LECTURE NOTES – VII

« HYDROELECTRIC POWER PLANTS »

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Chapter 7

The Headpond

The purpose of the headpond (or forebay) is to distribute evenly the water conveyed by the power canal among the penstocks and, at the same time, to regulate the power flow into the latter, as well as to ensure the disposal of excess water. At the headpond the power conduit widens into a basin and thus a part of the suspended sediment still carried by the water settles down. The storage capacity of the headpond tends to drop of water level in case of sudden load increase. Headponds having a storage capacity may even provide daily storage for the plant.

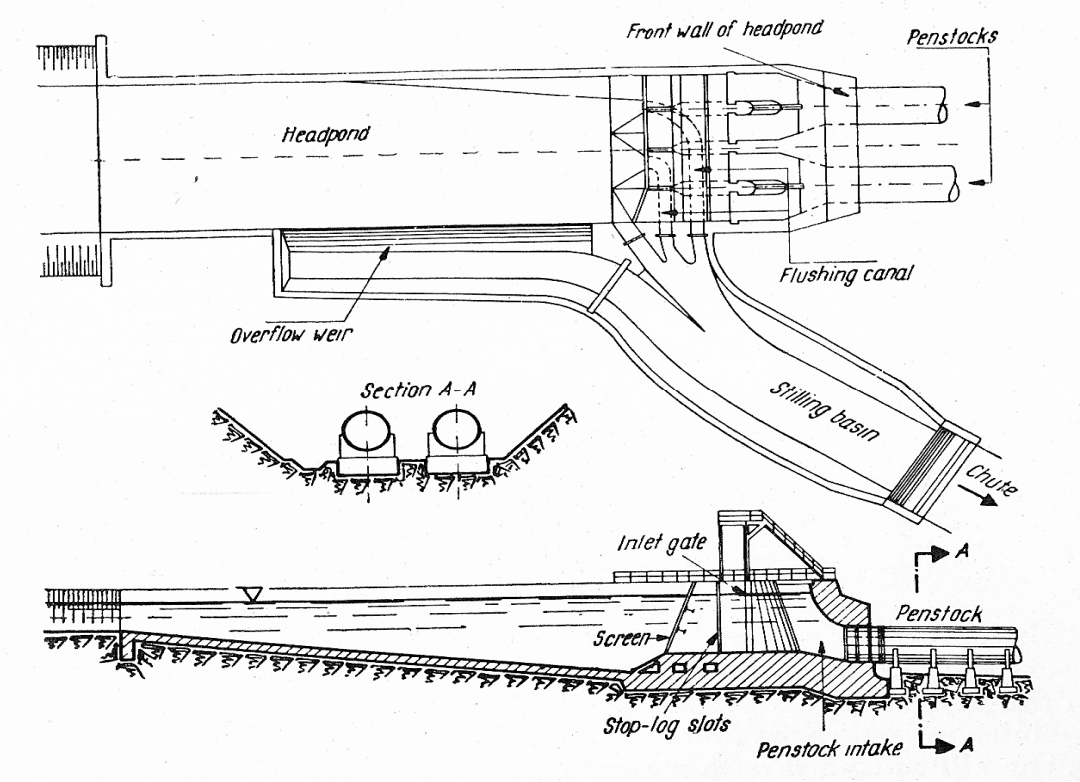

Figure. General arrangement of the headpond

Parts of the headpond are;

1. The *basin*,
2. The *spillway* (sometimes of the siphon type), with the overflow weir,
3. The *bottom outlet* which is generally flushing sluice gate for sediment,
4. The *sill equipped with a screen*,
5. The *gate (valve) chamber*,
6. The *penstock inlet*.

The bottom of the headpond is governed primarily by topographic conditions, the geology of the site should be considered. The site of both the headpond and the powerhouse should be selected simultaneously with a view to ensure the shortest possible penstocks. Parts of the map where the contour lines are close to one other and closely follow the banks of the river course should be investigated as potential sites.

The power canal should join the headpond over a gradual transition and the bottom of the basin should have a slope towards the sill.

A bottom lining of the basin is indicated only in soils where seepage is to be expected. The spillway is usually an ogee type weir located in the valley side retaining wall of the basin with a sufficient length to discharge the entire full load water supply with a small increase in the basin level.

The spillway and the bottom outlet canal should be united immediately at the foot of the basin. Water spilling over the spillway crest and through the bottom outlet can be,

a) Diverted into a suitable river bed in a nearside valley,
b) Conveyed by a special chute.

The bottom outlet is controlled by a vertical lift gate. Sediment accumulating before the sill can also be flushed through the bottom outlet. If flushing is not of the desired efficiency and the amount of the remaining in the basin is significant, this should be removed mechanically.

The entrance of accumulated sediment into the penstocks is prevented by a sill and a screen. At high head installations the width of the opening is from 15 to 50 mm, depending upon the type of the turbine. Flow velocities related to the overall area of the screen may vary between, V = 0.80 – 0.25 (m/sec) at high-head power plants. When the water is free of sediment load, flow velocities through the gross screen area may have a value as high as 3 to 3.5 m/sec. Screens may either be extended uninterrupted over the entire inflow cross-section, or be arranged between the piers separating the penstock intakes.

Flow to the pressure conduits is controlled by vertical lift gates located in the gate chamber. Gates are operated by *electric remote control* from the switch room of the powerhouse and also directly from the gate house. The gate should close automatically in a case of turbin stop or penstock failure.