iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** V **Month of publication:** May 2023

DOI: https://doi.org/10.22214/ijraset.2023.52277

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue V May 2023- Available at www.ijraset.com

Development of Hydraulic Ram Pump for Agriculture Uses and Approach A Review

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Abstract: ***This report focuses on Hydraulic Ramp Pumps that have been used worldwide for over two centuries in many areas. The project idea is to build a pump known as Hydraulic Ram Pump [HRP] that gets the water higher level, Kinetic Energy at the inlet, and converted it into pressure energy. This is commercially successful because of its simplicity and reliability.***
The hydraulic ram pump (hydram) is a viable and appropriate renewable energy water pumping technique developed in many countries, our project team can get the idea to design and manufacture a more efficient and long time durable Hydraulic Ram Pump so that it can solve major problems by providing adequate domestic water supply to Rural Populations and Agricultural Land, it is difficult to the water served by a conventional pipe system.
Keywords: Experimentation, Design, Optimisation, Efficiency rate, Pressure rate, templates, journals

I. INTRODUCTION

The application of water and uses has been the most important factor in raising the productivity of agriculture and ensuring predictability in outputs. Water is essential to bring forth the land potential and plants and animals variety improved to make full use of other yield-improve production factors. Increasing sustainable water management (especially combined with adequate soil husbandry) and increasing productivity helps to confirm better production both for commercial disposal, and direct consumption, so enhancing the generation of essential economic surpluses for that increasing rural economies.
In India, more than 60% population depends on agriculture, because the Indian economy is an Agri-based economy even the growth of the economy totally depends upon the products of agriculture. Agriculture depends on seasons (mainly the rainy season). In the rainy season the majority of crops is depends on water. Irrigation is still in the majority of rural area power is not available at any time. Therefore ponds and rivers are available, and continuous water supply by channel is also available. it is difficult to get their land irrigated properly. They use pumps like diesel pumps and petrol pumps for the irrigation of land and farms. which is costly and unaffordable to the agriculturist, so either the electricity is available or not available or it is costly, so they need non-conventional energy sources. Solar pumps are also available but these are not in use. Because it is so highly costly and the other issue is commercialization, it is to build up and developed machines/mechanisms that work without unconventional or conventional energy like solar, wind, etc.

II. WORKING OF HYDRAULIC RAM PUMP

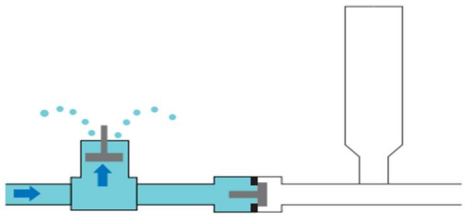

FIGURE 15: HRP working cycle: a wasting period.

When water enters the drive pipe from a specific high height at a high flow rate. The discharge valve is a nonreturn valve. The waste valve is open and the discharge valve is closed. Water that flows out around a waste valve is called a wasting period. since water is wasted (Figure 15). Under the action supply head (S_H), the water drive line is accelerated. When a flow velocity is increased the waste valve will be closed and a very high pressure wave will be created. Static supply pressure is lower than this pressure.

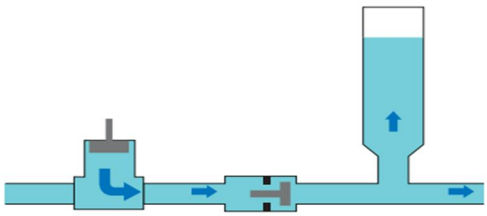

FIGURE 16: HRP working cycle: a pumping period.

