Why Governing of Turbine is required?

When a turbine drives an electrical generator or alternator the primary requirement is that the rotational speed of the shaft in which both the turbine rotor and the generator or alternator are coupled should maintain a constant speed the rotational speed of the shaft will be fixed well. So, therefore, the speed of the rotor rotational speed of the rotor will also be fixed why it is.

This is because the frequency of the electrical output has to maintain same to maintain the constancy in the frequency of the electrical output the rotational speed of the shaft coupled with the electric generator or alternator has to fixed. So, what happens, when the electrical load changes according to the demand then the speed of the turbine also changes. This is because the shaft in which the turbine and generator or alternator fixed rotates at a constant speed. Because of a balance between the resistance torque giving by the electrical load and the driving torque depending upon the change of the angular momentum of the fluid flowing through the turbine clear.

Now, when the electrical load changes, the resistance torque changes; while the driving torque remains the same. So, therefore, the balance is distorted and the revolutionaries speed or rotational speed changes for an example if the load is increase then the resisting torque on the shaft increases while the driving torque remains the same which comes from the change in the angular momentum of the fluid. So, therefore, what happens this speed falls similarly if the reverse happens when the electrical load is reduced then the resisting torque is reduced while the driving torque remains the same to speed is increased.

So, therefore, to maintain a constancy in this speed needs to change the driving torque accordingly with the change in the resisting torque because of a change in load which means that if the load is increased. So, driving torque has to be increased or load is decreased driving torque has to be decreased now driving torque comes from the change in the angular momentum now you see the friction of the fluid velocity is fixed as far as the rotor is fixed because the design of the blades and everything is fixed. So, therefore, the change in angular momentum can be accomplished only by a change in the flow rate of the fluid.

So, therefore, it is the flow of the fluid coming to the turbine is changed to change the driving torque which means if the load is increased the flow of water to the turbine is increased. So, that the driving torque is increased accordingly to maintain the constancy in the speed of the shaft similarly load is decreased. So, the flow rate going to the turbine or flow water to the turbine is decreased. So, this change in the flow to the turbine with the load is done automatically and that is known as the governing of the turbine. This response in the flow to the turbine (Q) with the change in the load is known in general as governing of turbine.

$Q = V \times A$, here V is constant as it is a function of H. Therefore only way to change the Q is to change in A, i.e. fluid flow cross-section area. And, this is done as follows.

13.9.2 Governing of Pelton Turbine

Modern Pelton turbines are provided with double regulation that is the combined spear and deflector control.

The automatic arrangement for controlling the speed of Pelton turbine with the feedback servomechanism is shown in Fig. 13.22. The main components are: (i) the centrifugal governor or the actuator, (ii) oil pump with gear pump, (iii) relay or distributing valve, (iv) servomotor, and (v) deflector arrangement.

The centrifugal governor is attached to the main shaft of the turbine and has fly balls which respond to the variation in load. When the load on the turbine decreases, the speed of the turbine increases and the flyballs of the governor rotate at higher speed and move away from the axis. Thus the sleeve has an upward movement. The motion of the flyballs is transmitted to the bell crank lever and it rotates anticlockwise. The roller on the cam is raised and the deflector is brought between the nozzle and the buckets. That is, the jet

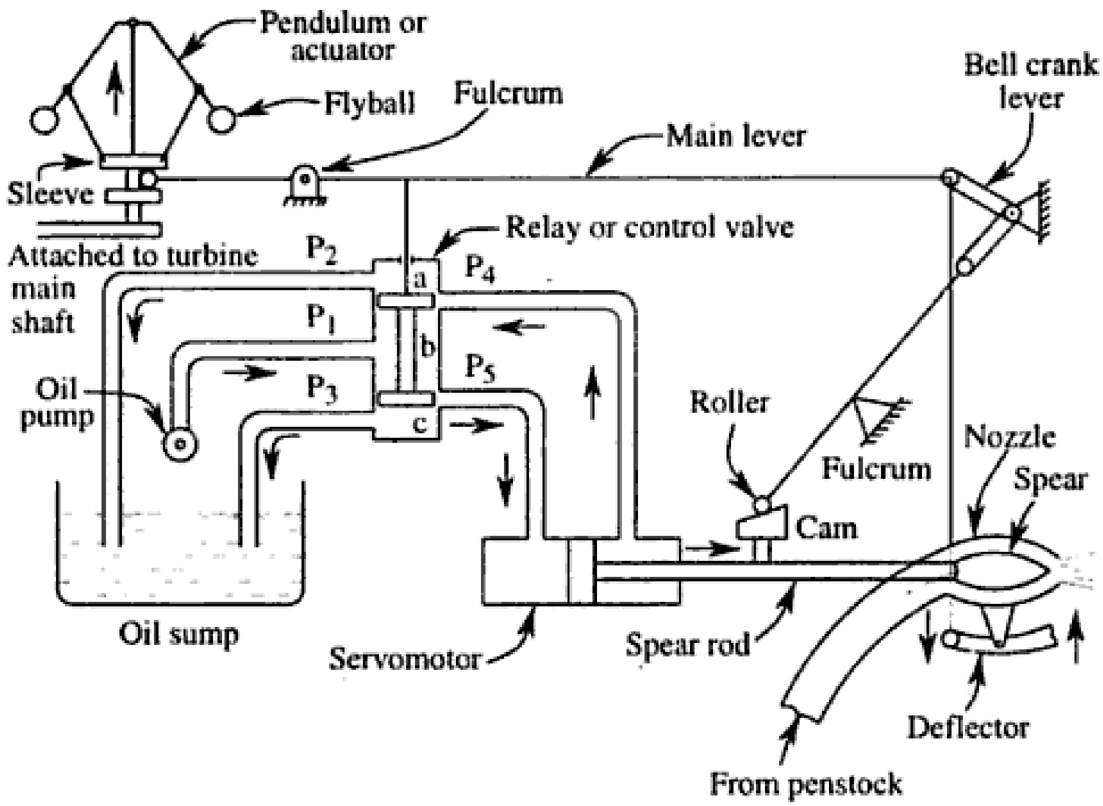

Fig. 13.22 Governing of Pelton turbine

deflector, controlled directly by the governor, deflects the jet within a very short period and remains engaged until the spear has been adjusted to a new position of equilibrium. In order to bring the spear in the required position, the double piston in the relay valve moves down. High pressure oil from the sump enters the distributing valve in the space *b* and flows down to servomotor striking the piston, so that the spear moves to the right reducing the nozzle outlet area.

The quantity of water striking the blades is reduced and the speed, which was increasing with the decrease in load, is brought under control and remains constant. The movement of the spear takes place in the opposite direction when the load on the turbine increases, i.e., when the speed has a tendency to decrease. These days, the flyball governor is being replaced by a electro-hydraulic governor which is provided with an electric circuit sensitive to frequency. Whenever there is a change in speed (frequency) there is a variation in voltage, and the voltage variation is transformed into electric impulses and are fed into the hydraulic circuit causing the movement of the spear and deflector in the desired direction.