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DETERMINATION OF POWER INHYDROELECTRIC PLANT DRIVEN BY HYDRAM: A PERPETUAL MOTION MACHINE TYPE 1

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Abstract:

The power generated in any system by natural phenomenon has lots of limitations because of the inconsistency in the supply of the energy by the source. Therefore it is mandatory to design a system which produces continuous and repeated power for the effective use. The present paper deals in designing a closed loop in which the fixed amount of water is driven to the higher elevation by hydram and it is made to hit the turbine blades to generate power. The water is collected and reused to continue the cycle which runs till infinity. The entire cycle which the system represents perpetual motion machine of type 1.

Index Terms: Perpetual Motion Machine, Hydram, Power, Hydroelectric Plant

1. Introduction:

There are different ways in which the energy can be generated in a natural way. It can be by solar, wind, hydraulic, pneumatic principle etc. Hydraulic principle is effectively used throughout the years to generate power efficiently. The challenge has been to design a system which does not waste the water, which should be used again. With the continuous growth of population the human use of natural water resources has increased steadily. There is a growing concern over the availability of adequate water supply to meet the future needs of society [5]. Therefore the use of this resource effectively especially in the regions where the limitations are plenty is a great challenge. Hydraulic ram pump is a renewable energy technology which draws the water to the higher level and is supplied to desired destinations. It uses the kinetic energy of falling water or gravity to elevate the water [1, 2].

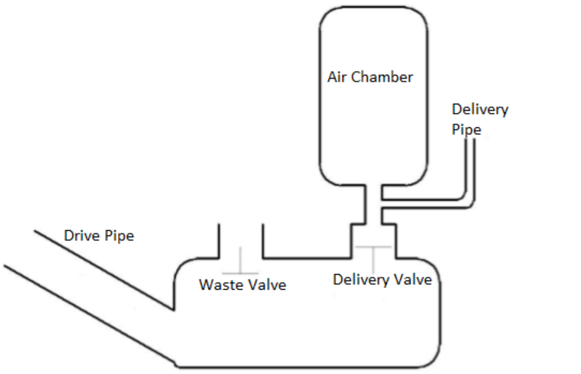

Figure 1: Representation of hydraulic ram pump

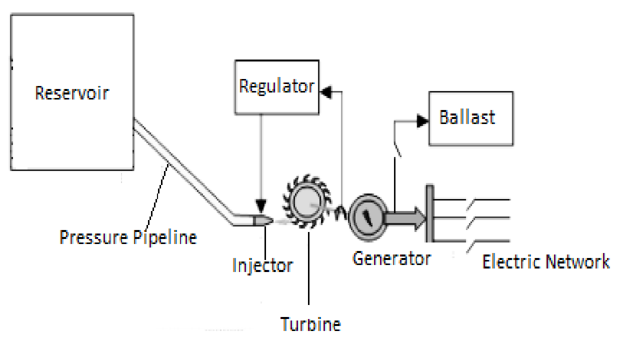

Figure 2: Representation of hydraulic electric plant

Figure 1 represents the hydraulic ram pump where the water is lifted to the higher level. The water moves from the drive pipe is pressurized greatly and exited at delivery pipe [1, 2]. Figure 2 shows the representation of hydroelectric plant where the power is generated [5].

Perpetual motion machine of type one states that a machine continues to function perpetually without supplying any energy [7]. Also it is defined as "A perpetual motion machine (PMM) is a device based on mechanical, chemical, electrical or other physical processes which, when started, will remain in operation forever and provide additional work as well. Only the natural wear of the components will eventually stop its operation [8]. Figure 3 shows the plumbing mechanic system which consists of two liquids of different density (water and mercury). The globules moves perpetually in both tubes floats in the liquids. Globules moves upwards because of the buoyant force in the left tube and falls on the wheel which rotates because of the momentum. These drops gets collected in the right tube, this increases the total weight at the right side of the tube to rise the surface of the liquid in the left and so on [8].

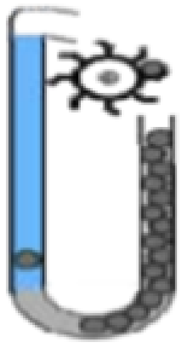

Figure 3: Perpetual motion machine consisting of a plumbing mechanic system [8]

The present paper deals with combining of hydram principle & perpetual motion machine to generate the power in hydroelectric plant. A theoretical power is calculated with the consideration of the entire assembled set up.

