Fabrication Of Advance Impeller For Lifting Fluid At Certain Height By Limited Rpm Without Using Electricity

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Abstract- As per the technical evolution and latest technological trends taken into consideration so here effectively created an optimistic system i.e. "Fabrication of advance impeller for lifting fluid at certain height by limited rpm without using electricity."The manufacturing of this project is followed by using Human Power and available resources taken into consideration so that this will be helpful for common man in their daily life. This project works on the human power so that; there is no utilization of any electricity. This project can be useful in the agricultural area to provide water supply to plants where electricity is not available. This project can be use where there is requirement to lift water and oil towards overhead tank for any relevant application. Projects works on the bicycle pedal gear and related setup. Initially with the use of basic things available, that is Driver front Sprocket pedal gear, driven element (Sprocket gear) and chain. In this project, pumping of water done by impeller which is created vacuum according to fluid movement, so that fluid can be able access from anywhere and lift at the top of the building while vacuum creation is very much important task which is taken into consideration. Impeller fabrication is very much important for lifting of liquid towards overhead container. The designing and fabrication of impeller is created is according to type of liquid. There are many types of liquid i.e. water, oil, petrol, diesel, crude oil etc. this project here used hybrid impeller so as to lift any liquid towards overhead container. In this project here used advanced impeller with multiple blade arrangement for water lifting with thick dimensions shown above. This project uses two individual impeller. One impeller works on clockwise rotation and another impeller works on anticlockwise direction. Over single pedal rotation can able to move two different impeller. One impeller for clockwise movement and another impeller for anticlockwise movement. This impeller is like curves shape so as to lift maximum liquid towards overhead container. The spacing between the impeller and hollow cylinder will decide the lifting of liquid towards overhead distance. The minimum spacing between the impeller and cylinder can able to lift up to maximum distance.

Keywords: Impeller, human powered pump analysis.

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1. Introduction

Driving mechanism of the projects is bicycle pedal gear related setup. Initially with the use of basic things available with us that are Driver i.e. front Sprocket pedal gear, driven element i.e. Sprocket gear and chain. In this project, pumping of water done by centrifugal pump which is created according to water movement should at the top and inlet at the bottom level so that water can be able access from anywhere and able to lift at the top of the building while creation of this vacuum creation is very much important task which is taken into consideration. Sub class of dynamic axis symmetric work-absorbing turbo-machinery are centrifugal pumps are used to transport fluids by the conversion of rotational kinetic energy to the hydrodynamic energy of the fluid flow. The rotational energy typically comes from an engine or electric motor. The fluid is accelerated by impeller which enters along the rotating axis of the impeller, and flows radially outward into a diffuser or volute chamber (casing), from where it exits. The efficiency of centrifugal pump is determined by impeller. Vanes are designed to meet a given range of flow condition.

Project Objective

1. To study and understand Lifting Mechanism and related resources.
2. To understand Principal Centrifugal force creation with minimum RPM.
3. To understand Human power rotation using pedal mechanism and chain arrangement.
4. To fabricate advance impeller and vacuum creation so that fluid can lift with minimum RPM.
5. To fabricate Link between Pedal, chain and lifting machine arrangement with centrifugal force creation.
6. To generate calculation for Advanced Impeller

2. Problem Identification and Solution

Identification:

1. For lifting of highly inflammable liquid, requirement of High RPM impeller to generate centrifugal force or need to fabricate minimum RPM Impeller.
2. High RPM generates through high capacity electrical motor which is quite difficult to use because use of electricity chances of fire or blasting.

3. High capacity electrical motor requires electrical power and related power system manufacturing at relevant places which is a biggest issue and chances of trouble.
4. Gasses states of highly inflammable liquid also create a huge problem of fire if it comes under the influence of any small fire.

Solution:

1. Advanced Minimum RPM Impeller helps to generate centrifugal force within the device.
2. Human power advanced impeller can able to lift a lift highly inflammable liquid towards overhead container.
3. No requirement of electrical motors as complete assemble is human power based.
4. No chances of fire and blasting as there is no requirement of electricity

3. Experimentation

In this project the impeller rotation depends onthemovement of main ARM and linking with the subARM via chain coupling. In this project here used bicyclei.e. human power to lift the fluid. This project suitablyselected for common man who will use their own powerand for that there will be no requirement of electricity.This project can be useful in agricultural area where thereno availability of electricity. In this project here useCoupling Unit to carry Main ARM which is use to carryall following thing. primarily the aligned movement ofMain Sprocket gear depends on the Coupling Unit.

For Pedal RPM of 20 rpm/min

The study also identified an acceptable water velocity range from 3 to 10 m/s under the experimental conditions.

A) For Pedal RPM = 20 RPM

The force transfer from Pedalto main Sprocket = RPM of Pedal* 5
= 20RPM * 5 (Gear Reduction Value)
= 100 RPM of Main SprocketARM.

