



Design and Fabrication of Pendulum Operated Hand Pump

Sagar Niturkar^{#1}, Tejas Niturkar^{#2}, Sanket Madane^{#3}, Sandesh Jadhav^{#4}, Prof. Tukaram B. Patil^{*}

[#]Dept. of Mechanical Engineering, B.E. Final Semester

^{*}Assistant Professor at SKNCOE, Pune

¹sagarniturkar007@gmail.com

²tejasniturkar834@gmail.com

³sanketmadane1642@gmail.com

⁴Sandeshjadhav16999@gmail.com

^{*}tbpatil@sinhgad.edu

Abstract— The traditional hand water pump may take more efforts, the man who operates traditional hand water pump has to apply his force continuously on the lever of pump, due to which man who are using this pump get tired immediately. One important think of a pump with a pendulum is that the work is alleviated or in simple terms it makes work rather easier when is compared with a traditional hand water pump. By the use of pendulum-based water pumping system we can increase the efficiency of the plant and reduce the effort, cost of production, production time, and manpower requirement. The research done fill today is concentrated on the working and effectiveness of the mechanism only. Considering all of the advantages of the mechanism it was decided to use it for lifting water with the help of reciprocating pump such that the input to the mechanism is given by humans which is comparatively less than the effort applied by humans to lift water using hand pumps directly.

Keywords— Effectiveness of the mechanism, efficiency, cost of production, production time, water pump.

I. INTRODUCTION

The main importance of a pendulum pump is that the initiation energy for starting the process of pumping, swinging of the pendulum, is considerably less when compared with the work required to operate hand pumps. Typical hand pumps require sufficiently large effort and an average person can use the pump continuously only for a short time, but the pendulum pump requires only minimum of the effort, because it is only required to oscillate the pendulum and can maintain these oscillation for several hours, without any fatigue. The advantage of this invention compared to present hand pump solutions are: less force to start the pump, less water consumption, and both arms can be used to fetch the water.

New and technically original idea - hand water pump with a pendulum - provides alleviation of work, because it is enough to move the pendulum occasionally with a little finger to pump the water, instead of large swings.

II. PROBLEM STATEMENT AND OBJECTIVES

“Every time using human effort with hand pump is takin the half energy of the human and if we see, it is waste of human energy. So, it is required to prepare or finding good and cost free solution, which can be work without electricity for rural areas.”

The objectives of our problem statement are as follows;

To reduce the effort made by the farmer for supplying fertilizers.

To reduce the effort of farmer for supplying of water for drip irrigation.

To reduce the work of supplying of water for gardening.

To save electricity consumption.

For drinking water facility.

III. WORKING PRINCIPLE

The pump is made of pendulum, two-leg lever and cylinder with the piston which pumps the water. Oscillation of the pendulum is maintained by periodical action of the human arm. Oscillation period of the pendulum is twice bigger than the period of the lever oscillation. Piston of the pump has reverse effect on the lever and damps its oscillation. Damping of the lever motion causes damping of the pendulum, but the work of the force damping the pendulum is less than the work of the forces which damp the lever. Equilibrium position of the lever is horizontal, and the equilibrium position of the pendulum is vertical. Oscillation of the lever and the pendulum takes place in the same plane, vertical in reference to the ground. Physical model of this type of water pump was shown at a number of exhibitions, in some publications.

