

The Hydraulic Ram Pump as a Low-cost Water management solution for Rural villages

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Abstract – The Hydraulic Ram Pump is a simple device which works on the water hammer principle and uses a non-return valve which should be typically made up of brass which is an alloy of copper and zinc which gives the valve the property of being corrosion resistant. The speciality of the Ram Pump is to lift water to almost six times the supply head and has energy efficiency up to sixty percent. What make the device more practical is the cost of assembly which is very reasonable and the maintenance which is very low when compared to the regular electrical pump. Thus this device is very reliable, Efficient and has very low maintenance.

Key Words: *Hydraulic Ram Pump, energy efficiency, practical, Efficient, Low maintenance,*

1. INTRODUCTION

In remote village everyone faces two major issues namely water management and load shedding. Both issues go hand in hand as abundant water is required to produce electricity, the same electricity is required to provide water to higher altitude. To save water, electricity, money and efforts the hydraulic ram pump can be used with a water management system. The modern-day water management systems like RO/UV purifiers are more advanced but are not cost efficient because of frequent maintenance and high initial cost.

During the purification process many essential ingredients are also filtered unnecessarily resulting in a loss of essential minerals and vitamins necessary for a healthy immune system.

Here if we use the Ram Pump as a complete water management system, we can solve both water management and eliminate the use of energy. The Ram pump requires abundant water for it to run more efficiently but in regions with water scarcity or droughts the pump can run with lesser efficiency. In these regions we can keep the water reservoir above the pump so we can use the potential energy instead of kinetic energy.

The ram pump consists of standard components which could be availed from standard hardware stores and the total cost of assembly is also very low. Which makes this device suitable for rural areas facing similar issues.

2. Objectives, Working and Costing

2.1 Objectives

1. To save and eliminate the use of electricity.
2. To manage water loss of conventional fluid systems.
3. To find practical applications as A low investment low maintenance product.
4. To eliminate the need of high maintenance electrical equipment in water management system.
5. To save cost reduce money.
6. Find use of affordable modern technology as A solution to agricultural issues

2.1 Working

The hydraulic ram is a pump which raises water without any external power for its operation.

One essential requirement for the satisfactory operation of hydraulic ram is the availability of a large quantity of water with a small positive head or height. This large quantity of water at a small height is sufficient to lift small quantity of water to a greater height. It works on the principle of “Water Hammer.”

In practicality the factors which affect the energy efficiency of the pump are head and flow rate of water also the more compact construction is the better would be the efficiency of the ram pump. The components required for the assembly of the ram pump are shown in the photo below



Photo -1: Components required for assembly



Photo – 2 Tools used for the assembly



Photo3 – Completed assembly of Ram pump

2.2 Pricing

The list of components and the pricing of the entire assembly is given in the table below

Sr.no	Component name	MRP
1	. 1-1/4” ball valve	90
2	. 1-1/4” * 3/4 “ bushing	80
3	. 3/4” PVC union	60
4	1-1/4” FTA threaded	120
5	1-1/4” metal or PVC T *2	150
6	4” * 2ft PVC pipe	80
7	1-1/4” PVC union	120
8	4” PVC cap	145
9	1-1/4” threaded brass check valve	550
10	PVC cement and primer	60
11	3/4” ball valve	115
12	3/4” pressure gauge (optional)	310
13	1-1/4” ball valve	90
14	1-1/4” * 3/4 “ bushing	80
15	3/4” PVC union	60
Total cost		1810

Table 1. Total cost of assembly of Ram pump

Sr no	Name of tool	MRP
1	Hacksaw	180
2	Std Tool Box (optional)	2500
3	PVC solvent	65
Total cost		2745

Table 2. Total cost of tools and accessories

3. WATER MANAGEMENT

The Hydraulic Ram Pump can be very efficient in terms of water lifting but the remnant of the energy efficiency is all waste water or water loss which is almost up to 40 to 60 percent this can be utilized in 3 ways

1. Potable/Drinking water by using a low-cost filter
2. Water for Domestic animals
3. Drip irrigation system for agricultural purposes

All these methods are shown in the figure below where we can see that the water which is falling out of the valve is collected into a reservoir and then given to a cheap water filter which consists of fine sand moderate sand and cores sand as three layers of filtration which is strained through a strainer consisting of alum powder which removes dirt and bacteria from the water which is then passed on to the bamboo drip irrigation system and the remainder of water can be used by domestic animals for drinking purposes

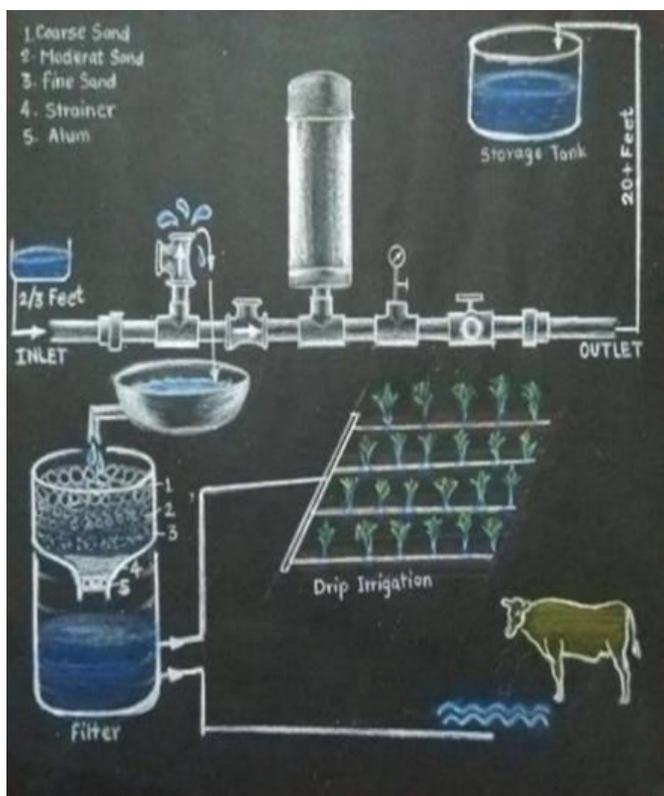


Photo -4 Ram pump with water management system

From the table given below we can see that the total cost of assembly is less than the estimated cost hence the project is a very practical solution to areas which are in the rural sector

and are facing issues of excessive rainfall, water logging and load shedding.

SR.NO	ASSEMBLY/COMPONENT	ESTIMATED COST	ACTUAL COST
1	RAM PUMP	3000	1810
2	DRIVE PIPE	500	250
3	DELIVERY PIPE	500	350
4	IRRIGATION SYSTEM	2000	800
5	ACCESSORIES AND TOOL	2000	2250
TOTAL COST		8000	5460
OVERHEAD COST/COST OF MAINTAINENCE		1000	1000

Table – Total cost of entire assembly

4 CONCLUSIONS

After understanding the working and mechanism of the hydraulic ram pump the following results were concluded.

1. The device is capable of lifting water without any electrical device is to its greatest advantage as an economical leverage as well as immune to problems like load shedding.
2. It is easy to construct and cheap to maintain.
3. The waste water is not managed to its right extent and filtered for potable use or saved for agricultural use.
4. The remnant water is also used as a drip irrigation system and water storage for pondage or energy generation .

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