conveyers was made of steel and left in place, jets of compressed air swept the belts clean of concrete at points of discharge. Fifty thousand yards of concrete was handled in this manner.

The material of which the dam has been built was subject to much study and experimentation before being used. There was discovered several sand deposits within a short distance of the dam, but this sand contained a certain amount of silt, so that washing would have been necessary and the amount of sand required could not have been furnished fast enough to maintain the progress decided upon. A source of supply in the Bear River, near Colfax, about 60 miles away, was chosen as the best one available for the purpose. Here the material was in the form of gravel and sand in proportion very close to the desired mixture. The Lake Spaulding dam is therefore largely constructed of the quartz, gravel and sand from the Bear River, with but a small proportion of other gravel and rock, necessary to mix in at times when the bank run of the natural gravel deviated the desired proportion. Throughout the work, samples of green concrete were taken from the dam after concrete had been deposited, these samples being obtained at various points in the dam. Enough samples were taken every day to supply three for a 7-day test, one for a 28-day test, one for a 60-day, one for a 90-day and one for a 5-year test. Each day the test samples, as their time became due, were broken, and very complete records were made on each to determine the condition of the mix and to make any corrections necessary.

The average minimum crushing strength per square inch was about as follows: 7-day specimens, 400 lbs.; 28-day, 900 lbs.; 60-day, 1,000 lbs. or more. The ultimate strength should considerably exceed these amounts. The proportion of the mix generally used for the lower portion was 1 part of cement, 2½ of sand, and 4½ of gravel. Towards the crest the mix was made richer, about 1:6, using up to 1¼ barrels of cement per cubic yard. A wet mix was used, which was turned for 1½ minutes in the mixers before being discharged into the gravity flume. By experimenting, it was found that 1½ minutes was the minimum time to thoroughly mix a batch, so as to ascertain maximum compressive strength.

Design.—It was first proposed to build a gravity dam, arched in plan, having an upstream radius 600 ft. long. Such a structure was started in 1912 and during that year reached an elevation 28 ft. above the river bed at the upstream face and less at the downstream face, as shown on Fig. 1. During the winter the original plans were changed and the construction of the dam continued the following summer in accordance with design shown on Figs. 1 and 2. At Elev. 4,628 the length of the upstream radius was changed to 250 ft. and kept at this length up to Elev. 4,675. Up to this elevation the canyon is very narrow compared with the thickness of the arch and the curved beam and wedge action will therefore predominate over the arch action. From Elev. 4,675 up to the crest, the length of the upstream radius increases so as to keep the subtended central angle as constant as possible, as shown by the table in Fig. 2. This subtended angle is not as large as could be desired, but is as great as the site would permit, considering that the ultimate proposed crest elevation is to be at Elev. 4,905, and considering that this type of dam had to be built on top of the other type already started. The proper place for the new type would have been about 100 ft. further upstream.

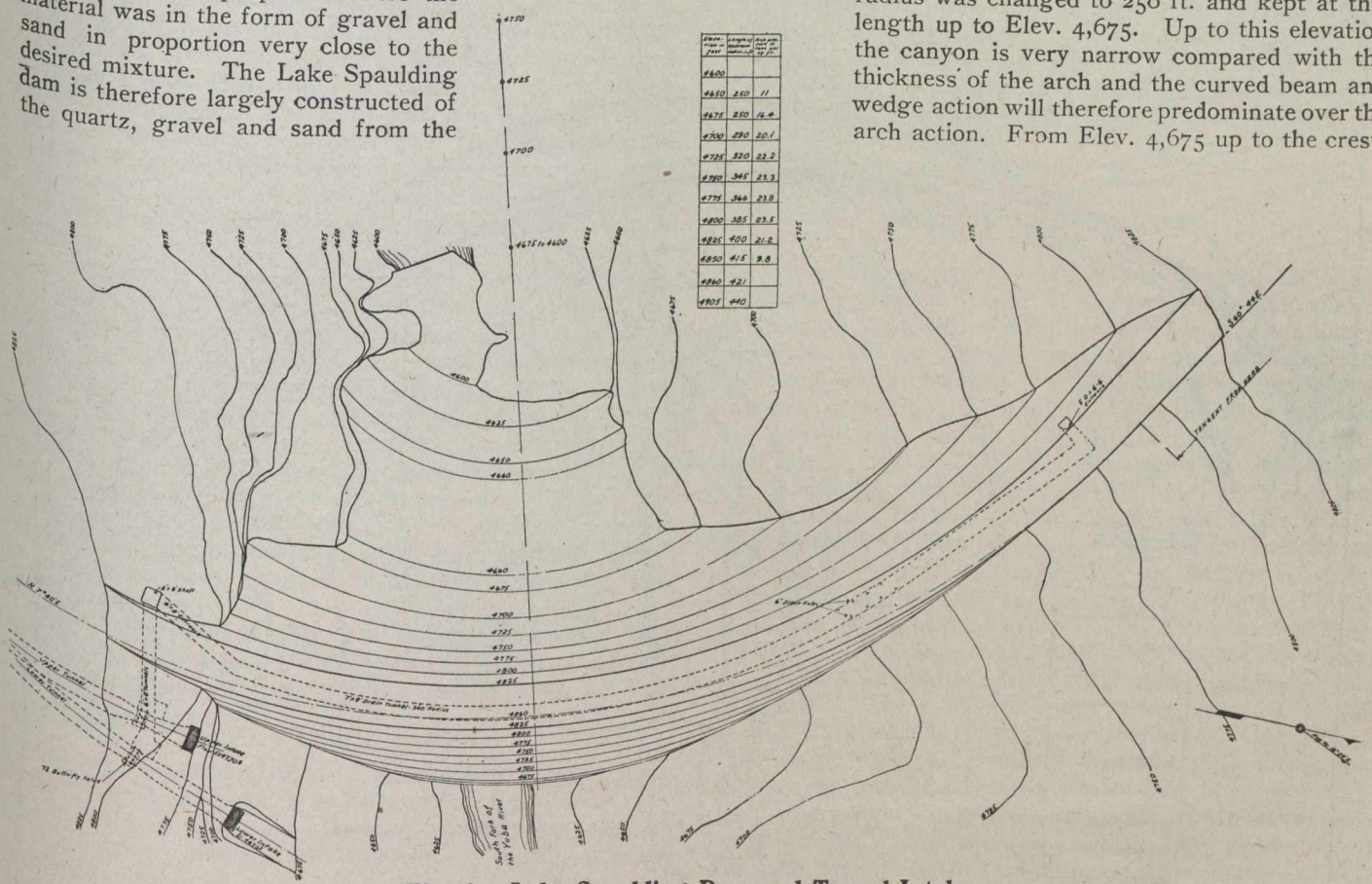

Fig. 2.—Lake Spaulding Dam and Tunnel Intakes.

The Lake Spaulding dam is provided with an inspection tunnel, a drainage system and contraction joints; which are usual features in dams of large proportions. These details are shown plainly in Figs. 1 and 2. The section of the arch above Elev. 4,660 is of such dimensions that it will stand an extension of 35 ft. in height above the present crest elevation (4,825) without any addition to its thickness. The maximum arch stress (q in Formula 1, page 317, *The Canadian Engineer*) will exist at Elev. 4,775 with the water level at Elev. 4,860, or 260 ft. above the river bed, and will amount to 23.8 tons. It is fairly