2. Related Study:

Arnold F. DumaoalSr et.al [1] worked on the design and construction of downdraft type of ram pump to use it in rural areas. It plays a key role to supply the water to the higher elevation without the use of electricity. Paper reaches an important conclusion that Downdraft type hydraulic ram pump which is installed occupies less space that the traditional types of ram pump. F. Zolleret.al [2] worked on the alcock hydraulic ram pump which is designed smartly such that it can be used in rural areas where there is water flowing, has a good reliability, low cost of maintenance, etc. There are three phases of the ram pump: acceleration, delivery and recoil. Paper reaches a conclusion where just by adjusting the waste valve, amount of intake water could be adjusted to the limited amount of water during dry season. This is very useful in the vegetable gardens, etc. Seemin Sheikh et al [3] explained that the water coming downhill due to gravity falls on the ram pump and this is how the ram lifts and pumps water without the use of electricity. Authors have also explained the various parameters used for the ram. The paper has been concluded by mathematically calculating the efficiency and suitable design of the ram pump, later compared to an experimental model. Shuaibu N Mohammed et.al [4] worked on the design of the hydraulic ram pump. She has explained in detail about the different working and movable parts in the ram. On further analysis, it is also seen that the author has explained about the various types of pipes used in the early times and explained their uses. The conclusion for ram pump is that they are very useful in rural areas for the farmers as they are cheap, long life machines, no maintenance required and very low on cost. O.A.Nneeet.al [5] worked on the automatic hydraulic system for grey water reuse. The author has explained the importance of water conservation in today's world in many different ways using devices like modified ram pumps. The system works on the principle of modified ram pump. The article has been ended by noting down the various advantages and conclusions of the water system, which are: it is low cost, saves water, a little maintenance required, can be used anywhere to conserve water. Mohammad Imran Ahmed et.al [6] worked on a KHPP stage 4 which generates lower electric output than installed capacity but with high maintenance. Study involves dynamic response and plant performance under various conditions head height, operating gates, etc. Author has explained the construction of the model along with examples and calculations. It has been concluded that speed of turbine depends upon head height and water flow. The results were almost same as in the real power plant. This also gave the authors an encouragement to work on future models using different tools. M Arsic et.al [7] worked on hydropower system with river section, storage and hydro power plant. Here, it is explained mathematically so that it is easier for the future design estimations and preciseness of the work. Factors like: storage and discharge play a vital role in the experimentation. Author has also explained the chances of leakage which will affect the stored water in the dam. This was taken on a real basis taking River Drina Basin into consideration. The conclusion is that through proper water storage we can save and produce electricity, conserve water, and this helps in design. D. Tsaousis [8] discussed every version of perpetual motion machine which gives knowledge to develop the system. This paper inferred that perpetual motion machine clashes with the laws of nature therefore it is impossible to manufacture a system and function it effectively.

N.M. Dehelean et.al [9] used ancient ideas related to the system named “perpetual mobile”. This mechanism produces work represents a true perpetual motion machine. This paper tries to develop a true thermal engine that is able to use solar and other renewable energy. GeorgiKrastev [10] et.al dealt with the perpetual motion phenomenon of second kind. The modification which is made in the system violates the second law of thermodynamics.

3. Methodology:

Hydram of hydraulic ram is a mechanical device which uses the simple principle of transfer of energy that is from potential to the kinetic energy. Water which is at an higher elevation flows downhill due to gravitational force. Water which will be at one hydraulic head flows into a higher hydraulic head. It basically uses water hammering effect in order to develop the pressure. The water at higher potential is made to fall on the blades of the water turbine to rotate the shaft, where the power is generated. The entire process is a perpetual motion of type 1 [1, 2].

Formula used to calculate the fall and Elevation is shown in equation (1)

$$Vol \times (h / H) \times \eta = Q' \qquad (1)$$

The vital factors to be considered while calculating the power are mainly the flow and head. Flow is the volume of water which is stored and re-directed to turn the blades (shaft). The head is the height at which the water will fall. With the increase in the flow there will be rise in the water head which give rise to higher energy to convert into electricity. Therefore flow is directly proportional to the head and the power. The relation between power, head and flow is shown in the equation (2)

$$P = H \times Q \times g \qquad (2)$$

Hydro power turbine generators are very efficient when compared to wind turbine generators and solar panels. Efficiency of around 70% can be obtained which means remaining energy is lost in converting the mechanical energy to electrical energy.

