

Design Of Human Powered Water Lifting System

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ABSTRACT – The objective of this paper is to design the water lifting system which is of human operated. In all over the world there are various types of water lifting systems currently in use. Some are electrically operated and some of them are mechanically operated and some are still traditional way of system. In India there are some basic types of water lifting system still in use such as Hand Pump, rope well. It can be use in everywhere but it need more manual power. Now electrically water lifting system is also in use. But drawback is electricity is costly and hence not efficient to use. Some of manual operated system is use like Traddle Pump and many other types of system using, but the design of this system is more critical and maintainance cost is high. The many water lifting system is not portable and does not reach the maximum height and also the rate of discharge is less. Other drawback is it is not easily availability of the spare parts once get damaged. Hence in this preview paper we are considering the all above points and proposed the new design concept of bicycle powered water lifting system. It is in simple in design and portable.

Keywords: Ergonomic, environment , pump , efficiency , discharge rate

INTRODUCTION

Engineering plays a major role in the human life with respect of ergonomics, social, economic development. From the past decades the human develops the engineering concepts as per the need and the depending upon their types. The human basic need is food, shelter and clothes. But the major problem is how to fulfil their needs. The researcher then found the solution of the basic problems. In ancient days engineering was not fully developed i.e. it was very difficult to work on any problem solving concept. After many study and hard work they able to use the concept properly. Now we are getting the things very easily because of their hard work. In today's day to day life the human are trying to modify the system by keeping the basic concept same. In past the many system they used were very critical in design the parts made by heavy metals. Once the any part of the system damaged, it was very difficult to repair and its cost is high. Also the maintainance cost is high. Coming to the point of important need i.e. water , the water is the main part of our life and without it the human can not survive. The water is the naturally resources available in the earth. It means the earth is the main source of the water. We get the water in its pure form i.e. without any impurity. In past decades the human stored the water by making the small pond , lake and well so that the water could store for long time because the river water continuous flows and it was very difficult to block the river water. The human uses the water to fullfil their thirst and and other water related works. Later on as the need of the water is increased, the system of providing the water to fullfil need is changed. In the world the water providing system is still continuously changing. The India also known as traditional country and is developing country. The major business of India is agricultural and many people in the country still fully depend upon farm business. Where there is farm the need of the water is also arises. Many system uses in the farm like well to lift water. Then newly introduced hand pump, traddle, electrically operated pump and many other system is using to provide water in the farm. But all that was stationary and electric are also very costly so it can not be used in small villages because of no power supply in many times and they also can not afford the electric pump. So they use the basic types i.e. well to lift the water. The hand pump is also used in the farm but it is stationary and requires more power to handle. The hand pump is also stationary system. In some areas the traddle is using but the remedies is that it is stationary and can not be portable. Also the spare part unavailability on time. Maintainance is also very important issue in the system. Once the system is installed it can not get changed as it occupies more space. In the urban areas the water is the main problem to get because as the country is developing, the many sky touching buildings are to be built. All the facility they gets but the water is major issues because in the ground level the water flow rate is high and as the the height of the building increased, it is difficult to reach water at the same rate. Hence the discharge rate of the water is very less. The top floor people unable to get the sufficient amount of water. Then they started using the electrically operated water lifting system, But the same problem came in front of them is electricity is very costly and maintainance is high and if it by-mistake handle not properly, it would be dangerous to the people living in and around the building. The main remedy is in summer season the motor gets heated soon. So it is also the main problem of water lifting. In summer season the electricity mostly shut down because of over heating. That time no use of the electric pump. Now by considering the urban and

rural positive and negative points of water lifting issues, the newly introduced water lifting system by using bicycle are to be used in this project. The human using this system is eco-friendly and simple in use. In all over eyes it is mostly suitable system for water lifting.

GENERAL PRINCIPLE OF WATER LIFTING:

Defination of Work, Power, Energy and Efficiency

By definition, the energy is required to do work; the power is defined as the rate at which it is used. To do a specific amount of work, the maximum or minimum amount of power is required depending upon type of work.