IV. COMPONENT DESCRIPTION

1. **Reciprocating Pump:** - A reciprocating pump is a class of positive-displacement pumps which includes the piston pump, plunger pump and diaphragm pump. In reciprocating pumps, the chamber in which the liquid is trapped, is a stationary cylinder that contains the piston or plunger.
2. **Springs:** - A spring is an elastic object that stores mechanical energy. Springs are typically made of spring steel. There are many spring designs. In everyday use, the term often refers to coil springs.
3. **Levers:** - It is also the main component of the pump system and is made up of steel. Lever converts the oscillating movement of the pendulum on one side to the reciprocating motion of the piston to the other side. There are different types of levers which are based on the relative positions of the effort point, the load point and the fulcrum.
4. **Ball Bearings:** - Ball bearings are the elements which uses balls between bearings. These are used to reduce rotational friction and support axial loads.
5. **Pendulum:** - A pendulum is a weight suspended from a pivot so that it can swing freely. When a pendulum is displaced sideways from its resting, equilibrium position, it is subject to a restoring force due to gravity that will accelerate it back toward the equilibrium position. When released, the restoring force acting on the pendulum's mass causes it to oscillate about the equilibrium position, swinging back and forth. The time for one complete cycle, a left swing and a right swing, is called the period. The period depends on the length of the pendulum and also to a slight degree on the amplitude, the width of the pendulum's swing.
6. **Angle Bars:** A steel angle is long steel with mutually vertical sides. The steel angles are the CD steel. The most commonly found steel angles are formed at a 90-degree angle length. The sides are either equal or of different sizes. There are most basic formed and has two legs of equal. Variations in the steel angles depending on its basic construction.
7. **Metal Bracket:** - An angle bracket or angle brace or Angle Cleat is an L-shaped fastener used to join two parts generally at a 90-degree angle. It is typically made of metal but it can also be made of wood or plastic. The metallic angle brackets feature holes in them for screws.
8. **Nuts and bolts:** - Vehicles contain many different styles and types of nuts and bolts. Below list of common types of nuts and bolts that students should become familiar with,
 1)Hex or flat nut 2) Lock nuts 3) Slotted or castle nut:
 4)Set screw 5) U bolt 6) Thumb screw.

V. MANUFACTURING PROCESS

1. **ARC WELDING:** Arc welding is a welding process that is used to join metal to metal by using electricity to create enough heat to melt metal, and the melted metals when cool result in a binding of the metals. It is a type of welding that uses a welding power supply to create an electric arc between a metal stick ("electrode") and the base material to melt the metals at the point-of-contact. Arc welders can use either direct (DC) or alternating (AC) current, and consumable or non-consumable electrodes.

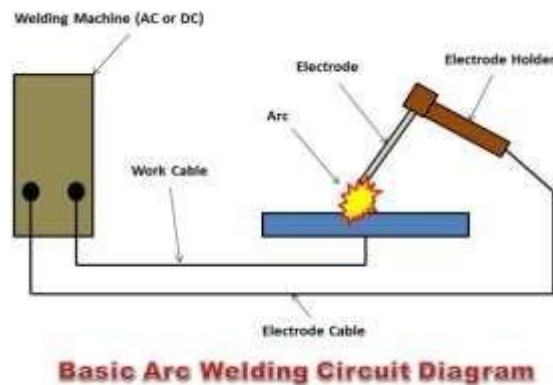


Fig. 1: Basic Arc Welding diagram.

2. **DRILLING:** Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multi-point. The bit is pressed against the work-piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work-piece, cutting off chips from the hole as it is drilled.

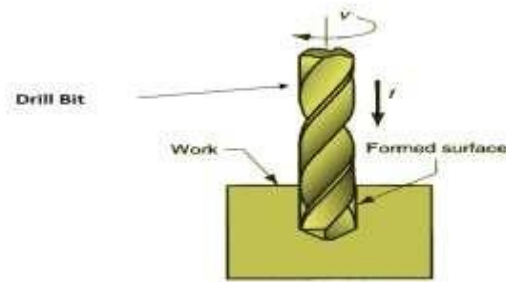


Fig. 2: Drilling Operation.

3. METAL CUTTING: Metal Cutting is the separation or opening of a physical object, into two or more portions, through the application of an acutely directed force.

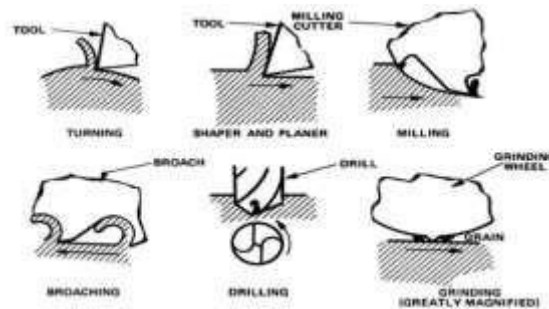


Fig. 3: Metal Cutting.