The methodology involved in determination of power in a hydroelectric plant in combination with the hydraulic ram pump. It begins with the definition of the problem where the objective is decided. Literature survey includes the collection of related data that supports the current modification of the design. Building the theoretical model depends on the design calculation and the selection of the key parameters . Mode is validated with the already experimented results. Last phase is documentation where all the data is stored [3].

4. Construction and Working:

Hydraulic Ram: Figure 4 shows the various parts which are involved in the construction of an hydraulic ram. The water flows from a height through the inlet pipe, passes thought the gate valve and the union, where it reaches a T-joint, which has a swing check valve placed on it in the downward direction. The velocity at which the water flows down causes the check valve to close and the water is forced to move into the second swing check valve, which is placed in the forward direction. The water then moves into another T-joint which has a chamber made of 4” UPVC (Unplastisied poly vinyl chloride) filled up to ¾ with closed cell foam. The air chamber also has a 2”-4” reducer attached in between it and the T-Joint. The water passes through the reducer and fills up the air chamber and the foam helps in increasing the pressure of the water, the water is then made to do back down into the reducer which increases the pressure more. At this high pressure the water may go back , which is where the second swing check valve closes and forces the water to move into the forward direction . The water then passes through another reducer of size 2”-1”. This further increases the pressure due to the change in diameter and allows the water to be pumped to a higher level. The water can be pumped to a height of 9m for a fall of 3m at a 45-degree angle. As the angle of supply line is reduced the water can be forced to maximum distance. The water coming out of waste valve (Wasted water) moves into water recirculation system and moves through water re circulation pipe into inlet [1].

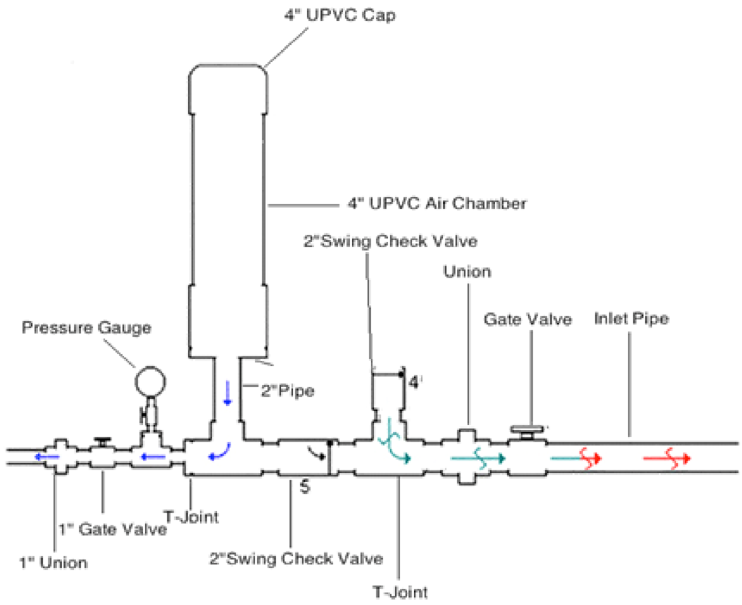

Figure 4: Working principle of hydraulic ram pump

Hydroelectric Plant: It generates electricity with the use of gravitational force of flowing water. Figure 5 shows the water which is stored in the reservoir 1 falls on the water turbine stock which is co-axial with the shaft. The shaft rotates to generate the electricity. The water moves inside the reservoir 2 to move inside the hydram [11].

