## MATHEMATICS AND THE ENGINEER.

Theory and practice, in the minds of most engineers, have not a proper relationship. It is too commonly accepted by the profession to-day that a distinct line must be drawn between the purely theoretical man and the practical designer and constructor. We often hear the statement made that theory is all right, but practice and experience are the safest in the long run. As a matter of fact, there is no line to be drawn between theory and practice.

It is true that it is hard to analyze the strength of any engineering structure by means of mathematics without a practical knowledge. At the same time, it will be readily admitted that the progress made in engineering design and construction during the past few years has been due to the application of mathematics in the analysis of the stresses in their component parts.

In an address delivered by Sir William H. White, at the recent International Mathematics Congress held at Cambridge, another view of the utility of mathematics to the engineer is given. No one knows, he pointed out, any method by which the strength of a ship can be settled à priori, by deduction from the results of laboratory experiments on the physical constants of the materials used in its construction. All that is possible in getting out the scantlings of a ship, of larger size than ordinary, is to take as a model a ship which experience has proved to be of satisfactory strength. This is treated as a girder loaded in a hypothetical and purely arbitrary fashion. The stress which would result from this load is calculated, and a similar hypothetical load is then applied to the proposed vessel. Should the calculation show that this calculated, but wholly hypothetical, stress is not greater than in the model, the scantlings are considered satisfactory. The whole process, in fact, amounts to little more than an application of the rule of three, and experience shows that in this instance the procedure is legitimate. In fact, in a great number of cases we can find by mathematical methods the relative strength of two structures; but mathematical methods afford us generally no data as to the absolute strength of either. Indeed in certain cases, they fail even to indicate fairly the relative strength of similar members of different materials. Some years ago, for instance, the purchaser of a large testing-machine had considerable difficulty in persuading the builders of a well-known type to supply him with one having a steel beam. They wished to supply cast-iron, and submitted calculations which represented the latter to be not only stronger than the proposed plate-steel substitute, but stiffer. In the end, however, they gave way, but supplied their cast-iron model to another customer, with the result that it broke in seven pieces some eighteen months after being put into service. Taking a narrow view as to the field occupied by theory, it would be permissible to maintain that there was here a serious discrepancy between theory and practice; but, although it is not possible to express in mathematical form the difference in the reliability of a tough and of a brittle material, the difference cannot be neglected in any theory that claims to be in any way complete.

Mathematics to a great extent has been responsible for the benefits of our present day civilization, and it will always be the basis for engineering design. Mistakes have been made, and will continue to be made, not through the use of mathematics, but through the use of wrong assumptions on which the mathematics are based.

## MONTREAL HARBOR COMMISSION

The announcement of the resignation of Major George Washington Stephens from the position of chairman of the Board of Harbor Commissioners of the port of Montreal brings to its end a Commission which has appeared to shipping and commercial circles of Montreal almost ideal. The resignation of Major G. W. Stephens came shortly after those of his two fellow-commissioners, and to some extent was no doubt occasioned thereby. Mr. Stephens makes that fairly clear in his letter of resignation, in which he refers to the manner in which the three Commissioners always worked in harmony, and expresses the view that harmony of that character is essential to the effectiveness of a commission. He considers, therefore, that it is best to retire and give the government an opportunity of electing an entirely new commission.

Part of the success of the commissioners and the cleanliness of their administration was no doubt due in large part to the fact that none of them were in financial need of the appointment. The chairman is a millionaire, and the financial remuneration attached to his position was of little consequence to him, and would be largely exceeded by the cost of maintaining the position. Messrs. Ballantyne and Geoffrion are wealthy men, and would also make more money attending to their own businesses.

The post of chairman of the Commission is one which demands the highest type of executive ability and imaginative power.

The government can only be praised for the appointments made to the chairmanships of the Transcontinental Railway Commission in Mr. R. W. Leonard, and to the International Joint Commission in Mr. C. A. McGrath. The action of the government in the selection of a new Commission will be awaited with much interest. It is to be hoped the choice of a chairman will fall on a man of engineering training and of the requisite administrative capacity.

## TRINIDAD ASPHALT MINING.

The consumption of Trinidad asphalt, mainly for street construction and in a minor degree for chemical and other purposes, increases from year to year. The bulk of it is recovered from the pitch or asphalt lake on the island situated on elevated ground about fifteen miles from the sea shore. Smaller quantities are recovered by open pit mining in the close vicinity of the lake, where various deposits have accumulated from overflows in prehistoric times. The lake covers about 40 hectares, and is very deep; its surface is solid and hard enough to carry people. The asphalt is cut off with large hoes; the pieces so recovered are carried by hand into trucks attached to cable trams, and removed to the sea shore for export. A comparatively small portion of the output is, previous to being exported, freed from its water contents in a refinery on the island. The crude asphalt represents a brownish-black mass with a peculiar smell; it contains about 30 per cent. water, 30 per cent. mineral substances, and the rest is bitumen. The bitumen averages 82 per cent. C, 10.5 per cent. H, 6 per cent. S, and 1 per cent. N. The yearly export has now reached about 180,000 tons. Of late a liquid asphalt, or rather a highly asphaltic mineral oil, has been recovered on the island and exported, after the elimination from it of the liquid oils. It is particularly suitable for softening the hard Trinidad asphalt. The natural generating and hardening processes, which have ultimately resulted in the production of the asphalt, are of a very complicated nature; sulphur seems to have played a conspicuous part in them in conjunction with oxydation and polymerisation processes.