B) For Main Sprocket RPM = 100 RPM

The force transfer from main Sprocketto Sub Sprocket= RPM of Main Sprocket* 2
= 100 RPM * 2 (G. R. Value)
= 200 RPM of Sub Sprocket ARM

C) For Sub Sprocket RPM = 200 RPM

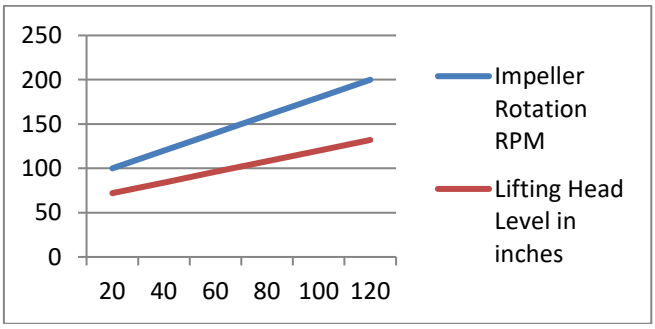
The force transfer from Sub Sprocketto Impeller = RPM of Sub Sprocket / 2
= 100 RPM * 2 (G. R. Value)
= 100 RPM of Impeller Shaft.

D) For RPM of Impeller = 5 * RPM of Pedal Shaft for time period of 20 sec
With head 72 inches

Pedal RPM vs. Impeller Rotation in RPM and Lifting Head

Sr. No.	Pedal RPM	Impeller Rotation	Lifting Head in Inches
1	20	100	72
2	40	120	84
3	60	140	96
4	80	160	108
5	100	180	120
6	120	200	132

Table 3.1: Lifting head in inches



Graph 3.2: Lifting head in inches

4. CAD model of gear box:

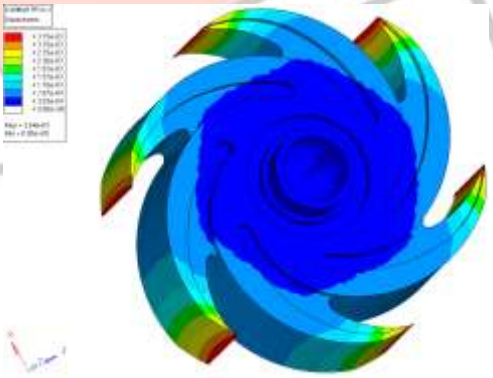
Fig. 4.1 Cad model of Impeller

Fig. 4.2 Front View of impeller cad model

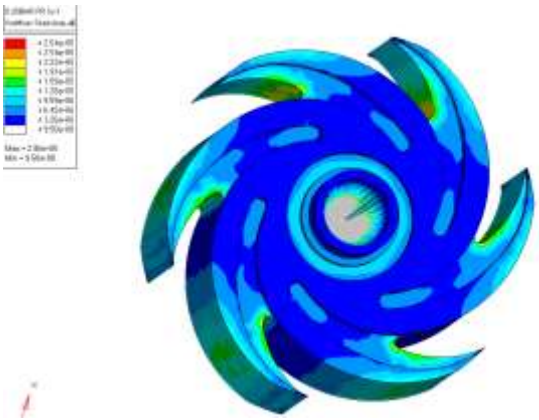
5. FE ANALYSIS OF GEARS

Linear Static Analysis

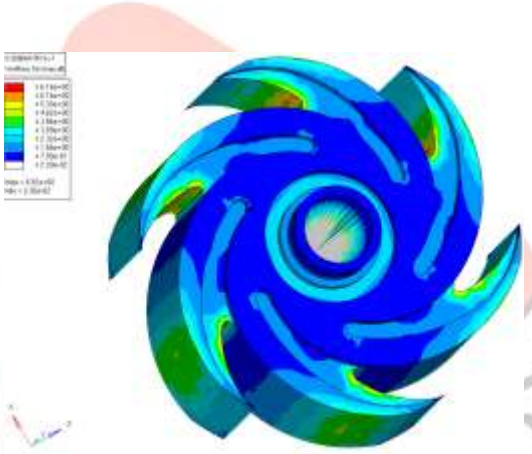
This impeller is to lift various fluids with different densities,here linear analysis is performed for highest density liquid (water = 1000 kg/m3) and results are shown below



Max. Displacement = 0.00354mm



Max. Vonmises strain = 0.000028



Max. Vonmises stress = 6.92 MPa

material properties of structural steel is used for the impeller as shown below,

SS 316 LN-IG

Mechanical & Thermal Properties of SS 316LN-IG

Properties	20° C	250° C	350° C	400° C	500° C
Density (kg/m³)	7966	7867	7824	7804	7760
Young modulus (GPa)	192	174	166	161	153
Poissons ratio	0.3	0.3	0.3	0.3	0.3
Tensile strength (Mpa)	529	461	453	449	430
Yield strength (Mpa)	220	131	121	114	109
Design stress intensity (Mpa)	147	121	109	105	97
Thermal conductivity (W/m-K)	13.94	17.24	18.67	19.39	20.82
Specific heat (J/kg-K)	470	518	528	550	571

