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Pedal Operated Water Pumping System

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Abstract: -- A **Water system includes a reciprocating pump operated by pedaling power. The pump set and includes a housing in which a foot pedal and drive shaft rotate an eccentric pin rotating with the drive shaft moves a connecting rod which in turn causes push rod to move linearly. The pushrod extends into a pressure tight chamber formed above the rising main. A pump rod connected to the push-rod extends to the conventional plunger through verified motion. Here we use the foot pedal pump, powered by our legs instead of arms to lift the water from a depth range of seven meters. Throughout history human, energy has generally been applied through the use of the arms, hands, and back. With minor exceptions, it was only with the invention of the sliding-seat rowing shell, and particularly of the bicycle, that legs also began to be considered as a normal means of developing power from human muscles A person can generate four times more (1/4 horse power (hp)) by pedaling than by hand –cranking. At the rate of 1/4hp, continuous pedaling can be done for only short periods, about 10 minutes. However, pedaling at half this power (1/8 hp) can be sustained for around 60 minutes. The main use of pedal power today is still for bicycling at least in the high- power range (75 watts and above of mechanical power). In the lower-power range there are a number of use of pedal power for agriculture, construction, water pumping, and electrical generation that seem to be potentially advantages, at least when electrical or internal-combustion engine power is unavailable or very expensive.**

I. INTRODUCTION

Pumps come in a variety of sizes for a wide range of applications. They can be classified according to their basic operating principle as dynamic or displacement pumps. Dynamic pumps can be sub-classified as centrifugal and special effect pumps. Displacement pumps can be sub-classified as rotary or reciprocating pumps. In principle, any liquid can be handled by any of the pump designs. Where different pump designs could be used, the centrifugal pump is generally the most economical followed by rotary and reciprocating pumps. Although, positive displacement pumps are generally more efficient than centrifugal pumps, the benefit of higher efficiency tends to be offset by increased maintenance costs.

A centrifugal pump is of a very simple design. The two main parts of the pump are the impeller and the diffuser. Impeller, which is the only moving part, is attached to a shaft and driven by a motor. Impellers are generally made of bronze, polycarbonate, cast iron, stainless steel as well as other materials. The diffuser (also called as volute) houses the impeller and captures and directs the water off the impeller. Water enters the center (eye) of the impeller and exits the impeller with the help of centrifugal force. As water leaves the eye of the impeller a low-pressure area is created, causing more water to flow into the eye. Atmospheric pressure and centrifugal force cause this to happen. Velocity is developed as the water flows through the impeller spinning at high speed. The water velocity is collected by the diffuser and converted to pressure by specially designed passageways that direct the flow to the discharge of the pump, or to the next impeller should the pump have a multi-stage configuration. The pressure (head) that a pump will develop is in direct relationship to the impeller diameter, the number of impellers, the size of impeller eye, and shaft speed. Capacity is determined by the exit width of the impeller. The head and capacity are the main factors, which affect the horsepower size of the motor to be used. The more the quantity of water to be pumped, the more energy is required.

Reciprocating pumps are those which cause the fluid to move using one or more oscillating pistons, plungers or membranes (diaphragms). To 'Reciprocate' means 'To Move Backwards and Forwards'. A 'RECIPROCATING' pump therefore, is one with a forward and backward operating action. The simplest reciprocating pump is the 'Bicycle Pump', which everyone at some time or other will have used to re-inflate their bike tyres.

Reciprocating-type pumps require a system of suction and discharge valves to ensure that the fluid moves in a positive direction. Pumps in this category range from having "simplex" one cylinder; to in some cases "quad" four cylinders or more. Most reciprocating-type pumps are "duplex" (two) or "triplex" (three) cylinder.

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Furthermore, they can be either "single acting" independent suction and discharge strokes or "double acting" suction and discharge in both directions. The pumps can be powered by air, steam or through a belt drive from an engine or motor. This type of pump was used extensively in the early days of steam propulsion (19th century) as boiler feed water pumps. Reciprocating pumps are now typically used for pumping highly viscous fluids including concrete and heavy oils, and special applications demanding low flow rates against high resistance.

