

layer which would prevent rain from replenishing any loss of water from the pores and joint-planes in the columnar rock below. I feel convinced that the provision of an impermeable covering over the ridge between the headrace and the river-gorge, which would allow the underlying rock to dry out, with a consequent contraction and production of deep, though possibly small cracks, would create a new danger rather than act as a safeguard.

Another suggestion that has been given consideration is that of digging open ditches in the surface to increase the run-off of rain-water, but I am very firmly convinced that the stability of the country is best safeguarded if, after closing the present cracks with concrete, the whole ridge between the main dam and the falls is left in its present state. There is no indication that the natural stability of the ridge between the headrace and the gorge has been impaired; rather do my deductions lead me to believe that the strength has been improved. It would seem, therefore, that the leaving of the processes of evaporation and replenishment by rainfall along the ridge to counterbalance one another, as they have done during geological ages, is the best method of maintaining the stability of this part of the country.

A similar consideration applies to the ground under the headrace itself. After a careful study of all conceivable factors relating to this question, I have arrived at the conclusion that it is of no great importance whether rain-water is or is not prevented from having access to the ground under the actual headrace. If anything, an advantage would be gained if rain-water was able to find its way on to this part of the ground, as in this way there will be no change produced in the present state of saturation of the ground.

I have assumed in the foregoing that all the cracks are to be filled with concrete. This assumption refers to such cracks only as reach the surface of the columnar rock. There may, however, be cracks that are located at greater depths and that do not reach this surface. It may be difficult to grout these cracks, and may even be dangerous to attempt to do so, as an imperfect grouting might obstruct the drainage of water from such parts as are left open, and thus make possible the accumulation of water under high pressure. Instead of an attempt to grout deeper located cracks, I propose that in the lower strata of the ridge drainage-tunnels be arranged at right angle to the axis of the ridge.

It is, of course, essential that the large volume of water that is impounded above the spillway to a depth of some 30 ft. should not be given any opportunity of soaking into the ground or causing any alteration in the capillary condition due to the considerable hydrostatic pressure from the headrace. This can be prevented in different ways. A system of pipes or a flume carrying the water to the intake and to the spillway can be arranged, or the bottom and the sides of the headrace can be provided with an impermeable lining, separating the water in the headrace from the ground.

There is no difference between these arrangements as far as the penetration of water into the ground is concerned. They differ, however, in relation to the pressure against the sides and the bottom of the headrace. Not only the pipes, but even the flume, can be arranged so as to relieve the sides of the headrace from hydraulic pressure; should only a lining be arranged, the hydrostatic pressure against the headrace would remain the same as before. It is, therefore, necessary to show that this pressure does not constitute a dangerous element, before the lining can be compared with the other arrangements mentioned.

In my investigation as to the cause of the rupture that occurred on the 7th June, 1930, reasons were given showing that the primary cause of the rupture cannot be traced to the hydrostatic pressure against the side of the headrace. I have also in the present part of my report drawn attention to the circumstance that the crack which still exists offers a means of making the ground more stable than it has previously been. This refers especially to the efficiency of the ridge between the headrace and the river, considered as a buttress against water-pressure from the headrace. I must, consequently, draw the conclusion that the hydrostatic pressure on the side of the headrace cannot cause a new earth-movement if it is not assisted by other agents of destruction.

There remains, however, a conceivable source of apprehension which I find it convenient to deal with in this connection.