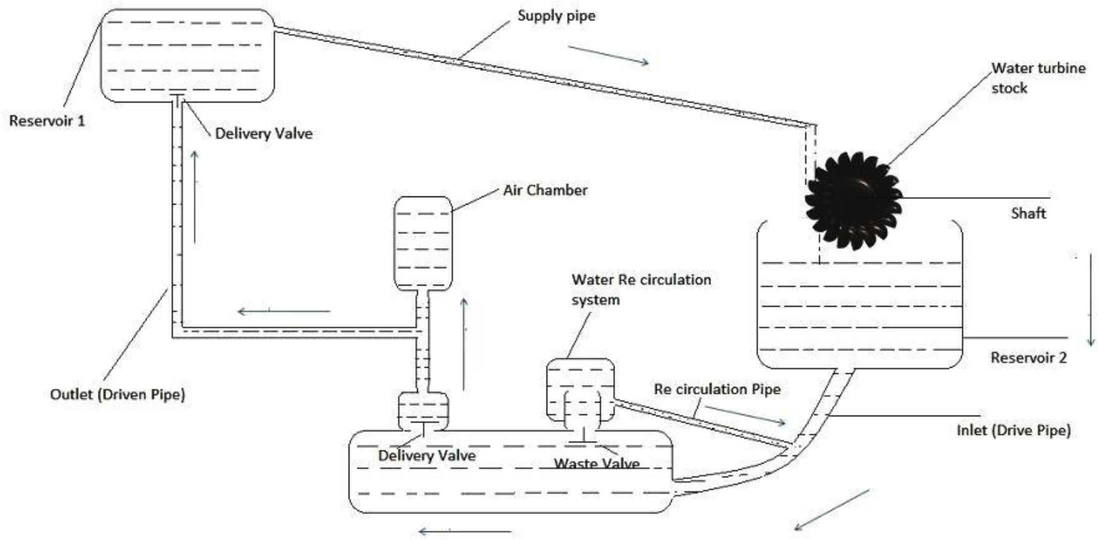

Figure 5: Construction of the model (Perpetual motion machine type 1)

5. Experimentation and Validation:

By using equation (1) the elevation to which the water gets pumped could be determined which is shown in table 1. The water required to fill the reservoir 1 is with the flow rate of 500 liters per day or 0.3472 liters per min by considering the efficiency of the ram pump is 60% . The amount of water supplied is 3 liters which is much higher than it gets delivered ,that is in ram pump around 10 to 12% of the water is elevated and the remaining water goes out of waste valve which will be guided into the inlet by the re circulation system provided. The fall height is considered to be 1.5 m. With the help of equation (1) the total elevation to which the water can be pumped is 9.375 m.

Table 1: Determination of the elevated height of water

Sl.No	Inlet Fall Height (m)	Input flow rate (Liters/min)	Efficiency of pump %	Output Flow rate (liters/min)	Total elevation to which water gets pumped (m)
1	1.5	3	60	0.3472	9.375

From the equation (2) the total power generated in the model is calculated. The water which is elevated is the total head in which it impinges on the water turbine blades to rotate the shaft which generates the electricity. Table 2 shows the total amount of power generated.

Table 2: Water generated in a hydroelectric plant

Sl. No	Water Head (m)	Flow rate (litres/min)	Power generated (W)
1	9.375	20	1839.375
2	10.5	22	2266.11