VI. CAD DESIGN

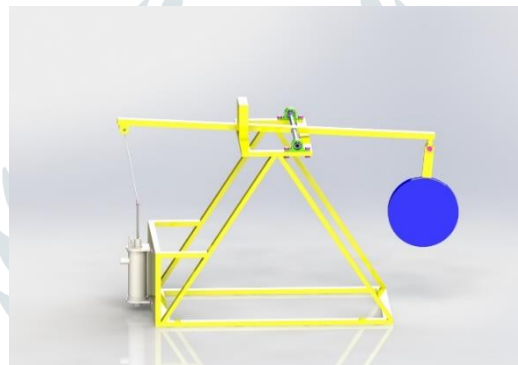


Fig. 4: Project assembly in Solidworks software.

Above figure shows the design of actual project made in solid works design software. Which mainly contain its frame and bearing – pendulum mechanism.

Dassault Systems SOLIDWORKS Corp. Offers complete 3D software tools that let you create, simulate, publish, and manage your data. SOLIDWORKS products are easy to learn and use, and work together to help you design products better, faster, and more cost-effectively. The SOLIDWORKS focus on ease-of-use allows more engineers, designers and other technology professionals than ever before to take advantage of 3D in bringing their designs to life.

VII. CONCLUSION

From this design and fabrication of pendulum hand pump, we have reduced the human effort by providing the pendulum bob which is attached in the hand lever. While pumping the pendulum oscillates to and fro and provides continuous energy to the hand lever which pressurizes the water and lifts the water from lower head to higher head and provides the continuous flow of liquid.

VIII. ACKNOWLEDGEMENTS

We take this opportunity to express our deep sense of gratitude to our Prof. T.B. PATIL for his valuable guidance and inspiration in spite of his busy schedules He devotes himself in completing our task with the admirable excellence. He has taken keep and personal interest in giving us constant encouragement and timely suggestion. And also, to our Head of Department, DR. T. S. SARGAR for cheerful encouragement and notable guidance.

My special thanks to our all mechanical staff, who gave precious guidelines for my project, "DESIGN AND FABRICATION OF PENDULUM OPERATED HAND PUMP" and supporting staff of mechanical department for their invaluable help in our project. I

also express my heart full thanks to our beloved PRINCIPAL DR. A. V. DESHPANDE has provided the facility for project I am also thankful to all my group.

IX. REFERENCES

1. IJSART – Volume 4 Issue 5 – MAY 2018 ISSN [ONLINE]: 2395-1052 Page | 611 www.ijstart.com Design and Fabrication of Pendulum Operated Pump.
2. IRJET – Pendulum operated hand pump by Anant Patwari | www.irjet.com
3. Design of a prototype of Pendulum Operated Piston Pump by Arka Dutta | www.slideshare.com
4. IJSER – International Journal of Scientific & Engineering Research, Volume 8, Issue 2, February-2017 ISSN 2229-5518
5. IJMERE – Volume-5, Issue-6, December-2015 | www.ijmer.net | International Journal of Engineering and Management Research Page Number: 357-361
6. “The secret of free energy of the pendulum v. Milkovic, 2010 edition (vrela, novi sad, Serbia, 2001).
7. “ANGULAR MOMENTUM OVER UNITY” Jovan Marjanovic, 2011 edition, VOL 4
8. © 2019 IJRAR June 2019, Volume 6, Issue 2 www.ijrar.org (E-ISSN 2348-1269, P- ISSN 2349-5138)
9. IJRARIAMP014 International Journal of Research and Analytical Reviews (IJRAR) www.ijrar.org 94
10. IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308
11. Kathmandu University Journal of Science, Engineering and Technology, Vol. 15, No. 2, August 2021
12. IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308 <https://doi.org/10.15623/ijret.2018.0703015>
13. Vaibhav M. Nimbalkar, Saurabh S. Bhangre. 2018.0703015 P.M.M.I.T & R Bandnera on ICSTSD vol[03] are done swing set irrigation system at [2016].
14. International Journal of Engineering Science Invention (IJESI) ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726 www.ijesi.org || Volume 8 Issue 03 Series. II || March 2019 || PP 36-38.

