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RENEWABLE ENERGY HYDRAM – A REVIEW

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ABSTRACT

Hydraulic ram pumps are water-lifting devices that are powered by falling water. These pumps work by using the energy of water falling at small height to lift a small part of that amount of water to a much greater height. The main and unique advantage of hydraulic ram pumps is that with a continuous flow of water, a ram pump operates automatically and continuously with no other external energy source –be it electricity or hydrocarbon fuel.

I. INTRODUCTION

In many parts of the world, villages are situated abovethe spring: it does not allow water to flow to compounds by gravity. For example, in hill areas province, India, 20 percent of the population lives upstream the closest source of water. A pump is needed to lift the water from this source to their compound. There are virtually no rural electrical mains. Engines pose problems of both fuelling and maintenance. A hydraulic ram (also called hydram) is a pump that uses energy from a falling quantity of water to pump some of it to an elevation much higher than the original level at the source. No other energy is required and as long as there is a continuous flow of falling water, the pump will work continuously and automatically. The hydraulic ram pump (hydram) is an alternative pumping device that is relatively simple technology that uses renewable energy, and is durable.

II. LITERATURE REVIEW

The Fleming Hydro-Ram is an efficient, lightweight, dependable and inexpensive hydraulic ram pump made possible by modern technology. It works on the same principles of physics that enable its cumbersome redecessors to water the farmlands of Europe, the Mideast and Asia over the past two hundred years. John Whitehurst is credited with inventing a non-selfacting ram pump in England in 1772. By 1796 a Frenchman, Joseph Michael Montgolfier, had added a valve, which made the device self-acting, making the ram pump almost a perpetual motion machine when water supplies were steady. In 1809, the first American patent was issued to J. Cerneau and S.S. Hallet in New York. But it wasn't until 1832 that information began spreading across the eastern states about the "simple pump that pushes water uphill using energy from falling water." Prior to the 1840's most ram pumps in were imported from Europe, but in 1843, H.H. Strawbridge of Louisiana claimed to be the first to put an American made model into use. His first ram, built entirely of wood exploded, prompting a later model boasting "crossboltsand rivets of iron." A cast iron ram soon followed.

Water-hungry rural Americans were intrigued by the pumps. Benson's Patent Water Ram could pump water from the powering stream or spring up a hill or it could use that po Articles in magazines such as the Farmer's Cabinet and American Farmer brought further recognition and understanding of the ram and its possibilities. A detailed book on the ram, published in 1842, was in its 16th edition by 1870.

In 1879, The People's Cyclopedia included the hydraulic ram among the 55 most important inventions in the history of mankind. It defined the hydraulic ram as: "A simple and conveniently applied mechanism by which the weight of falling water can be made available for raising a portion of itself to a considerable height." Benson's ram was said to "raise twice the water than any force pump will, with the same water power." IT was described as "very simple and easy to keep in order." Patents on the ram abounded in the 1840's and 1850's, but after 1858 none were secured until 1870 when another burst of interest saw four patents awarded in 3 years.

Though many used rams for individual homes and farms, an 1852 advertisement for Birkinbine's Patent Improved Hydraulic Ram proclaimed that the ram had pumped 20,000 gallons a day to the town of Naples, NY. The ad invited individuals to order a "proper ram and pipe sent them with directions for putting up." Birkinbine's rams were "warranted in every respect." One of the best known large rams was the Rife Hydraulic Engine, which could pump 50,000 gallons a day and 200 feet vertically.

III. METHODOLOGY

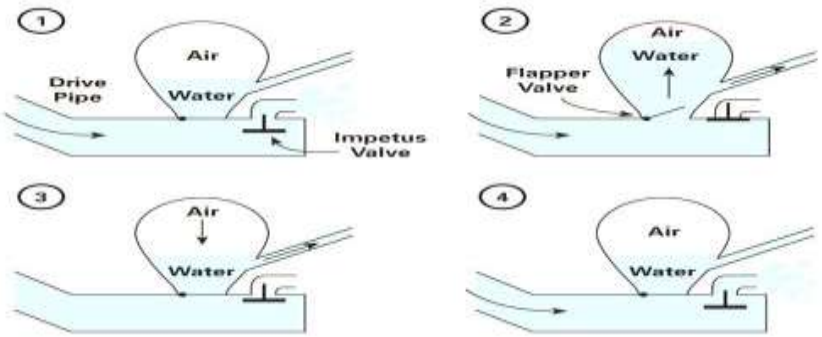

Figure Step by step process of Hydram

All ram pumps work on the principle of momentum, which is controlled by a cycle set up by the interaction of two valves—an impetus valve and a flapper valve— in the pump. When the impetus (aka “waste”) valve is opened (this must initially be done by hand to start the pump cycling), water begins to flow down the drive pipe and through the impetus valve as in Figure 1.

The drive water velocity increases until water friction slams the impetus valve shut, as in Figure 2. The momentum of the water forces open the flapper valve and pushes water past it to pressurize the air chamber above the water level.

In Figure 3, the water pressure above the flapper valve overcomes the spent momentum below it, forcing the flapper closed again. The water that made it past the flapper in Figure 2 is then forced by the extra air pressure out the delivery pipe and up to the delivery point.

Since the momentum of the water coming down the drive pipe was spent, the pressure in the impetus area momentarily decreases to zero, the impetus valve falls open, allowing water to flow down the drive pipe again as in Figure 4 (just like Figure 1), starting the cycle over again.

This process occurs over and over until something happens to stop the cycle. Ram pumps can cycle anywhere from 25 to 300 times per minute. The frequency of the cycle is adjustable by changing the length of the stroke of the impetus valve. A longer stroke produces a lower frequency. Weight added to or subtracted from an impetus valve, and even springs, have been used to adjust the frequency. Lower frequency means more of the supply flows to and through the pump and more is pumped up the delivery pipe.

The stroke is adjusted to restrict the amount of water used to the amount available from the source, or if the supply is unlimited, to regulate the amount delivered to match the amount needed.

IV. CONCLUSION

With the design parameters for the hydraulic ram pump like drive pipe diameter from drive pipe length, flow discharge in drive pipe, total head losses in the system, pressure at waste valve and power developed by the hydram. We will mathematically calculate the efficiency of the hydraulic ram pump and the suitable design of the hydraulic ram pump is produced. The result will be compare with experimental model.

REFERENCE

[1.] Teferi Taye, "Hydraulic Ram Pump",Journal of the Ethiopian Society Mechanical Engineers, Vol. II, No. l, July 1998.

[2.] Jeffery, T. D., "Hydraulic Ram Pumps – A Guide to Ram Pumps Water Suppl System",Intermediate Technology Publications, 1992.

[3.] Fluid mechanics and hydraulic machines by R.K.Bansal, laxmi publication pvt ltd.

[4.] DTU Ram pump program publication published by university of Warwick Mihelcic, J. R., Fry, L. M., Myre, E. A.,Phillips, L. D., & Barkdoll, B. D. (2009).Field guide to environmental engineering for development workers: Water, sanitation, and indoor air. Reston, VA: American Society of Civil Engineers.

[5.] A. Tessema, "HYDRAULIC RAM PUMP SYSTEM DESIGN AND APPLICATION ,"ESME 5th Annual Conference on Manufacturing and Process Industry, Vol. ,no. , pp. , September 2000. ESME.

[6.] Krol J (1947), “A Critical Survey of the Existing Information Relating to the Automatic Hydraulic Ram, Part I”, Ph.D. Thesis, University of London.

[7.] Lai C (1962), “A Study of Water Hammer Including Effect of Hydraulic Losses”, Ph.D. Thesis, University of Michigan.