Design And Fabrication of System to Lift Water By Hydraulic Energy

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Abstract- *In a world where the resources are either getting expensive or scarce it is important to utilize the available resources effectively. Present work aims at helping the regions where there is plenty of resources available but lack in the development or technology by installing a device that delivers water without any involvement of prime movers and electricity to run them.*

Keywords- Hydraulic, lifting water, pumping water, swing check valve mechanism, water discharge

I. INTRODUCTION

Water that is elevated has more gravitational potential energy than water at a lower level. As water flows from a higher level to a lower level, its potential energy changes to kinetic Energy. The kinetic energy of the moving water can be made to turn a bladed wheel to produce mechanical energy.

Our device is used to lift the water without any prime mover by utilizing the hydraulic energy of flowing water. In this system the impact of water is converted into shock waves which are called water hammer. This energy is utilized for lifting of water. The essential components of the system are check dam, supply pipe, air vessel, swing check valve, storage tank and discharge pipe. Except for changing of washers in the valves, there is no repair and maintenance required and the ram can operate 365 days in a year without any trouble.

For fixing a setup a check dam is constructed on flowing water of a river, streams to create low head. Due to velocity and pressure of the water, the valve flap closes suddenly which creates a water hammer in the system. This causes building up of high pressure, which opens the tank valve and water rushes to the tank. The tank is enclosed from all sides and the air present in it creates further pressure on the water, which enters the tank and closes the valve of tank thus discharging water from it. This discharged water is lifted to higher head than the supply head. During this action part of the water in the supply pipe also starts flowing in reverse direction and the water valve is opened due to its own weight and the water again starts running in supply pipe. This action continues unless the action of valve is stopped.

II. WATER LIFTING PROCESS DESCRIPTION

Considering all the ideas of water lifting in the most efficient manner the valve pumping concept was the one which caught our interest regarding the water lifting as it could work 24/7 and 365 days a year if and only there is a constant supply of water.

There would be no requirement of any man power for water supply. (Thriftyoutdoorsman.com, 2016)

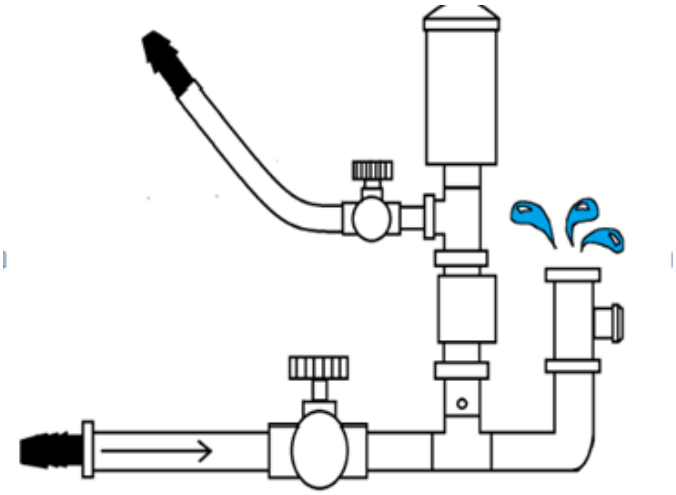


Figure 1: Swing Check Valve mechanism

Limitations:

- Might discharge less quantity of water as the supply head is increased
- This limitation would be turned for our advantage as we will try different assembly types to increase discharge efficiency

III. LITERATURE REVIEW

This article was written by Hunt in year 1984, it discuss about causes and effects of a solutions to water hammer problems. The following topics are addressed: basic phenomena of water hammer; the effects of a friction gradient; vapor column separation; events that typically cause undesirable transients such as, valve motion, and improper operation of surge protection devices; and surge control devices such as vacuum breaker-air release valves, relief valves, standpipes or surge tanks, and air bottles (also known as accumulators or closed surge tanks). Examples of water hammer problems and solutions to the problems are presented. (Hunt, 1984)

Structural analysis of water column motion in pressurized pipe

This article is written by James K in 1988, it discusses about considering the dynamic structure of water column motion in a pressurized pipe, for a compressible fluid, as well as the energy losses in the elastic walls of the pipe, we present for the calculation of the flow and pressure oscillation damping a formula based on the structural (hysteretic) friction forces In the case of elastic bodies the structural damping forces are proportional to the elastic forces, but a quarter of a period phase out. By putting into practice the presented formula a good agreement between computations and experimental measurements is attained. (James, 1988)