Due to this pressure discharge valve is open and water is continued to flow to the air chamber. The air chamber is partially filled with air and partially filled with water due to continuous flow pressure with decreasing velocity. Some energy is stored in an air chamber due to air compression. The inertia of flow mass of fluid to maintain flow during this period flow is decelerated. Discharged valve is open and the waste valve is closed known as the pumping period.fig (16)

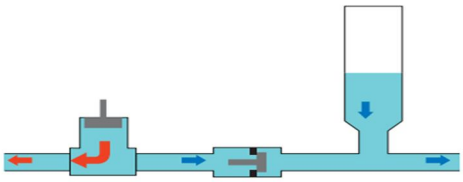

FIGURE 17: HRP working cycle: a recoil period.

When the flow speed is zero, the discharge pressure return flow to the discharge valve. The waste valve is open and the discharge valve is closed. The pressure inside the drive pipe, waste valve, atmospheric, and weight of waste valve get net force to open the waste valve automatically called as recoil period. Fig (17)

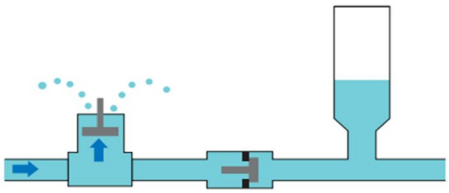

FIGURE 18: The automatic HRP working cycle.

When opening the waste valve the pressure is atmospheric flow is back toward the supply reservoir due to the action of the supply head it gives zero velocity, then get speed up toward the waste valve to start another cycle. Fig (18)

III. APPLICATIONS OF HYDRAULIC RAM PUMP

1) Its cost is very low.
2) Use of Renewable energy resources.
3) It has low maintenance requirements because of simplicity and reliability.
4) In rural villages is more impactable.
5) It has a good potential for local manufacture.
6) It has continuous, automatic operation and requires no human input or supervision.
7) Pumping is a small area of the proportion of the available flow that has little environmental impact.

IV. ADVANTAGE AND USAGE

1) Low maintenance requirement.
2) Little environmental impact.
3) The use of a renewable energy source ensures low running costs.

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V. USAGE

Pumps water from source to community.

VI. DESIGN ASPECT FOR "HYDRAULIC RAM" PUMP, AND VARIOUS DESIGN COMPONENTS, DESIGN FORMULAS.

A. Design Formulas

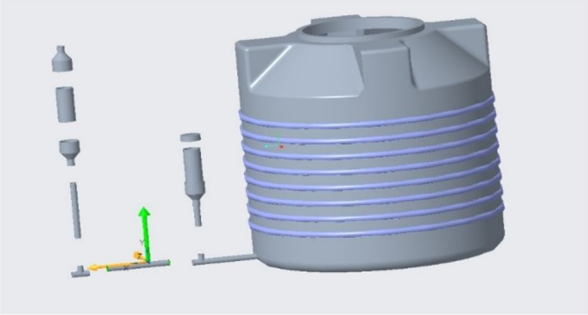
FB:- Waste valve beats per minute (times/min*)*
g: - Gravitational acceleration (m/s ^{2})
P :- Pressure = Head x 0.433 psi/ft
H: - Total head of water
HRP: - Hydraulic ram pump
H*: - Head ratio
Pc: - Pressure inside the chamber (bar)
POW: - Power (P)
Q: - Volume flow rate (m^3/s)
Q* : - Pump Flow is in liters/minute
ή: - Efficiency
ρ :- Density (Kg/m^3)
d : - Delivery pipe
w: - Waste Valve or impulse valve
s:- Supply or drive pipe

Various Design components:-

- Delivery valves
- Water storage tank
- flow valve
- non -return valve
- supply pipes
- End Caps
- Air chamber

B. Actual Model

C. CAD Model (3D)



VII. CONCLUSION

After a brief explanation of the project, we conclude the following terms about our project. Due to its small size, it can implement in any place. It does not require any external source of energy like electricity, etc. Due to its low manufacturing as well as maintenance cost, a common man can easily afford it.

The project has many practical implementations and uses. As the energy sources like petroleum gas, fuel, etc. are depleting day by day, we designed this Hydraulic Ram Pump which does not need any external energy sources.