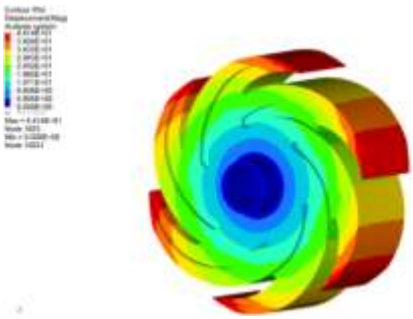
Stresses obtained from FE analysis (6.92 MPa) is less than the material yield stress (220 MPa), hence the design is safe for the 200 rpm speed of impeller with 0.329 bar pressure.

Modal Analysis

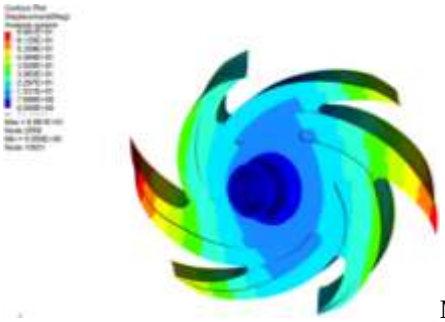
From the modal analysis first 6 mode shapes with natural frequencies obtained are shown below

Mode shape	Natural Frequency

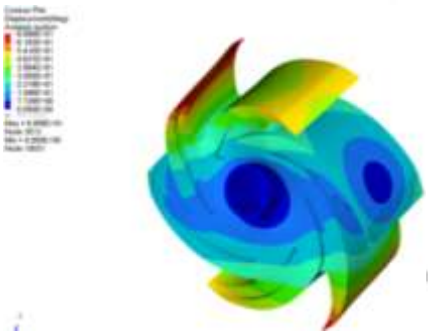
1	6609 Hz
2	10280 Hz
3	10290 Hz
4	11880 Hz
5	12460 Hz
6	12480 Hz



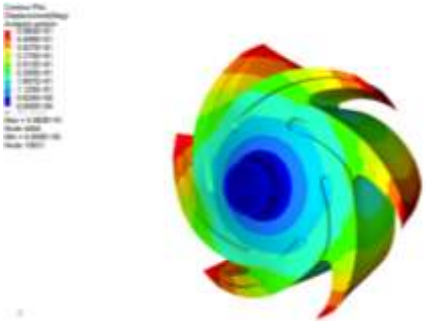
Mode 1



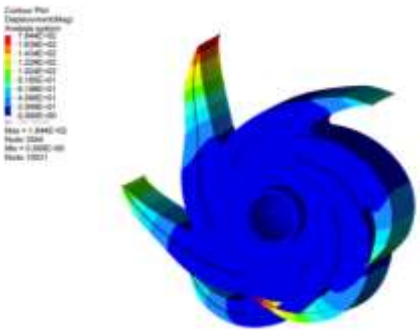
Mode2



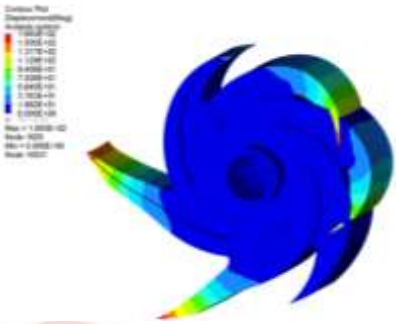
Mode3



Mode4



Mode5



Mode6

When the excitation frequency matches with any natural frequency, a large displacement occurs that is resonance.
Systemfrequency:
Maximum RPM of impeller is 200, which is equal to 3.33 Hz.from the Modal analysis it is observed that first natural frequency is 6609Hz. and it will never coincide with the system excitation frequency 3.33 Hz. hence the design is safe for the dynamic loading.

6. Conclusions

Design and analysis of Human powered assembly for lifting the water from lower domain towards upper domain using advanced minimum RPM impeller is performed in this study. The impeller having capability that the impeller can be able to lift water towards upper higher overhead tank as it is created according to vision i.e. huge suction with minimum RPM so it can be able to absorb water from ground also. This impeller basically hybrid type so it can able to lift water, oil, fuel, highly inflammable solution with any viscosity. This project uses sprocket chain drive mechanism so load transfer is easier with minimum loss is possible. As using human power system main sprocket is rotating and small sprocket is placed over shaft of impeller so power transfer is suitably maximum so with the help of this kind of mechanism i.e. sprocket chain roller system can able to lift water or any solution towards overheat with variable increasing rate dimension that is the advantage of this project that means as system want to lift water greater than previous once so we need to increase the rotation of impeller with few RPM.

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