Water Pump Using Scotch-Yoke Mechanism

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Abstract:-- Scotch-yoke mechanism mainly used where the maximum discharge is needed. The main aim of our project is to increase the discharge of the pump.The Scotch-yoke mechanism lifts water from two sides so high output is obtained at less time.This kind of pumps is largely helpful in agricultural field.Motor capacity of 0.25hp is used to lift the water,when the motor starts rotating the pulley also starts rotating.Tje speed is maintained constant .The rotating motion of pulley is converted in to linear motion inside the cylinder this creates vaccum inside the cylinder, it helps to suck the water from the well.

Key Words: DC motor, pulley, cylinders, Scotch- yoke, pipes, metal frame.

1. INTRODUCTION

Every one of us will be in need of some kind of water source for drinking, bathing, washing clothes, preparing food and for irrigation. We may get the water from various sources like, lake, river, ponds, open well, bore well. So, we have to pump the water from the source and use the water for the various purposes. Pumps operate by some mechanism(typically reciprocating or rotary), and consume energy to perform mechanical work by moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power which usually come in many sizes that vary from microscopic for use in medical applications to large industrial pumps. Generally, these mechanical pumps have numerous applications such as pumping water from wells which is used for agriculture and also the pumps used in the energy industry for pumping oil and natural gas.This Scotch yoke mechanism could be used for conversion between rotational motion and linear reciprocating motion. In general, this linear motion can take place invariousformsdepending on the shape of the slot, but mostly the basic yoke with a constant rotation speed produces a linear motion that is simple harmonic in nature.
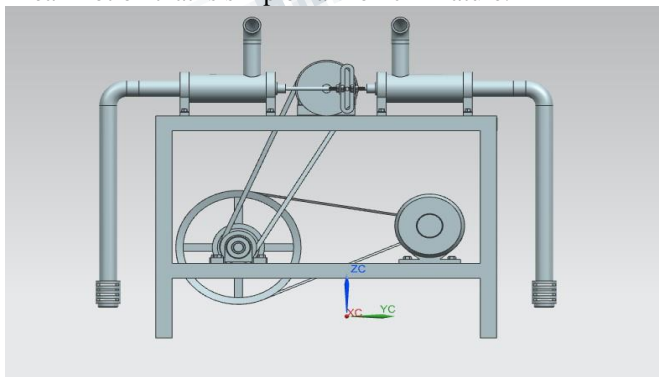
Fig 1: Model of proposed multi purpose solar operated agriculture machine

2. OBJECTIVES OF THE PROJECT

To study the concept and design features of scotch yoke mechanism.

To analyze various parameters of the pump, such as discharge, head, pumping action etc.

To compare the experimental results with theoretical values.

3. METHODOLOGY OF THE PROJECT

Selection of scotch yoke mechanism:
Considering various parameters like head, discharge and power input, Scotch Yoke mechanism is selected for a stroke length of 100mm.

Fabrication:
Model of the required system is made using NX software. Pump is selected for a stroke length of 100mm and piston diameter of 76mm. Dual side water pump system is fabricated as per draftinR51g specification.

Theoretical calculations:
Rate of discharge and head is calculated using theoretical data. Required formulas are used and suitable assumptions are made.

Experimentation:
Experiments are conducted on the fabricated system to check the performance of the system.

Comparison:
Experimental results are compared with the theoretical values and the results are concluded.

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4. SPECIFICATIONS

Motor Specifications Maximum Power : 0.25HP
Maximum Voltage : 200/220 V AC
Maximum Speed : 1200rpm
Current : 3.5amps

 Scotch yoke dimensions
Stroke length of the pump = 150 mm
Cam plate diameter =150 mm
Thickness of cam plate = 3mm
Inner diameter of roller = 6mm
Outer diameter of the roller = 10mm
Outside yoke length = 150mm
Inside yoke length = 10mm
Outside yoke width = 38mm I
nside yoke width = 30 mm
Bearing diameter = 28mm
Connecting rod length = 150 mm
Diameter of the pulley = 290mm
Width of belt = 12mm
Thickness of belt = 8mm
Suction and Delivery pipe diameters Outer diameter of the pipe = 42mm
Inner diameter of the pipe = 34 mm
We design the dual side water pumping system using scotch yoke (prototype) for the above dimensions.

5. WORKING MECHANISM.

1.Switch on the motor after connecting to mains.
2. The motor starts rotating which makes the larger pulley rotating .
3.The larger pulley is connected to smaller Pulley through the v-belts also rotates.
4.The rotating motion of pulley is converted into linear motion inside the cylinder.
5.This creates vaccum inside the cylinder.
6.The water is sucked inside the cylinder on both sides from the well through inlet pipes.
7.The water is discharged out.
8.The process of suction and discharging takes place simultaneously.

5. 1 ADVANTAGES:
1.   Scotch yoke is independent of self weight.
2.   Quite running and smooth operation.
3.   Cumulative reliability of scotch yoke is high.
4.   The water pumped with a high pressure.
5.   The discharge of scotch yoke is more.
6.   This is of compact in size.
7.   Less maintainance is enough.

6. SCOPE FOR FUTURE WORK

The future work will be the dual side water pumping system can run with the aid of solar power by means of using solar panel and battery system. By using the solar power the electricity expenses will be reduced and the system can work at the time of electrical source is not available.

CONCLUSION

Thus the detailed study of our paper is carried out. By the design calculations provided above, the dual side water pumping system using scotch yoke mechanism is designed and analyzed for a prototype. It is inferred that the improved discharge and efficiency is achieved by the dual side water pumping system using scotch yoke mechanism. This method of pumping water is very efficient compared to other pumping system. The implementation of the design will definitely give excellent performance to the society.

Final fabricated model

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