Design and Analysis of Low Head, Light weight Kaplan Turbine Blade

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ABSTRACT:- The project deals with the development of the design of low head light weight Kaplan turbine blade. To enhance it's hydrodynamic efficiency by reducing weight, shape alterations, blade angle with combination of materials Aluminium alloy, Structural steel, Titanium alloy Stainless steel. The 3D model of blade is developed using software Solid Works and Analysis of blade is done on Ansys14.

Keywords:- Development, design, low head, light weight, Kaplan Turbine.

I. INTRODUCTION

A turbine is a rotary mechanical device that extracts energy from a fluid flow and converts it into useful work. A turbine is a turbo machine with at least one moving part called a rotor assembly, which is a shaft or drum with blades attached. Moving fluid acts on the blades so that they move and impart rotational energy to the rotor. Gas, steam and turbines have a casing around the blades that contains and controls the working fluid.

The Kaplan turbine is an outward or inward flow reaction turbine. Here working fluid changes pressure as it moves through the turbine. Power is gained from both the hydrostatic head and from the kinetic energy of flowing water. The Kaplan turbine is an outward flow reaction turbine, which means that the working fluid changes pressure as it moves through the turbine and gives up its energy. Power is recovered from both the hydrostatic head and from the kinetic energy of the flowing water. The design combines features of radial and axial turbines.

1.1 Components of Kaplan turbine

Scroll casing: casing in which water passes to the runner in the turbine. The water from the penstocks enters the scroll casing and then moves to the guide vanes.
Guide vanes: these guide the water and control the water passage. The Guide Vanes are fixed on the Hub.
Draft tube: After passing through the runner, the water is discharged to the tail race through a gradually expanding tube called draft tube.
Runner: it is connected to the shaft of the generator and consist movable vanes and hub (boss).
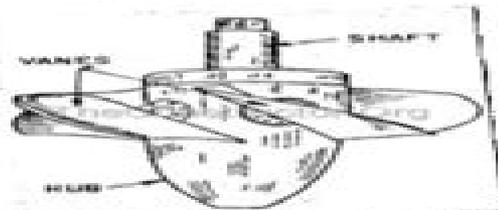**Hub (Boss):-** It is the part of runner on which blades are mounted.

Fig1.1 Kaplan Turbine Hub with Blades   **Fig. 1.2** Schematic diagram of Kaplan Turbine

1.2 Working of Kaplan Turbine

The Kaplan turbine is an inward flow reaction turbine, which means that the working fluid changes pressure as it moves through the turbine and gives up its energy. The design combines radial and axial features. The inlet is a scroll-shaped tube that wraps around the turbine's wicket gate. Water is directed tangentially, through the wicket gate, and spirals on to a propeller shaped runner, causing it to spin. The outlet is a specially shaped draft tube that helps decelerate the water and recover kinetic energy. The turbine does not need to be at the lowest point of water flow, as long as the draft tube remains full of water. A higher turbine location, however, increases the suction that is imparted on the turbine blades by the draft tube. The resulting pressure drop may lead to capitation. Variable

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