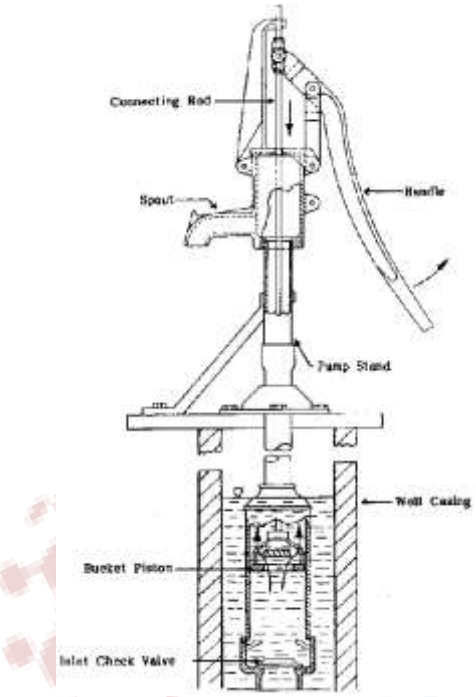

Fig. Reciprocating pump

II. DEFINITION OF PROBLEM

During summer season, due to water scarcity problem the people purchasing the water from lorry by collecting the water through their pots. These pots are carried by the men or women and getting tired when carrying water through staircase step those who are living in flat system. When this unit is installed in first floor of the building, the suction pipe is put in to the water delivery pipe of lorry and water is delivered through the flexible pipe to the required collecting point by pedaling this unit.

III. SCOPE OF THE PROJECT

- The outstanding advantage of water discharging system from the ground floor to first floor or discharging the water from the lorry to the collecting point by simply pedaling this unit.
- The water is carried by the flexible tube relieves the stress free painstaking water carrying through the pot while in staircase walking.
- Simple construction and less effort and costless maintenance and anybody can work this unit.
- Operation is very smooth and in this system we can get more output by applying less effort.

IV. WORKING PRINCIPLE

Pumps are a common means of lifting water from a clean ground water source to a useful point of access, but all pumps have moving parts and are therefore destined to break proper selection of a pump will reduce undesirable downtime and will empower the local community to manage their water source. Here we use the foot pedal pump, powered by our legs instead of arms to lift the water from a depth range of seven meters. Throughout history human, energy has generally been applied through the use of the arms, hands, and back. With minor exceptions, it was only with the invention of the sliding-seat rowing shell, and particularly of the bicycle, that legs also began to be considered as a normal means of developing power from human muscles. A person can generate four times more (1/4 horse power (hp)) by pedaling than by hand –cranking. At the rate of 1/4hp, continuous pedaling can be done for only short periods, about 10 minutes. However, pedaling at half this power (1/8 hp) can be sustained for around 60 minutes. The main use of pedal power today is still for bicycling at least in the high-power range (75 watts and above of mechanical power). In the lower-power range there are a number of use of pedal power for agriculture, construction, water pumping, and electrical generation that seem to be potentially advantages, at least when electrical or internal-combustion engine power is unavailable or very expensive.

V. CONSTRUCTION

5.1 HAND PUMP: -

Hand pumps are manually operated pumps; they use human power and mechanical advantage to move fluids or air from one place to another. They are widely used in every country in the world for a variety of industrial, marine, irrigation and leisure activities.