Water hammering effect in bends, columns and penstocks

This article was written by C V Campion in 2001, it discusses about the sudden pressure increases in the penstock or spiral case of a hydraulic turbine are the effect of sudden flow variation that occur during transient processes of type opening / closing or load rejection of the hydro unit. The consequence of the pressure rise in the spiral case and penstock is the water hammer phenomenon, whose effects can be devastating in some cases, up to breaking pipes and calamities produced in the area. (Campion, 2001)

Investigation of Water Hammer Effect through Pipeline System

This article is written by Aik K in 2012, it discussed about the condition where the water hammer effect is occurring in pipe line. Water hammer can cause the pipe to break if the pressure is high enough. The experiment will be set-up to investigate the water hammer effect in order to avoid the water hammer effect happen. (Aik, 2012)

Different pipelines used in pumping water

The pressure signal is presented at various locations in the pipe and compared with existing studies qualitatively. Pressure and velocity profiles are shown at various times during the pressure wave along the length of the domain, which indicates fluctuation of these variables as the wave passes through the changing geometry. Attenuation of the pressure amplitude was found to be slower in the current geometry compared with experimental results from the literature due to a more gradual change in cross-sectional area. (Dalton, 16 february 2017)

IV. OBJECTIVES OF PROJECT

1. To Carry out the survey based on the concepts of water hammering phenomenon, water flow through pipes, Knocking at valves, sudden bends
2. Arriving at the concept based on the above survey
3. Considering the different existing assembles and their limitations so that to obtain highest possible discharge through results obtained through various tests
4. To develop 3D model in solid edge software
5. To develop working model

V. METHODOLOGY

Design Concept and Analysis

VALVES

A valve is a device that regulates, directs or controls the flow of a fluid (gases, liquids, fluidized solids, or slurries) by opening, closing, or partially obstructing various passageways. Valves are technically fittings, but are usually discussed as a separate category. In an open valve, fluid flows in a direction from higher pressure to lower pressure. The word is derived from the Latin *valva*, the moving part of a door, in turn from *vulvae*, to turn, roll.

The simplest, and very ancient, valve is simply a freely hinged flap which drops to obstruct fluid (gas or liquid) flow in one direction, but is pushed open by flow in the opposite direction. This is called a check valve as it prevents or "checks" the flow in one direction. Modern control valves may regulate pressure or flow downstream and operate on sophisticated automation systems.

Valves have many uses, including controlling water for irrigation, industrial uses for controlling processes, residential uses such as on/off and pressure control to dish and clothes washers and taps in the home. (Dalton, 16 february 2017)

TYPES

Valves are quite diverse and may be classified into a number of basic types. Valves may also be classified by how they are actuated (Campion, 2001)

- Hydraulic
- Pneumatic
- Manual
- Solenoid
- Motor

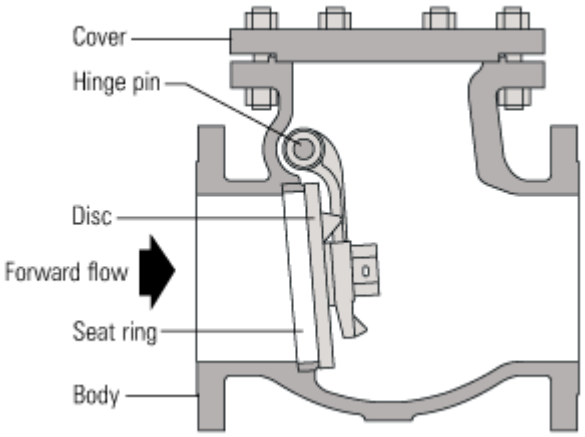
COMPONENTS

Cross sectional diagram of an open globe valve. (Aik, 2012)

1.Body
2. Ports
3. Seat
4. Stem
5. Disc (when valve is open)
6. Handle or hand wheel (when valve is open)
7. Bonnet

SWING CHECK VALVE

Swing check valve is a non return valve which operates by the swinging action of the disk. This valve is used for sizes 1" and above. There are two types of swing check valves available. They are the conventional swing check valves with flanged ends and the wafer type spring loaded check valves



VI. CONCLUSION

1. For every m^3 of water input we get $0.33m^3$ of output.
2. The project can be used anywhere where efficiency is not a priority.

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