

operation of other parts of the plant. The results of these efforts seem to a certain extent favourable, and I consider it my duty to bring them forth, because they may help to lead to a decision as to which course should be followed.

It seems, for the following reasons, likely that the breaking-down of the cliff that once formed the precipice would have been hampered if on top of the spillway channel there had been a layer preventing surface water from entering the rock.

In the joint-planes between the individual columns of the rock at the face of the "falls" the cohesive strength of the material is very small. Any alternately wet and dry surface causes the rock to "breathe," according to the saturation and evaporation, whereby a loosening of the joints, especially near the face of the cliff, may be effected.

Still greater, maybe, is the effect due to the vibrations when a thick sheet of water is rushing from the top to the bottom of the falls. It destroys whatever residuum of cohesive strength there is in the joint-planes between the columns, and water runs by gravity into what have become open cracks. Eventually the cliffs break off, either column by column, or in blocks consisting of several columns.

A lining of the spillway channel, preventing water from entering open joint-planes by gravity, must hamper the process of destruction.

Still another case may be anticipated when a lining of this kind would be a means of preservation. In the bottom of the overflow channel adjacent to the face of the falls there are a number of "potholes," some of which seem to give water access to deeper strata. A source of destruction would be removed if these potholes were closed by a lining.

When the sheet of water rushes over the falls a vacuum is created behind it which tends to break off the cliff. This process of destruction would be hampered by letting in air behind the jet.

For reasons dealt with in my report regarding the damage that occurred on the 7th June, all surface cracks in the ridge between the overflow channel and the river-gorge should be grouted, and, in addition, ample drainage of all deeper cracks should be provided. Even these measures, which in my opinion will be necessary supplementary measures to any scheme aiming at a definite consolidation of the "falls," are likely to slacken the speed of the destructive processes.

All these measures, which would involve comparatively low costs, could well be executed within the time necessary to bring the other parts of the plant into working-order.

It may also be mentioned that there is a possibility that the preventive measures required might be confined to the above-mentioned limits, if the power-station is soon fully developed to its ultimate proposed capacity, and if the diversion tunnel is made more fully adequate and reliable.

#### 24 (a-c).

(24) In the event of your deciding that there is no need to consider the abandonment of the scheme, are you of opinion—

- (a) That the diversion-tunnel should be strengthened and fitted with high-velocity dispersion-type valves?
- (b) That it should be duplicated?
- (c) That it should be permanently concreted up?

In my opinion it is entirely out of the question to concrete-up or otherwise permanently close the diversion-tunnel. This would make the dam completely devoid of any means of lowering the water-level in the lake, should this prove desirable or necessary for inspection purposes or in emergency cases in the future.

The diversion-tunnel should be considered as an essential and integral part of the dam, and it should be treated accordingly. On the other hand, I consider it quite unnecessary to duplicate the tunnel, provided that fully adequate measures be taken to keep the present tunnel and all its appurtenances fit for their purpose.