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Performance Analysis of Four Scoop Water Wheel Spiral Pump

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***Abstract*—Spiral water wheel pump, a clean energy pump that discharges & lifts water up to certain height without using any electrical or fuel sources and additionally non-temperamental and maintenance problem is also eliminated. This would be an aid to rural areas. At present, a simple spiral pump is already is in use with single flexible PVC tubes coiled on a wheel frame where one end scoops up the flowing water and other is attached to the rotary union further discharging the water at required place. The proposed methodology of this model includes four spiral tubes scoops coiled on the same frame at 90 degrees of the inlet ends and connected to common outlet tube at rotary union resting about vertical axis. The wheel rotates with the help of chain drive and sprocket which requires an initial start with a handle. The projected model is giving a good result.**

Keywords— Spiral water wheel pump, PVC tubes, head, discharge, rotary union, chain drive & spocket

I. INTRODUCTION

Spiral pump was invented originally in 1746 by H.A. Wirtz and re-invented by P. Morgan in 1984. The pump consists of a flexible plastic hose coiled spirally on the same axis and plane, so that each loop of the hose differs in diameter from the next, and the whole device resembles a large wheel with the axis parallel to the water surface. Around the world, pump is used for many purposes. In industries for pumping of any liquid such as chemicals, exhausts, etc. for cleaning purpose where dirty water is undesirably collected at some place and in agricultural applications. This pump is run by electric or fuel supply. In rural areas farmers are facing problems of cut-off of electricity. In some rural areas the problem of electricity is even worse. It is either due to complex physical location of the villages or tough environmental conditions prevailing there. We know that it is impossible to change the environmental conditions but technology, it can surely be changed or re- invented according to the needs.

India became the world's third largest producer of electricity in the year 2013 with 4.8% global share in electricity generation surpassing Japan and Russia. Apart from that, a current survey says that around 1.4 billion people in the world who have no access to electricity, India accounts for over 300 million. Electric Energy consumption in agriculture was recorded highest (18.45%) in 2014-15 among all countries. These all data point only towards two major problem. First, there are many regions where due to their physical conditions it becomes very difficult to supply electricity for them apart from we are capable of providing enough of this facility. Second, the major percentage of consumption of electricity is in agriculture sector.

Keeping these key points we have tried to bring new technology in pump for agriculture which will work without any consumption of electricity. This pump can be fabricated with the chipsets raw material as per as user need. Hence spiral pump is very economical. During its study some drawbacks we came through is that it's totally based on flowing water that restricts it only for rainy season and single scoop inlet which affects its efficiency. To overcome this drawback we decided to make change in its present technology. It is provided with four scoop inlet and chain drive mounted over its spiral wheel structure.

In proposed model, wheel structure is partially submerged in water. When force is applied by flowing water or manually by handle, the spiral wheel body will rotate accordingly. All the four scoops will collect water during every rotation and will pump that to desired location as per user's requirement. The overall process is free from electricity consumption and requires low maintenance. The model is designed in such a way that even a common man can easily assemble or disassemble it . This pump is very economical and feasible for rural and remote areas as we have used PVC pipes and wooden frame for its fabrication .

II. EXPERIMENTAL SETUP

For our research work , we developed a dynamic model of the Spiral Pump supported on a plywood frame of thickness 1 inch. This frame was used to support the spiral tubes around the rotating pipe. Baffle- like wooden slabs were also attached to the wooden frame to increase the area of impact of flowing water.

The wooden frame was mounted on a 1 inch thick PVC pipe at one end. This end was fitted with a PVC cross joint which act as inlet passage from the spiral tubes to a common PVC pipe. A pump stand was built on which the PVC pipe was mounted supported by bearings. A chain drive assembly is mounted in the middle of the pipe connected to a rotating lever to rotate the spiral structure at desired RPM.

The spiral structure is made of three flexible PVC pipes of diameter 1 inch and 2 mm thickness. At the end of each spiral there exist a scoop which provides an inlet passage for water into spiral tubes.

The other end of the pipe is connected to a rotary union.

The purpose of the rotary union is to make the outlet pipe (from the rotary union) stationary while inlet pipe rotates at given rpm. The outlet pipe is further connected to a stationary stand so as to measure the pressure head produced.

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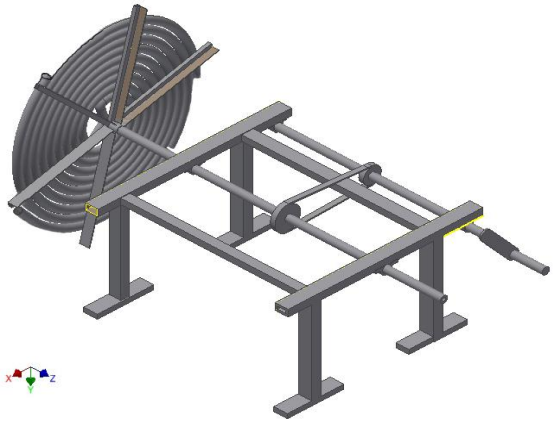

Fig. 1. Model of a four scoop Spiral Pump

Components Used

For constructing the model of four scoop spiral pump, the components that have been taken into use include plywood , rotary union and PVC pipes of different diameter and thickness.

