

time to experiments in the proportioning of materials for concrete, and in tests of cement and various aggregates. He devised the so-called "Heath-Edwards method" of proportioning materials by the area of the aggregates, and on this and other subjects he has written numerous valuable articles which have appeared during the past few years in *The Canadian Engineer*. When the United States entered the war, he resigned his position in Toronto to accept a captaincy in the engineer corps of the American army, but while instructing a squad in trench tactics at one of the Southern camps, he suffered an accident to a foot, which incapacitated him from further duty. After being honorably discharged from service, he returned to his former position with the city of Toronto. He is a member of the American Society of Civil Engineers, American Railway Engineering Association and American Society for Testing Materials, and has taken a prominent part in the work of those society committees which have dealt with masonry, cement, steel, and concrete aggregates.

GUNITE SHOWS ECONOMY IN CONSTRUCTION

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WITH the cost of materials showing very little sign of decreasing and the cost of labor decidedly the reverse, engineers, architects and contractors are casting about for means of obtaining cheaper construction. The product of the cement-gun, now familiarly known as "gunite," is receiving a great deal of attention in this respect, due to the satisfactory results that have been obtained from it during the last few years.

Although the aggregates of "gunite" and hand-applied cement mortar are the same, viz., sand and cement, the characteristics of the finished product differ widely and are greatly in favor of the former, the two chief reasons being that "gunite" is hydrated at the nozzle, thus obtaining only as the material is being shot into place, thus obtaining the benefit of the whole of the initial set; and secondly, the material being applied by air pressure ranging from 35 to 50 lbs. per sq. in., it is very much denser and enters into every pore of the surface to which it is applied, and a far better bond is obtained.

Exhaustive tests have absolutely proven that "gunite" of a thickness of 1 in. is not only fire-proof but water-proof, neither of which, of course, can be claimed for the same thickness, or even double the thickness, of hand-applied mortar. Tests made at Washington, D.C., by the Bureau of Standards and at Lehigh University by Prof. Frank P. McKibben, have established the fact that the relative strengths of "gunite" and hand-applied mortars or concretes are as follows:—

	"Gunite," Average of Samples	Hand-placed 1:2 Mortar
Compressive strength, lbs. sq. in.	4,145	2,184
Modulus of elasticity, lbs. sq. in.	4,278,000	1,538,000
Tensile strength, lbs. sq. in.	690	142

Besides its intrinsic merits, "gunite" possesses the additional one of very materially reducing the costs for labor on the work on which it is used. For example, on wall work, the work on which it is used. For example, on wall work, practically no form-work is required, thus making it possible to dispense with carpenters and eliminate the heavy cost of lumber for forms. An example of this class of work is the large machine shop recently built by the Traylor Engineering & Manufacturing Co., at Allentown, Pa. Over a framework of steel, "gunite" was shot onto 2 in. mesh No. 16 gauge expanded metal. The panels were designed of uniform size, and the only forms required were three movable ones which were used alternately and moved ahead of each other as the work proceeded. The thickness of the walls is 2 ins., and the total cost, exclusive of air but including the expanded metal, was 17½c. per sq. ft.

This is practically the most expensive type of construction on which "gunite" can be used. A much cheaper form has been adopted by the Hydro-Electric Power Commission of Ontario in connection with the various construction camp

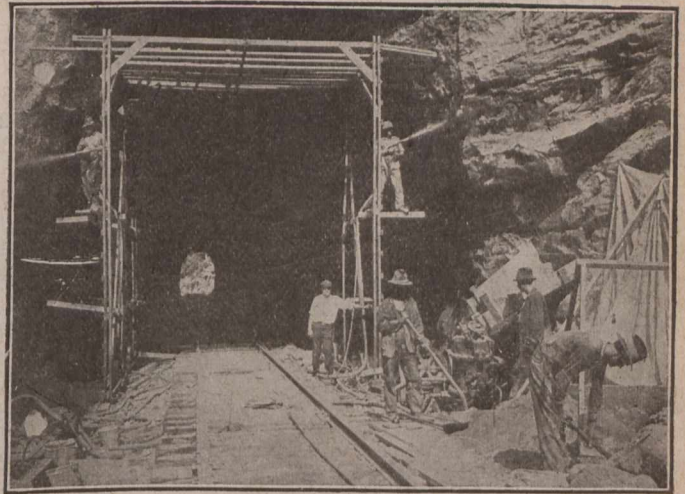
buildings on the Chippawa-Queenston hydro-electric development. In this case the majority of the buildings are of wood. Tar-paper and poultry wire, 2 in. mesh, No. 15 gauge, were attached, and over this a 1-in. coating of "gunite" was applied. The most recent building erected on this job has merely a wooden framework to which the tar-paper and reinforcement are nailed and the "gunite" shot over them. All of these buildings have proven themselves weatherproof, the last mentioned one being used as a cement store, and are fire-proof from the outside.

Other uses to which the cement-gun is being put are innumerable, but a few of them are as follows:—

Fireproofing of steelwork.—"Gunite" was specified for this purpose on the new Parliament Buildings at Ottawa, and the Union Station at Toronto. Also at the new paper mill now being built for the Kipawa Co., Ltd., at Temiskaming, P.Q.

Coke-oven repairs.—The cement-gun was used by the Wilputte Coke Oven Corporation at the Hamilton plant of the Steel Co. of Canada, Ltd., for filling in the preheating cracks, and is used by them on all their jobs.

Stucco work.—"Gunite" is specified on several hundred houses being built by the Halifax Relief Commission, the upper part of these houses being covered with "gunite."



LINING RAILROAD TUNNEL WITH GUNITE

Shipbuilding and lining.—A number of barges have been built for use on the New York State Barge Canal and others for the Standard Oil Company, the principle adopted being to use precast ribs and "gunite" sides, decks and bulkheads.

Lining steel smoke-stacks and acid tanks.—Remarkable results have been obtained on work of this nature, the "gunite" successfully resisting gases of combustion, and dilute sulphuric as well as strong nitric acid.

Repairs to masonry and coating of dams.—A typical example of the former is the coating of the piers of the Grand Trunk Railway bridge at Weston, Ont.

Mine work.—Fire-proofing of timbers and building of stopes has been carried out in the mines of the Acadia and Dominion coal companies in Nova Scotia.

The cement-gun is not a restricted article and is sold outright by the Cement-Gun Co., Inc., and is not rented. The ease and cheapness with which it can be operated is rapidly causing it to be looked upon as a standard part of their equipment by the more up-to-date contractors, whilst the superior qualities of "gunite" are appealing more and more every day to engineers and architects, as it becomes more widely known.

The annual convention of the Canadian Electrical Association will be held June 27th and 28th at the Thousand Island House, Alexandria Bay.