There is a further need for enhancement of the efficiency of the hydram

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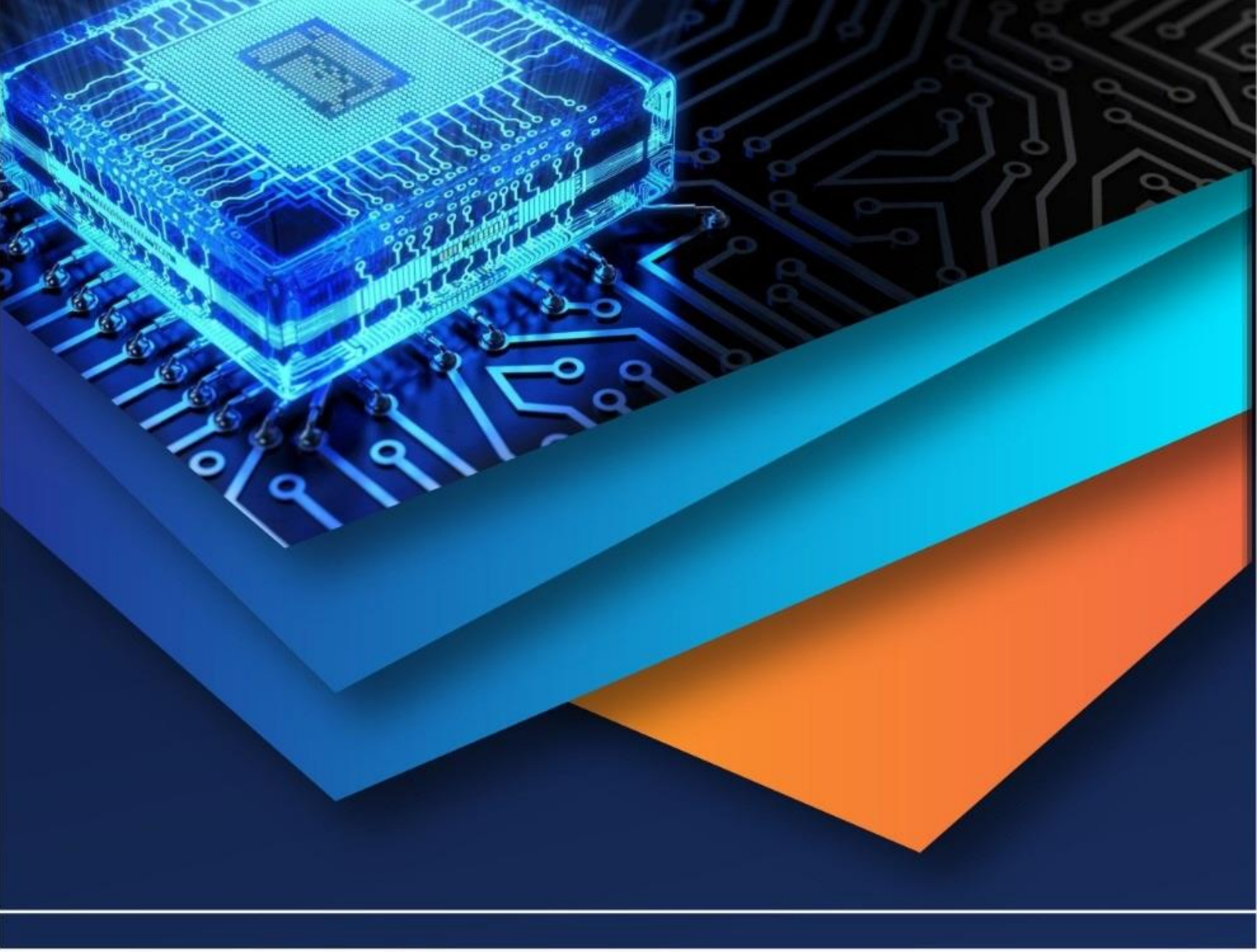

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