

THE Railway and Shipping World

With which is incorporated The Western World. Established 1890.
Devoted to Steam & Electric Railway, Shipping, Express, Telegraph & Telephone Interests.

OLD SERIES, No. 154.
NEW SERIES, No. 72.

TORONTO, CANADA, FEBRUARY, 1904.

10 CENTS A COPY.
\$1 A YEAR.

Grain Pressures and Grain Bin Design.

J. A. Jamieson, M. Can. Soc. C.E., recently read a paper before that Society, on "Grain pressures in deep bins and the problem of grain bin design." He gave the results of a large number of tests which he had made in full-sized and model bins, and descriptions and drawings of the testing gauge and appliances which he designed and used in making the tests, and also illustrated the pressures by means of a large number of diagrams. He first showed that no data could be found in any of the engineering text-books on this important subject, and that there were no records of any tests for the pressure produced by grain having been made on this Continent, and only one or two of any value in Europe, and that while the necessary strength of the regular-sized elevator bin built of wood had been well established by practice, that many of the large-sized grain tanks being built throughout the country were designed by pure guess-work.

In describing and illustrating the tests he showed that in the regular-sized elevator bin, 12 to 14 ft. square and 60 to 70 ft. deep, when filled with grain, the horizontal pressure would be only from 9 to 12%, and the vertical pressure 15 to 18% of the pressure produced by a fluid of the same weight as grain, and that, therefore, the bin bottom only requires to have sufficient strength to carry a comparatively small part of the grain load, and while the walls do not require to have much horizontal strength, the friction between the grain and the walls is such that 83 to 85% of the grain weight will be carried by the walls, which must therefore have great vertical strength to carry the load.

Illustrating the difference between designing for the storage of grain and for the storage of fluids, he demonstrated that a bin or tank designed on accurate data, having a large factor of safety for the storage of grain, would not necessarily be safe, if filled with a fluid of the same weight as grain. On the other hand it was quite practicable to design and build a tank or stand pipe which would have an ample factor of safety for the storage of water, and which would undoubtedly fail when used for the storage of grain; thus entirely differing from the theory of the experts appointed by the ex-Minister of Public Works to report on the plans of the Montreal elevator.

The financial importance of having an accurate knowledge of grain pressures was shown by the statement that while the original plans selected for the Montreal harbor elevator were for a structure of undoubted strength for the safe storage of grain, to have made it safe for fluid pressure would have unnecessarily added over \$200,000 to the

cost, and Mr. Jamieson contended that the direct loss to the Harbor Commissioners will largely exceed this amount by reason of the plans which they originally accepted being condemned by the ex-Minister of Public Works and his experts on the alleged ground that it would not stand fluid pressure; while the design selected and forced on the Commissioners by the ex-Minister will, Mr. Jamieson contends, neither safely stand grain pressure nor 10% of fluid pressure. He claims that the same structure, instead of being a regular working elevator of 1,000,000 bush.



HON. H. R. EMMERSON, M. P.
The Minister of Railways and Canals.

capacity, proves to be a simple but expensive storage house of considerably reduced capacity, and with only about one-third of the machinery, power and handling equipment called for, and necessary to meet the requirements of the port.

After fully describing the tests and showing the movement of the grain in the bins, and the pressures obtained, he dealt with the questions theoretically, and showed that the results obtained by the tests were entirely in accord with the formulas deducted from the angle of repose of grain, and the coefficient

of friction between grain and the walls of the bins; thus proving the accuracy of both the tests and the theoretical calculations. He described in detail the manner in which the coefficients could be readily obtained for any variety of grain or other granular material, and also the mode of making the calculations, and said, the paper being as follows:—

"We now find that the proportion of the total weight of grain in a bin that would be carried by the walls, and on the bottom of the bin, and therefore the intensity of both the vertical and lateral pressures produced by grain, is chiefly dependent upon three factors: The coefficient of friction between grain and the bin walls, and between grain and grain, the ratio of the breadth or diameter of the bin to the depth, and the ratio of the horizontal area of the grain column to the area of the bin walls. Having established the factors and their values which govern the pressures produced by grain, it becomes a comparatively easy problem in simple arithmetic to determine the vertical and lateral pressures, and the proportion of the weight of the contents of a bin of any given breadth and depth, or construction of walls, that will be carried by the walls and on the bin bottom."

The process of calculation was illustrated, and the formula by which to make the calculation was given. The paper covered very fully both the theoretical and practical features of the question, and was of considerable length, occupying over 2½ hours in reading and illustrating by lantern slide diagrams, and while it was necessarily largely of a technical character, it was presented in such a manner as to be readily understood.

The Canada Atlantic Ry. carried on its steamers to Depot Harbor, Ont., thence by its railway and barge line to Montreal, 15,000,000 bush. of grain during the season of 1903, being about 2,500,000 bush. in excess of that carried during the season of navigation of 1903.

The Imperial Construction Co. (Ltd.) has been incorporated under the Dominion Companies' Act with a capacity of \$199,000 to carry on business as general contractors. The provisional directors are C. A. Masten, J. R. L. Starr, J. H. Spence, T. G. Wilson, E. P. Roden, and the head office is to be at Toronto.

The C.P.R.'s Bristol, Eng., agency, recently moved into its new offices on St. Augustine's Parade. The offices have been especially arranged for the Company's business, and include entrance hall, inquiry office, general office and private office. On one of the side walls of the general office is painted a map 70 by 25 ft. showing the Company's steam and rail routes.