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Performance and Analysis of Triple Scoop Spiral Pump

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Abstract: *To reduce manual work and provide best and efficient machineries requiring less conventional sources are sum of the known tasks of engineering. Engineering is not only a way to the easier world but also a boon to the fast moving world. The main concentration of the respective study is the degradation of non-renewable fuels and electric sources in the whole working of a pump. A further modification in this model is the Spiral water wheel pump, a clean energy pump that discharges & lifts water upto 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(1 inches in dia.) coiled on a wheel frame(around 6ft in dia.), where one end scoops up the flowing water and other is attached to the rotary union further discharging the water at required place. Previous research by collaboration of students of KEC, Ghaziabad & JSSATE, Noida with multiple coiled spiral tubes which got very good results and discharge efficiency is commendable. The proposed methodology of this model is one step further modification in the existing research with three spiral tubes scoops coiled on the same frame at 120 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 high result and any improvement is carried out by the institution.*

Keywords: *Spiral water wheel pump, PVC tubes, head, discharge, rotary union, chain drive &sprocket.*

1. INTRODUCTION

Different ways of using the pump effectively as well as efficiently have been investigated all over the world. The pump is generally run by electricity or fuel supply. Most frequently pumps are used in industries to pump water, waste chemicals etc. and also for agricultural processes. As per as the current scenario the biggest problem any nation is facing is Power-generation. Although many steps have been taken to minimize this problem and because of this we are opting the alternate options. For a developing country like India and many other countries which has agriculture as its main source of production cannot take this problem so lightly. So the idea of creating a pump which runs without any power source came from here which is named as "Spiral Water Wheel Pump".

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[2].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[6]. Electric energy consumption in agriculture was recorded highest (18.45%) in 2014-15 among all countries[7]. 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. The idea of "spiral tube water pump" came to think over which somehow reduces such problems, which was originally created by H.A. Wirtz in 1746. Initially it was an alternative for Archimedean screw[3]. But spiral tube water pump can lift water up to a greater height than Archimedean screw which made it more popular. 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 itstotally 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 has provided with three 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 three scoop 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 require a low maintenance. Keeping in mind of rural areas the design is made so simple that even a common man can also assemble and disassemble if required. This pump is very economical and feasible for rural and remote areas as

we have used PVC pipes and wooden frame for its fabrication.

2. EXPERIMENTAL SETUP

For the present research work, a supporting frame made of plywood of thickness 0.75 inches was made which was used to support the spiral tubes around the rotating pipe. Baffle-like wooden slabs were attached to the wooden frame so as 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 form the spiral tubes to a common PVC pipe[8]. 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.

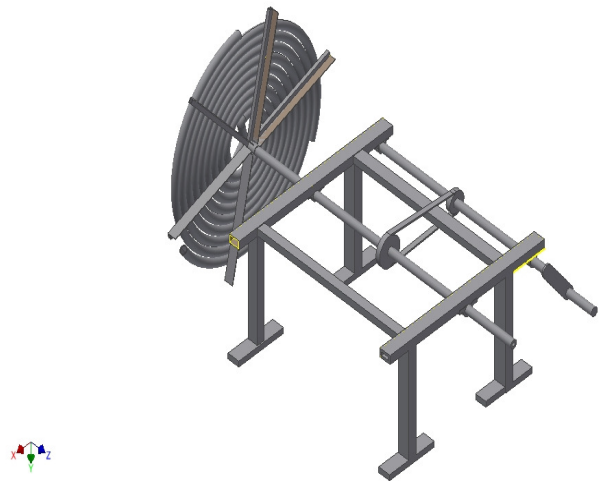

Fig. 1. Project model of three scooped spiral pump

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. The table given below provides the specification of the components used:

TABLE 1.

