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A NOVEL DESIGN OF HYDRO ELECTRIC TURBINE USING FLOW LIMITATION OCCURRING IN MODIFIED LARGE COLLAPSIBLE TUBES

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ABSTRACT

Turbines that have evolved from ancient water wheels are one of the most efficient devices available for extraction of energy from flowing fluids. All turbines work on same physical principles and have similar basic components consisting of stators and rotors connected to vertical shaft, which rotates freely. They convert kinetic energy of flowing water to mechanical energy by changing the momentum of flow of water. They suffer drawback of being inefficient and expensive when used for low energy density flows. I had exploited the phenomenon of flow limitation occurring when fluids flow in collapsible tubes and also strong fluid structure interactions occurring when a flow stops suddenly, to design a novel type of hydraulic turbine. Water from small reservoir enters a large collapsible rubber bladder and as the flow is established due to Venturi effect the rubber bladder collapses suddenly on to the mouth ‘U’ shaped flexible tube held by elastic supports. This action occludes the flow suddenly converting steady continuous flow to unsteady pulsatile flow. The kinetic energy of flowing water is converted to negative pressure wave energy or water hammer, which interacts with walls of flexible tubes at, bends and transmits power to the system. This enables us to develop turbines, which operate at very low heads and low discharge conditions (heads as low as < 1.5 m and flows as low as < 0.3 litre/sec) and generate power efficiently in a very cost effective manner. This radically new principle can be applied to other fluid flows like gas turbines and produce novel efficient machines for harnessing power.

KEYWORDS: Collapsible Tubes, Fluid Structure Interactions, Hydraulic Ram, Turbines