3	11.0	23.5	2535.885
4	11.5	25	2820.375
5	12.0	27	3178.44

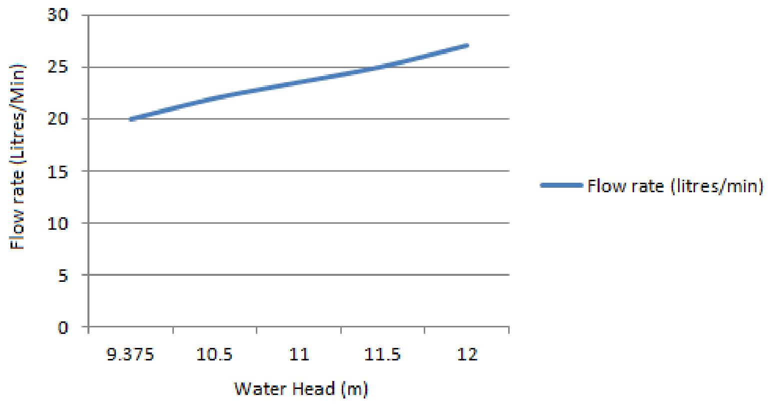

Figure 6: Variation of Flow rate of water with the water head

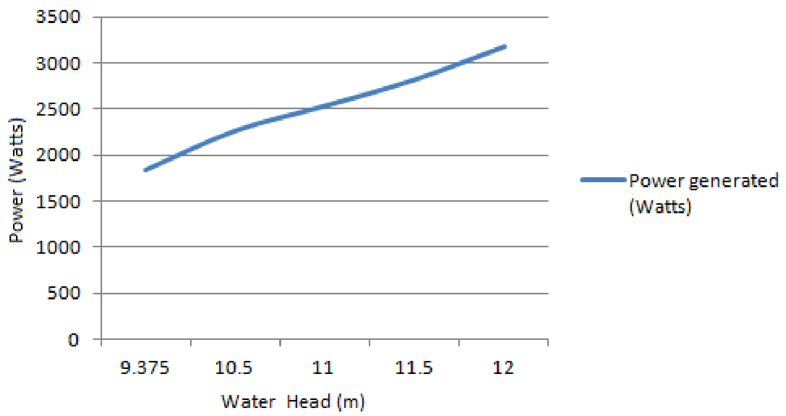

Figure 7: Variation of power generated in the system with the water head

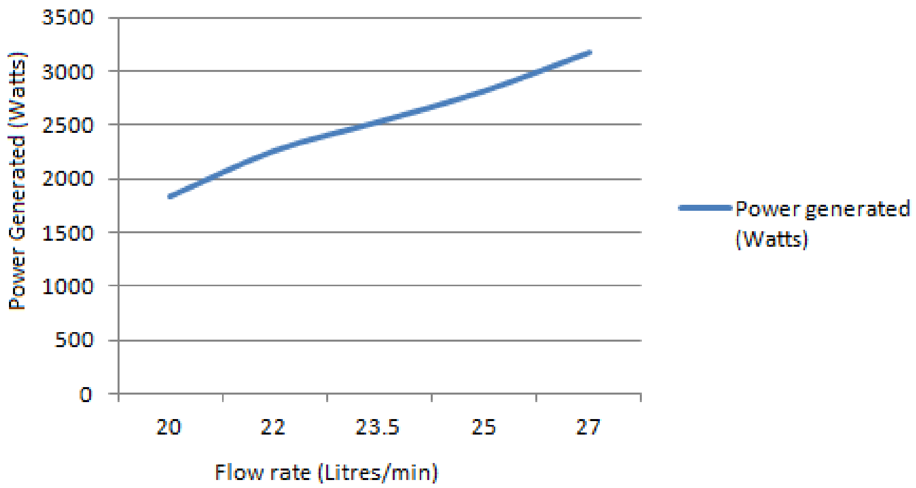

Figure 8: Variation of power generated in the system with the Flow rate

Figure 6 and 7 shows the variation of water flow rate and the power generated in the system with the water head. It shows that as there is a rise in the water head or the elevation of the water, there is a increase in the flow rate and power generated. Figure 8 shows that there is a rise in the power generated with the increase in the flow rate [11]. All the graphs which are plotted matches with the research paper by O. B. Nganga [11], hence the above work is validated.

6. Conclusions:

No system which is designed is completely efficient there are plenty of losses for eg: in hydraulics or mechanical machines there are friction losses. Along with the efficiency production of continuous energy is a greatest challenge. Water conservation and sustainable energy is one of the very important element, therefore the design of hydram plays an important role to lift the water without the aid of external means. And the water is directed to generate energy. Not a percent of water is wasted which is utilized completely within the cycle.

The installation cost of the entire setup is very less, compact & simple. It could be tested at the region where the horizontal water stream flow has greater pressure and velocity. Steady flow energy equation could be adopted in order to determine the velocities at various points since the discharge at various points in the set up doesn't remain constant. By providing water re circulation system maximum wastage of water is prevented which is vital in rural areas.

From the graph plotted it is proved that with the increase in the water head there is rise in the flow rate and the power generated. Similarly there is a increase in the power generated with the rise in the flow rate. The water is pressurized in hydram and pumped into the higher elevation of 9.375 m. The current system which is designed produces a power of 1839.375 W.

The analytical calculations can be made further simple by writing a computer programme which will help to determine the optimum solution. Modelling and analysis can be carried out using Ansys Fluent which determines.

Nomenclature:

Q= Water Discharged from reservoir 1, litre/min
h= supply head, m
H= delivery head, m
P=Power generated, W
Q'= Discharge at the outlet into reservoir 1, litres/min
g= Acceleration due to gravity, m/s^2
η= Efficiency of the hydram, %

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