S.no	Name of Component	Specifications
1	Flexible PVC Pipe (for spiral)	OD = 1 inch, thickness = 2mm
2	PVC Pipe	ID = 0.75 inch, thickness = 4mm
3	Plywood	Thickness = 0.75 inch
4	Rotary Union	ID= 0.75 mm

3. RESULTS

The proposed model had been experimented in the laboratory and the test results are shown below at various heads to compare the discharges at different RPM of rotations. As expected the three scooped at 120 degrees had shown improved results than a normal scooped spiral pump.

Discharge of liquid denoted by: Q (in ltrs)

Speed of wheel rotations denoted by: N (in RPM)
Height of liquid pumped denoted by: H (in ft.)

TABLE 2.

Discharge of liquid at various heads 'H' (Q (in litres)				
N (in RPM)	**Ground Level**	**h= 2 feet**	**h= 4 feet**	**h= 6 feet**
20 –25	**6.3**	**5.2**	**4.4**	**3.2**
30 - 35	**7.4**	**6.4**	**5.3**	**4.1**
40 – 45	**5.8**	**4**	**3.1**	**2.3**

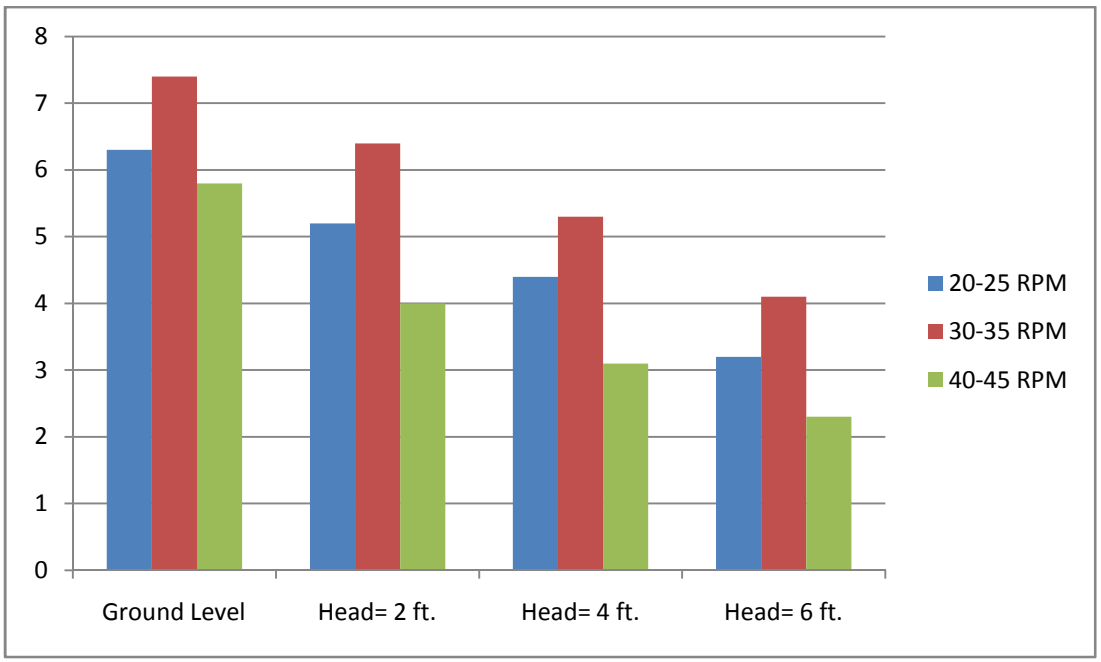

Fig. 2. Graph between RPM of wheel rotation Vs Discharge of Liquid

4. CONCLUSIONS

We have successfully concluded the limited tests performed on the Three scooped Spiral Water Wheel Pump in the lab. The tests demonstrate the excellent potential of this preindustrial concept when experiment with a modified scaled-down testing apparatus that allows us to precisely control variables and accurately measure experimental results. The teamanticipating continued progress on this result on this research project as we continue to develop more computational models for more complex systems.

The three 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 three 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 and hope that this research will continue in ISFT for further years.

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