Design Development and Analysis of Low Pressure Bladeless Turbine

Hekare Akash P.[1], Game Saiprasad D.[2], Game Pravin S.[3], Kasar Prasad A.[4], Prof. Dange Bharat S.[5]

[1,2,3,4]BE Student, [5]Department Of Mechanical Engineering, SND COE & RC, Yeola, Maharashtra, India
[5]Assistant Professor, Department Of Mechanical Engineering, SND COE & RC, Yeola, Maharashtra, India

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Abstract:- *There are many instances and applications in process industry where the processing of a fluid stream (air / gas) requires its pressure to be reduced. This pressure reduction is usually accomplished through use of a throttle valve. In this method the energy of fluid flow is lost, Currently emphasis is being placed on more 3 effective energy usage in processing industry. As a consequence, areas in which energy is wasted are being closely monitored and energy recovery methods are being investigated. this calls effective low pressure recovery systems for developing. Project work includes the design development analysis of a bladeless turbine, Decrease in the weight of the energy generating mechanism is the major factor driving the global bladeless wind turbines market. As high quality machinery is required to avoid structural damage the construction cost of traditional wind turbines is significantly high. As bladeless wind turbines oscillate when responding to whirlwind, the risk of heavy structural damage is comparatively low. Moreover, as bladeless wind turbines contain poor parts, they emit less noise and also pose no threat to birds, eliminating two of the major complaints that consumers have from traditional wind turbines. The incorporation of fewer moving parts also makes construction of bladeless wind turbines more reliable than the conventional ones. Traditional wind turbines are also more expensive than bladeless wind turbines and are easy to install. These factors together are likely to drive the increase of the global bladeless wind turbines market.*

Key Words: Fluid stream, Vortices, Bladeless, Process industry, Low pressure

1. INTRODUCTION

The **Tesla turbine** is a bladeless centripetal flow turbine patented in 1913 by Nikola Tesla. It is referred to as a bladeless turbine. The Tesla turbine is also known as the cohesion-type turbine, boundary layer turbine and Prandtl layer turbine (after Ludwig Prandtl) because it uses the boundary layer effect and not a fluid influence upon the blades as in a conventional turbine. Bioengineering researchers have mention to it as a multiple disk centrifugal pump. One of Tesla's desires for implementation of this turbine was for geothermal power, which was described in Our Future Motive Power.[1]

A Tesla turbine consists of a set of smooth disks, To the edge of the disk nozzles applying a moving fluid. The fluid drags on the disk by means of adhesion and the viscosity of the surface layer of the fluid. As the fluid slows down and adds energy to the disks, it spirals into the center exhaust. Since the rotor is very sturdy, it has no projections.

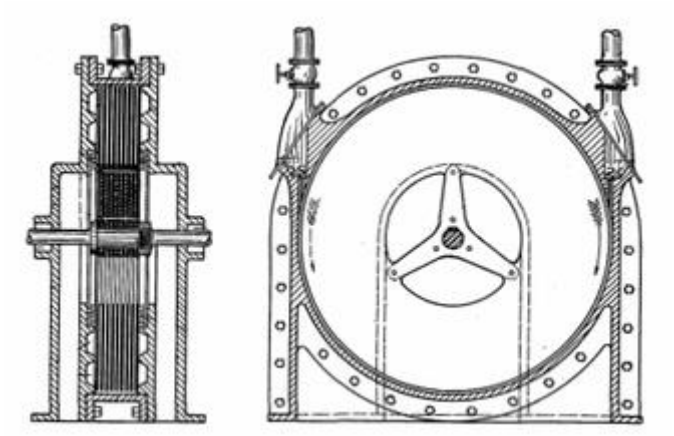

Fig.1 View of Tesla turbine "bladeless" design

2. DESIGN

Design consists of application of scientific principles, imagination and technical information for development of new or improvised machine or mechanism to perform a specific function with maximum economy & efficiency .

Hence a careful design request has to be adopted . The total design work , has been share up into two parts;

- System design
- Mechanical Design.

2.1 SYSTEM DESIGN

we mainly concentrated on the following parameters In system design: -

1. System Selection Based on Physical Constraints

While selecting any machine it must be checked whether it is going to be used in a industry small-scale or a large-scale industry. It is to be used by a small-scale industry in our case. So space is a major constrain. The system is to be very compact so that it can be adjusted of a room to corner.

The mechanical design has direct standard with the system design. Hence the standard job is to control the physical parameters, so that after mechanical design the distinctions obtained can be well fitted into that.

