Rome." This article, read in conjunction with the foregoing description will be of interest to our readers.

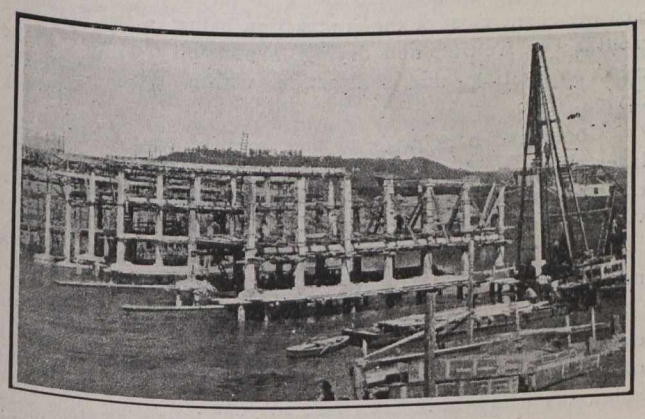

Fig. 9.

Table of Long Concrete Arches.

NAME	Used for	Built in	Span ft.	Rise ft.	Crown-thickness in.	Thickness at springing lines, in.	Material
Bridge over the Petursse-Tal, Luxembourg	Street ..	1900/03	240	55	57	86	Sandstone
Bridge over the Adda Line Colico-Sondrio, Italy	Railway	1902/04	233	34	60	88	Granite
Bridge over the Steyrling Line Wienera - Triest. Austria	Railway	1903/04	233	52	80	136	Granite
Bridge over the Isar, Munich	Street ..	1903/04	233	42	32	36	Reinforced Concrete
Bridge over the Tsonzo Line Triest-Klagenfurt, Austria	Railway	1904/05	284	73	84	140	Limestone
Walnut Lane Bridge in Fairmount Park, Philadelphia	Street	1906/08	237	72	67	116	Concrete
Bridge at Teufen, Schwizelaw	Street ..	1908	263	88	48	85	Reinforced Concrete
Bridge over the Valserine, France	Railway	1908/09	268	66	60	100	Limestone
Grafton Bridge in Auckland, Australia	Street ..	1907/10	320	86	67	73	Reinforced Concrete
Bridge in Cleveland (Ohio)	Street ..	1908/10	284	81	73	134	Concrete
Bridge in Milwaukee (Wis.)	Street ..	1909	256	58	48	96	Reinforced Concrete
Bridge in Spokane (Wash.)	Street ..	1909/11	285	117	82	226	Concrete
Bridge in Constantine (France)	Street ..	1910/11	233	83	60	60	Concrete

STADACONA HYDRAULIC COMPANY:

Announcement has been made at Quebec of the organization of the Stadacona Hydraulic Company, which is undertaking the development of the power at Seven Falls, back of Ste. Anne de Beaupre. The falls, which have a head of over 400 feet, will at present enable the company to obtain an initial development of 10,000 horse-power. The company is backed by a group of Montreal, Quebec and foreign capitalists, and the arrangements concluded, it is said, will result in the company being able to deliver power by the end of the present year. Among the interests identified with the company are: President, Hon. L. P. Pelletier, postmaster-general of Canada; Sir Rodolphe Forget, M.P.; Neuville Belleau, banker, Quebec; Hon. C. E. Dubord, Quebec, member of the Legislative Council of the Province of Quebec; Mr. D. O. Lesperance, banker, Quebec; Mr. Alfred Bouvier, Brussels; Mr. H. J. Bierman, Shawinigan Falls; and Mr. Andre de la Morinerie, France.

DESTRUCTION OF CEMENT MORTARS AND CONCRETE THROUGH EXPANSION AND CONTRACTION.

One of the most important of the standard tests for Portland cement is that for "Constancy of Volume"—a lulling title which carries with it the implication that our cements are actually constant in volume. It requires no very keen observer to find numerous instances where the implication has not been justified. Cracked copings and walls, sidewalks warped and split, and stucco dropping from houses, are sights which are so frequent as to force upon the observer the feeling that the phenomena must be due to some property characteristic of many if not all concretes which are exposed to the weather.

Professor A. H. White, of the University of Wisconsin, gave the results of his investigation of the subject in a paper before the American Society for Testing Materials. The paper in abstract form, as here given, is most interesting.

The change in volume of concrete due to temperature change has been determined with considerable accuracy to be for unit length 0.0000055, or 0.00055 per cent., per degree Fahrenheit. There are, however, other changes due to the chemical processes of setting and hardening which are barely mentioned in even the more important treatises, and other variations due to the wetting and drying of the concrete whose very existence is practically unknown. It is with these two latter classes of changes that this paper will deal.

The following pages show especially the effect of alternately wetting and drying bars of neat cement and sand mortar. There are also included the behavior of various bars of neat cement kept continuously in water and in air. These are included not only because more data on the subject are desirable, but because the Portland cement now being used is a different material from that tested by the European investigators, who undoubtedly worked with cements made in the old vertical kilns. The modern American cement made in rotary kilns differ from the older not only in method of manufacture but also in chemical composition, and is worthy of separate study.

Experimental Method.—The method of making and measuring the expansion bars was that of Campbell and White. The dimensions of the bars are approximately 1 by 1 by 4 ins., and they contain bevelled glass plates cast into the end to ensure a smooth surface for the micrometric measurements. The Portland cements used were all commercial samples which passed successfully the standard tests for soundness. Standard methods were used in proportioning the water and in mixing. The initial measurement was made after the bar had stood 24 hours in the damp box.

Illustrations from Actual Practice.—It may be urged that the tests were all made on small bars manufactured in the laboratory and that such large values might not be obtained in actual practice.

Bar 156 A is made from a part of the cement sidewalk on the north side of the campus of the University of Michigan. It was laid in 1890 from imported German cement by the University workmen who were paid by the day and under no temptation to slight the work or skimp cement. Most of the slabs of this walk are now warped slightly so that shallow puddles of water stand in them after rain, and even after twenty years the expansion is still occasionally causing adjacent blocks to heave and form an inverted "V." The top layer is split from the bottom in many places and it was from one of these pieces of the top coat that bar 156 A was sawed. An examination of its lower surface shows that the split was not due to faulty bonding, for the break has occurred not at the exact junction of the top coat and base,