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Research Paper

Fabrication of Pedal Operated Water Pump

Engineering

KEYWORDS : pedal, centrifugal, pump, pulley, shaft, impeller.

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ABSTRACT

In this paper, design and construct pedal operated water pump which used in small irrigation and garden irrigation. The pedal operated pump can be construct using local material and skill. A water system includes a Centrifugal pump operated by pedal power. The pump stand includes a housing in which a foot pedal and a drive shaft rotate. It works on the principle of compression and sudden release of a tube by creating negative pressure in the tube and this vacuum created draws water from the sump. This bicycle pedal operated pumps water at 2-3 gallons per minute from wells and boreholes up to 23 in feet depth. Provides irrigation and drinking water where electricity is not available.

introduction

FABRICATION OF PEDAL OPERATED WATER PUMP



In this paper, design and construct pedal operated water pump which used in small irrigation and garden irrigation. The pedal operated pump can be construct using local material and skill. A water system includes a Centrifugal pump operated by pedal power. The pump stand includes a housing in which a foot pedal and a drive shaft rotate. It works on the principle of compression and sudden release of a tube by creating negative pressure in the tube and this vacuum created draws water from the sump. This bicycle pedal operated pumps water at 2-3 gallons per minute from wells and boreholes up to 23 in feet depth. Provides irrigation and drinking water where electricity is not available. They can be built using locally available materials and can be easily adapted to suit the needs of local people. They free the user from rising energy costs, can be used anywhere, produce no pollution and provide healthy exercise.

Construction :

ROTARY VANE VACUUM PUMPS AND COMPRESSORS HAVE CERTAIN SIGNIFICANT ADVANTAGES. IN ADDITION TO PROVIDING SMOOTH, PULSE-FREE AIR FLOW WITHOUT RECEIVER TANKS, THEY ARE COMPACT (OR EQUIVALENTLY OFFER HIGH FLOW CAPACITIES FOR A GIVEN SIZE), ARE SIMPLE AND ECONOMICAL TO INSTALL AND OPERATE, HAVE LOW STARTING AND RUNNING TORQUE REQUIREMENTS, PRODUCE MINIMAL NOISE OR VIBRATIONS, ARE CAPABLE OF LONG, SERVICE-FREE LIFE, AND ARE EASILY SERVICED.

BODY (CATIA V5) :



Working of Project:-

Pumping action is produced by a series of sliding, flat vanes as they rotate in a cylindrical housing.

As the diagram shows, an eccentrically mounted rotor turns and the individual vanes slide in and out of their slots by centrifugal and pressure-loading forces. This creates a series of air compartments of unequal volume against the wall of the housing. These compartments get larger during the suction part of the cycle, creating vacuum at the intake port and smaller during the discharge portion of the cycle, creating pressure at the exhaust port.

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The vacuum and pressure flows are free of pulsation because the inlet and exhaust ports do not have valves, and the air is moved continuously rather than intermittently.



RESULTS AND CALCULATION:
Rotary pumps calculation formulas:
Flow:
Q = n.Vvolume .ηvol

Where,

Q = Flow in Meter Cubic per Second (m3 /s) n = revolution per second (rev/s)

Vstroke = Swept Volume in cubic Meters (m3) ηvol = Volumetric Efficiency (%)

Power:
P = n * Vstroke * Δp / ηmech, hydro

P = Power in Watt (Nm/s)

n = revs per second.

Vstroke = swept volume in (m3)

Δp = pressure difference over pump in (N/m2)

ηmech, hydr = mechanical/hydraulic efficiency (%)

Power and Efficiency:-
Brake Horsepower (BHP) is the actual horsepower

Delivered to the pump shaft, defined as follows:

$$BHP = \frac{Q \times Hr \times Sp.\ Gr}{3960 \times Eff.}$$

Q = Capacity in gallons per minute.

Hr = Total Differential Head in absolute feet

Sp. Gr. = Specific Gravity of the liquid. Eff. = Pump efficiency as a percentage

Water Horsepower (WHP) is the hydraulic horsepower delivered by the pump, defined as Follows:

WHP = Q x Hr x Sp/Gr.

3960

Q = Capacity in gallons per minute

Hr = Total Differential Head in absolute feet

Sp. Gr. = Specific Gravity of the liquid

The constant (3960) is the number of foot-pounds in one horsepower (33,000) divided by the weight of one gallon of water (8.33 pounds).

Brake horsepower is always greater than hydraulic horsepower due to the friction in the pump. Pump

Efficiency is the ratio of these two values.

Pump Efficiency = WHP/ BHP.

CALCULATION:-
Minimum rpm required for impeller shaft = **1000 to 1200 rpm**

Rpm available in rear wheel = **200 to 300 rpm**

RESULTS:-
Pump was able to pump at maximum of 23 feet. At desired height of 18 feet pump pumped at rate of 2.5 Gallons/min.

1 Gallon = 3.7 Litres.

2.5 Gallon = 9.3 Litres.

CONCLUSIONS:-
The whole study over the topic that the wheel deal bicycle powered water pump is a very advantageous especially for rural areas. The problem of energy crises is very big in India and many rural powered water pumpby use of this project we save electricity and get a particular water head and we supply the water in irrigation. We will operate a water pump by using bicycle mechanism in the project and we can fill the water tank of housing power and get construction work. when we drive a bicycle the wheel of bicycle are rotate so we can provide a pulley over the wheel the pulley is mounted on the shaft impeller of impeller of the pump the impeller is rotate due to rotating of wheel with rotation of pulley. So we operate the pump and deliver the water at a particular head this project is installed any of the place where water.

Create a simple and efficient way of pumping water utilizing a human powered bicycle for communities where electricity is unavailable or impractical. Isolated community with or without electricity in need of efficient water pumping. Pumps can be adapted to fit individual community needs.

It can also be placed in garden, both gardening & cycling can do simultaneously. Operate pump near best efficiency point. Replace old pumps by energy efficient pumps. Reduce system resistance by pressure drop assessment and pipe size optimization. Provide booster pump for few areas of higher head.

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