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Fig. Hand Pump

5.2 PEDAL ARRANGEMENT

This type link is used to connect the piston rod and foot step mechanism. This link is very sturdy due it will withstand cyclic load. Pedaling a modern stationary bicycle to produce electricity might be a great work-out, but in many cases, it is not sustainable. While humans are rather inefficient engines converting food into work, this is not the problem we want to address here; people have to move in order to stay healthy, so we might as well use that energy to operate machinery.
Pedal Arrangement The trouble is that the present approach to pedal power results in highly inefficient machines

Fig. Pedal Arrangement

5.3 ROD

It is connect the piston and foot pedal. It is also used push the piston according to the foot pedal action. Rod is used to connect the piston and foot pedal pump link. The maximum pressure is achieved pumping lifting height. It will convert angularity motion to linear motion

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Fig. Rod

5.4 VALVE

Forged ball valve is used to start or stop the flow of water from outlet port as desired.The main requirements of valves are a good seal when closed combined with lack of resistance to flow when they are open, and rapid opening and closing while achieving good durability. Usually rubber or alternatively precision ground metal mating surfaces are necessary to ensure there are no leakage gaps when the valve is closed. Effective sealing is particularly important with foot valves.

Fig. Valve

5.5 PIPE FITTINGS

Different pipe fittings are used ;-
1. 90° bend
2. Round Elbow

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3. Straight normal pipe
4. Standard Tees

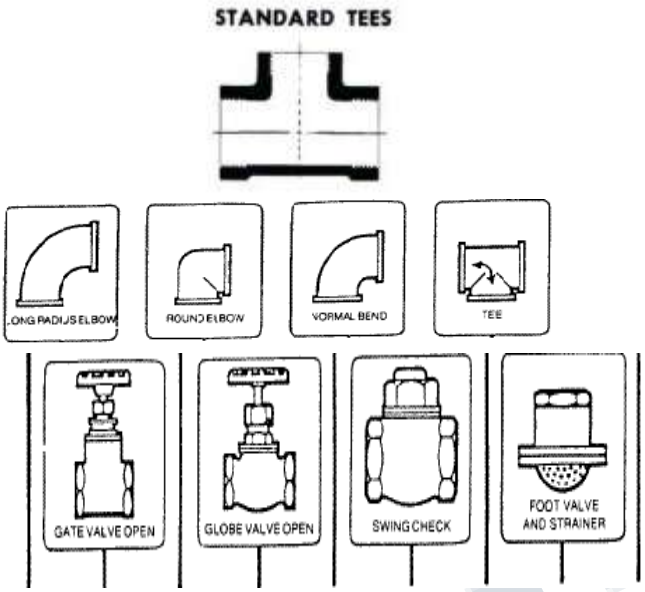

Fig.Pipe Fittings

5.6 Pressure Measuring gauges

It is often convenient to express pressure in terms of the height of a column of water, in meters or feet, instead of terms of psi or kPa. This is called pressure head. Two Pressure measuring gauges are used i.e, for Suction and Exhaust Delivery Pressure gauge.

Fig. Gauges

7.7 Supporting frame **:-** It acts as base stand for the hand pump and supports all moving and non-moving parts attatched the pump.

Fig. Frame

VI. ADVANTAGES

1. Single person is enough to operate this efficiently to pump the water from the sump..

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2. Easy and efficient handling of this unit without wastage of water or damage to unit, pump and to any other parts.
3. Low maintenance cost and life of equipment also increased..
4. Least maintenance of the equipment.
5. Need not require any individual work place.
6. Can be worked in the work spot.
7. Suited for pumping water for 15 feet to 20 feet depth.

Fig. PEDAL PUMP

VII. CONCLUSION

This modeling was centered towards the development of a hand pump by operating it with help of Pedals that would conveniently alleviate the portable water supply problems of rural communities throughout the underdeveloped and developing countries of the world at minimum energy input.

The requirement of Village Level Operation and Management (VLOM) of maintenance was considered in the course of this modeling. The model can be fabricated in the workshops as the design is made simple, while the standard parts like bearings, bolts and nuts, etc., are readily available locally.

It has been argued that current models of plunger pumps are inadequate in respect of the complex interactions which take place between the pump and attached pipelines. These arise because of the distributed parameter nature of the pipelines and because of cavitation. A finite difference method for modelling pipelines, based on a Galerkin method incorporating frequency-dependent friction, has been proposed. This approach circumvents the computationally intensive demands associated with the use of the method of characteristics.

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