2. Arrangement of Various Components

Keeping into view the space restrictions the parts should be laid such that their easy removal or servicing is possible.

More over every component should be easily seen none should be covert. Every possible space is utilized in component arrangements.

3. **Components of System**

As already stated the system should be concise enough so that it can be accommodated at a corner of a room. All the moving parts should be compact & well closed. A high weighted structure is desired to a compact system design.

4. Man Machine Interaction

Is an important criteria of design the friendliness of a machine with the operator that is operating. It is the application of psychological & anatomical principles to solve problems arising from Man–Machine relationship. Some of the topics included in this section is as following

- Design of foot lever
- Energy expenditure in foot & hand operation
- Lighting condition of machine.

5. Chances of Failure

Is an important criteria of design the losses incurred by owner in case of any failure. Factor safety while doing mechanical design is kept aloft so that there are less chances of failure. In addition periodic maintenance is required to keep unit healthy.

6. Servicing Facility

The layout of parts should be such that easy servicing is possible. Especially those parts which require frequents servicing can be easily disassembled.

7. Scope of Future Improvement

Arrangement should be provided to spread the scope of work in future. Such as to transmute the machine motor operated; the system can be easily configured to required one. The punch & die can be changed if required for other shapes of notches etc.

8. Height of Machine from Ground

For comfort and ease of operator the height of machine should be properly decided so that he may not get tired during operation. The machine should be slightly biger than the waist level, also enough clearance should be provided from the ground for cleaning purpose.

9. Weight of Machine

The total weight depends upon the selection of material dimension of components as well as the components. A higher weighted machine is difficult in transportation & in case of major breakdown, it is difficult to take it to workshop because of high weight.

2.2 MECHANICAL DESIGN

From view of designer the mechanical design phase is very important. as whole achievement of the project depends on the correct deign analysis of the problem.

Many introductory alternatives are eliminated during this phase. Designer should have adequate knowledge above physical properties of material, deformation, failure loads stresses. Wear and theories analysis. He should identify the Internal and external forces acting on the machine parts

These forces may be classified as ;

1. Dead weight forces
2. Friction forces
3. Inertia forces
4. Centrifugal forces
5. Forces generated during power transmission etc.

By using design equations designer should estimate these forces very accurately. If he does not have adequate information to estimate them he should make certain practical assumptions based on similar conditions.

Which will almost complement the functional needs. Assumptions must always be on the safer side.

Selection of factors of safety to find working or design stress is another eventful step in design of working dimensions of machine elements. The correction in the theoretical stress values are to be made according in the kind of loads, service & shape of parts requirements.

Selection of material should be made according to the condition of loading shapes of products desirable properties & environment conditions of material.

To minimize nearly adopting proper lubrications methods provision should be made.

In ,mechanical design the components are listed stored & down on the basis of their procurement in two categories .

- Design parts
- Parts to be purchased

For design parts a detailed design is designation & done thus obtain are compared to the next highest dimension which is ready available in market.

This simplification the post production as well as assembly service work. The individualize tolerance on the work are specified. The process charts are passed & prepared on to the work are specified.

The parts to be purchased directly are selected from various specification & catalogues so that any body can purchased the same from the retail shop with the given specifications.

3. APPLICATIONS

- Today, By using Tesla turbines many amateur experiments in the field have been conducted which use compressed air, steam as its power source (the steam being generated with heat from a vehicle's turbocharger, from fuel combustion or from solar radiation). By using new materials such as carbon fiber the issue of warping the discs has been partially solved. For example, both International Turbine, PNGinc And Power, LLC use carbon fiber discs in their Tesla turbine designs.
- From plural transverse runner faces that of blades projecting axially.
- One proposed current application for the device is a waste pump, in mills and factories where normal vane-type turbine pumps typically get blocked.
- Applications of the Tesla turbine as a multiple-disk centrifugal blood pump have yielded favorable results.
- Biomedical engineering research on such applications has been resume into the 21st century.
- Howard fuller for a wind turbine based on the tesla design was issued in 2010, U.S. Patent 7,695,242.

4. CONCLUSIONS

The concept of group project was included in our engineering syllabus with the view to inculcate within us the application ability of the theoretical concept of production and design engineering to practical problems . So also to help us to learn to work more as a team certain than an individual.

In completing our project titled 'TESLA TURBINE ' as per our time estimate gives us immense pleasure and a feeling of achievement . During the course of project we encountered mnay problems which we overcame with the able guidance of our project guide.

A brief mention of our efforts present on this project report. Project work has given us good exposure to the practical region which in the future is definitely going to help us….

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