a horizontal shaft, made of various blades, arranged radially and tangentially. The blade's edges are sharpened to decrease resistance to the stream of water. A blade is made in a cross-section (pipe cut over its whole length). The blades ends are welded to disks to form a cage like a hamster cage and are sometimes called "squirrel cage turbines"; Instead of the bars, the turbine has the trough shaped steel blades.

2.3.2 Reaction turbine

A reaction turbine develops power from the combined action of pressure and moving water. The runner is placed directly in the water stream flowing over the blades rather than striking each individually. Reaction turbines are generally used for sites with lower head and higher flows than compared with the impulse turbines.

2.3.2.1 Francis Turbine

The Francis turbine is a water turbine type that was invented by James B. Francis in Lowell, Massachusetts (Lowell Massachusetts). It is a turbine of an inward-flow reaction that combines radial and axial flow concepts.

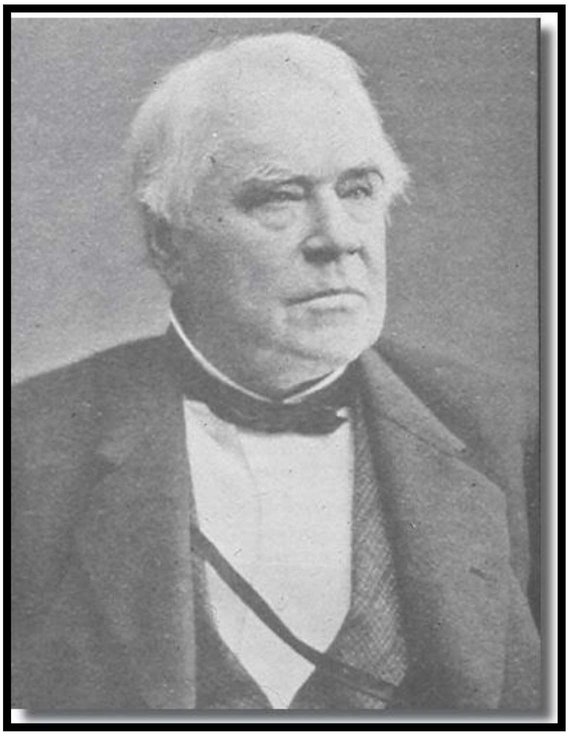

Figure 2.4: A developer of Francis Turbine, James B. Francis. (Lowell Massachusetts)

Before develop a turbine, Francis had developed a power canal to supply water power to the mills in 1845 and after eighteen months, in year of 1848 Francis completed the 5.6 miles of canals in his hometown, Lowell. With the completed of canal system, Francis turned his attention to turbines.

Originally the mills had used waterwheels or breast-wheels that rotated when filled with water. These types of wheels could achieve a 65 percent efficiency rate. One such problem with these wheels was backwater which prevented the wheel from turning. Studying the Boyden turbine Francis could redesign it to increase efficiency. Francis could achieve approximately 88 percent efficiency rate by constructing turbines as “sideways water wheels”.

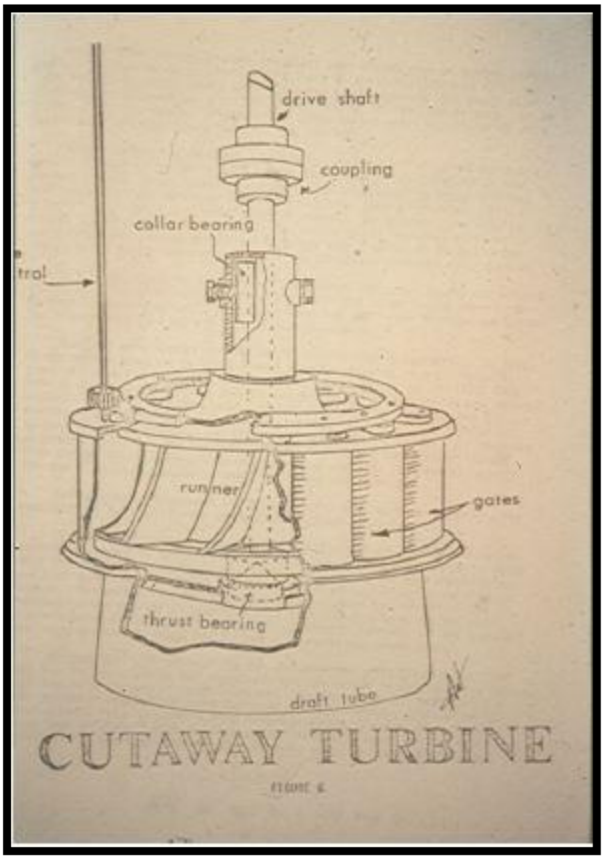

Figure 2.5: Francis Turbine development also known as “sideways water wheels”

After further experimenting, Francis developed the mixed flow reaction turbine which later became an American standard. Twenty-two of the “Francis turbines” reside in Hoover Dam. Everything works of these turbines then published as *The Lowell Hydraulic Experiment* in 1855.

2.4 Axis of Turbine

There is various type of turbine axis but mainly used are horizontal axis turbine and vertical turbine. Most of horizontal axis turbine using propeller type of turbine. It consists of two or three blades and a single or twin rotor system. The rotor rotated by the lift force generated by the fluid flow. The turbine can generate in one way flow or two-way flow, according to the geometric shape of the rotor blade and pitch control mechanism.

A vertical axis water turbine, also known as a cross-flow turbine and it is based on the Darrieus wind turbine which is rotated by the lift and drag forces (Paraschivoiu I, Wind turbine design with emphasis on Darrieus concept, Polytechnic International Press, 2002). The vertical axis type has the advantage that the rotor can be rotated regardless of the flow direction.