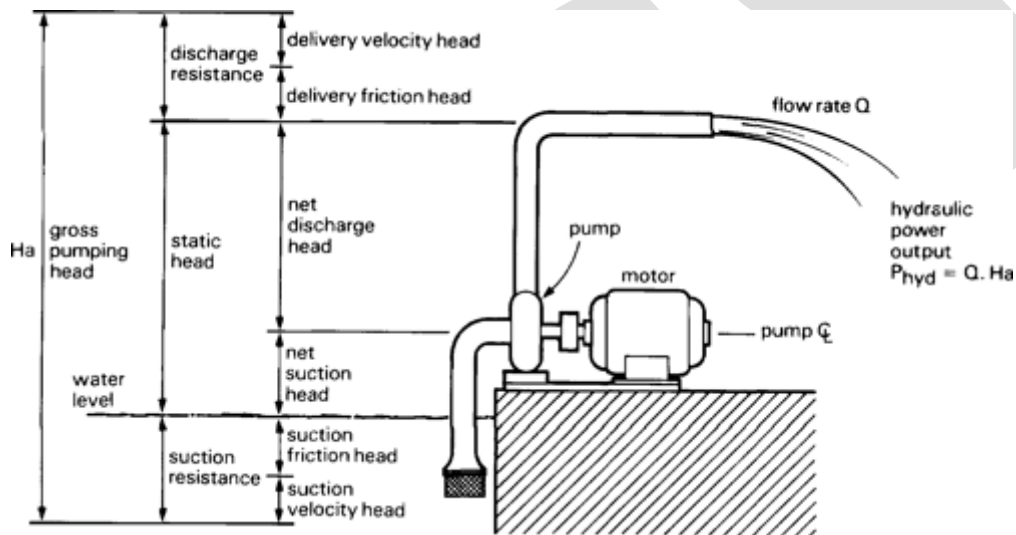


Fig: Typical pump installation

The general principle that,

$$\text{Power} = (\text{Head} \times \text{Flow rate})$$

$$\text{And Energy} = (\text{Head} \times \text{total amount of water lift})$$

This principle applies any type of water lifting system. The actual power and energy need are always greater than the hydraulic energy need because losses inevitably occur when producing and transmitting power or energy due to friction. The smaller the friction losses, the higher the quality of a system. The quality of a system in terms of minimizing losses is defined as its "efficiency":

$$\text{Where Efficiency} = \frac{(\text{Hydraulic energy output})}{(\text{Actual energy input})}$$

TYPES OF WATER LIFTING SYSTEMS:

HANDHELD PUMPS

Pneumatic (air) hand and foot pumps are commonly used today by people to inflate such things as tires, basketballs, and air mattresses. There are similar hand pumps that are used to pump water. A simple Modern lift pumps intended for village or community wells often are specially designed to support heavy, sustained use. This girl pumps water in Phai Sali, Thailand. Example is the pump used in a toy squirt gun. A more practical example is a handheld pump for collecting small quantities of water.



BUCKET, WHEELS AND PADDLES

Long before recorded history, people used buckets and pots to lift and carry water from its source. Wheels and paddles also were employed. The devices could be powered by humans or animals, by wind, or by the water itself.

A few examples are discussed in the following paragraphs.



Human-powered devices traditionally were used to move water short distances and up low grades. This irrigation wheel in Japan was still being used in 1958 to irrigate a small plot.

THE SHADUF

An old and simple device that evolved from the hand-carried bucket, and that was used by the ancient Persians and Egyptians, was the shaduf. It consists of a pole with a bucket or pot on one end and a counterweight at the other end, and supported in between by a vertical post. A person grasps the pole and dips the bucket into a body of water such as a stream or river in order to fill it with water.

The counterweight then lifts the bucket, and the bucket is swung over and emptied into an irrigation ditch. * The shaduf is still used in rural Egypt.

WHEELS AND LOOPS

An advancement over devices that used a reciprocating cycle (i.e., filling a container with water, dumping the water, then repeating the cycle) was the development of devices that scooped and emptied water in a continuous motion. The sakkia (or saquiyah), introduced by the ancient Persians during the fifth century B.C.E. , uses animal power to turn a wheel or chain that has numerous, evenly-spaced buckets attached. At the lowest point the buckets are filled with water, which are then emptied at the highest level. Like the shaduf, sakkias are still in use today.

Human-powered water wheels probably were developed more than 2,000 years ago during China's Chin dynasty (221–207 B.C.E.). Such wheels are turned by one or more people walking on them .A variation arranged the paddles or scoops in a linear fashion on a looped device, somewhat resembling a modern escalator or conveyor belt. The series of scoops would be advanced by a human operator, perhaps by walking on foot pedals mounted on an axle connected to the paddles.

HYDRAULIC RAM PUMPS

A hydraulic ram is a self-powered device which pumps water using only water pressure. The ram pump was invented in 1773 in England, and first patented in France in 1796. Unlike human-powered and animal-powered devices, the hydraulic ram is independent of any external power source. If a ram is properly located and periodically maintained, it can pump continuously for decades.



A hydraulic ram uses a combination of water pressure, air pressure, and gravity to pump water with no external power source (e.g., without electricity). The ram in this photograph dependably delivered spring water to a household in east-central Tennessee from the 1920s through the 1970s. The ram is shown in mid-stroke, when a spurt of water is wasted through an outside valve.

PROBLEMS IN CURRENT SYSTEM:

The following points are to be considered in the current system –

- In the current design system there are some design issues such as very critical in design to understand.
- Lack of deep study of need of human and as per the design correctly.
- Material cost is high.
- Limited life of the system.
- Once it is repaired, need to repair frequently.
- Noise occurs when started.

FUTURE SCOPE:

There is very bright future of this project because it will get the opportunities to make it always better than previous in all sorts e.g. in cost, design. The water lifting system related data and research data will be available for future reference. There are mainly two types of water available on earth such as normal water which we can get from river, rain water and second is salted water. When we processed the salted water to become use for our daily purpose, some impurities still present in water and when we lift that impure water, it affect on the system and the possibilities of damage and the layer of salt is obtained after some time. So in this project we are going to design the system in which salted water after processing when lifted, and if still impurity is present, the system automatically detect the impurity and that impure water filtered by the filtration process available in the system. And the pure water will be lift.

CONCLUSION:

The main purpose of this paper is to provide a basis for comparing and choosing between all present and future option for lifting water. It is also useful in the design of water lifting system for urban and rural areas. In it the waste material is also used for making the system less costly. This system can be use for salted water also.

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