The table below illustrates the components used and their specifications :

Table 1

S.NO.	Name of Components	Specifications
1	Plywood	Thickness = 1 inch
2	Rotary Union	ID = 0.75 mm
3	PVC Pipe	ID = 0.75 inch , Thickness = 4 mm
4	Flexible PVC Pipe	OD = 1 inch , Thickness = 2 mm

III. RESULT

After the successful establishment of the model , experiments were carried out in the laboratory . Pump was made to operate at different RPM's such as 25 , 35 and 45. The discharge of pump at different RPM's were observed for different heights above the ground level. The four scoop pump has shown better results than a normal scoop pump. The table below demonstrates the result of the experiments :

Discharge of liquid in litres : Q

Speed of wheel rotations : N (RPM)

Height of liquid pumped : H (feet)

Table 2

N (rpm)	Discharge of Liquid Q (litres)			
	h = 0 feet	h = 1 feet	h = 3 feet	h = 5 feet
25	6.7	5.5	4.6	3.4
35	7.5	6.7	5.5	4.3
45	6	4.3	3.4	2.4

In order to have a more clear view of the experiments carried out in the laboratory , graph between discharge and height for different RPM's has been plotted.

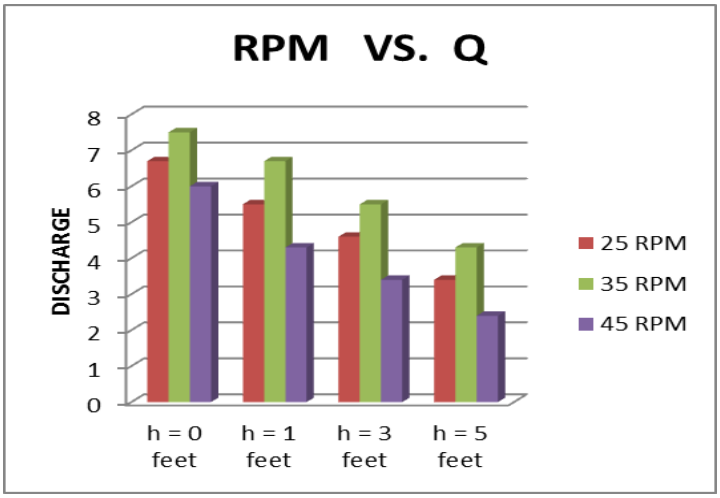

Fig. 2. Graph between discharge and height

Another graph depicts the discharge at different RPM's at ground level.

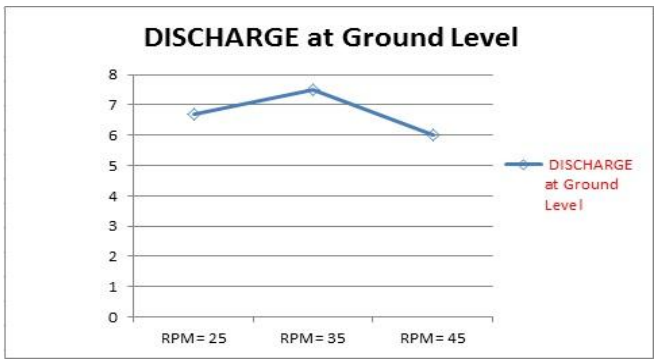

Fig. 3. Graph between discharge and RPM at ground level

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IV. CONCLUSION

We have successfully concluded the limited tests performed on the four scooped Spiral Water Wheel Pump in the lab. The tests demonstrate the excellent potential of this preindustrial concept when experimented with a modified scaled-down testing apparatus that allows us to precisely control variables and accurately measure experimental results. The four scoops concept has appeared as a boon to the spiral pump efficiency. As it reduces the chances of empty rotations of tubes and transfers more water in four continuous scoops in a single rotation. In some circumstances, hand or motor driven spiral pumps could be used to high heads discharge. We hope to eventually have a computational model which will allow us to more fully analyze the experimental measurements. As there is always a scope for improvement, we would kindly appreciate further suggestions and modifications.

V. ACKNOWLEGMENT

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VI. REFERENCES

[1] Rahul Urunkar & Prof. P.P. Deshpande, “Study of Drive Mechanisms of Bicycle, Tricycle or Like Vehicles to Optimize Operating Performance - A Review”, Int. Journal of Engineering Research and Applications, Vol. 4, Issue 1, January 2014

[2] Manager of asset mangt., “Allowable pipe size, class and materials for water mains”, S. A. water planning and infrastructure, September 2011.

[3] Samantha Marshall, “The Water Crisis in Kenya:Causes, Effects and Solutions”, Global Majority E-Journal, Vol.2, Issue. 1 pp. 31-45, June 2011.

[4] M. A. Younes, “Investigation of hydraulic problems in pumping station; case study”, Twelfth International Water Technology Conference, Alexandria, Egypt,IWTC12 2008.

[5] M. Denny, “The efficiency of overshot and undershot waterwheels”, European journal of physics, December 2003.

[6] S N Waghmare, M M Mestri, P V Lavekar, T S Misal &P C Nalawade(2014) , “Spiarl Tube Water Wheel Pump: A Proposed Model” Journal of civil and mechanical engineering (ISSN: 3347-4482) Nov- 2014.

[7] Henry P. Gavin, “Bicycle wheel spoke patterns & spoke Fatigue”, ASCE Journal of Engineering Mechanics, Vol.122, Issue 8, pp. 736–742, August 1996.