



# FROM OUR READERS

This page is reserved for the publication of articles from our readers. Contributions are invited on any subject of general interest, and further particulars are given at the foot of the page. See also the Editor's remarks on page 173 of this issue.

## A Meccano Boy Tells How Wembley was Built

THE year 1924 will always be remembered as the year of the great Empire Exhibition. All over the British Empire, and probably it would be no exaggeration to say all over the civilized world, people are talking of the marvels of Wembley.

The Exhibition is, of course, unique in many respects, and among the features that distinguish it from other previous exhibitions is the fact that it is not housed in temporary lath and plaster structures, but in permanent buildings of massive proportions. The amazing thing about these buildings is that they have all been erected in two years. How has this been done? The answer that at once suggests itself is—by means of an enormous army of workmen. This, however, does not account for the remarkable speed of building, and the secret lies in the use of reinforced concrete or ferro-concrete as it is called.

We Meccano boys are all familiar with the appearance of concrete, and possibly most of us know that it consists of sand and small stones bound together with cement. It is made by mixing the sand and stones thoroughly with cement and water until each stone is covered with wet cement and then, when the mixture dries, it sets into a solid rock-like mass.

Concrete as a building material has many advantages. It does not rust like iron or decay like wood and it needs no protection in the form of painting. It does not gradually deteriorate like so many other materials, but it appears actually to become stronger as it gets older. At the same time, however, concrete has one weak point. It is very strong in resisting a crushing stress, that is to say, a weight pressing directly down upon it, but it offers only feeble resistance to tension or a bending stress. On account of this weakness concrete alone is of little use for beams.

A beam supported at its ends and carrying a weight undergoes compression in its upper part and tension in its lower part. This fact may be demonstrated very simply. Take a wooden lath and cut grooves on both sides of it, as shown in the accompanying diagram. Then support the lath at its ends on two books or boxes, and place a weight on it at the centre. If the grooves are carefully examined it will be seen that those on the top close up while those underneath open out, thus showing that the top of the lath becomes shorter when it bends, and the bottom becomes longer.

As concrete strongly resists compression it would do very well for the upper part

of a beam, but owing to its small resistance to tension it would be of very little use in the lower part. In order to overcome this difficulty the concrete is reinforced



with steel, which supplies the tension-resisting power. The steel, in bars or in some other form, is embedded in the concrete while the latter is wet. When the concrete dries it grips the steel very tenaciously, and the resulting structure combines the qualities of the two materials.

Ferro-concrete, so called from the Latin word *ferrum*, meaning "iron," has revolutionised modern building practice, and its use is now so general that it has been proposed to call this the "Ferro-concrete Age."

"PENGLAM."

## The Big New Zealand Tunnel A Great Engineering Feat

Throughout the length of the South Island of New Zealand there runs a great range of mountains called the Southern Alps, which at their topmost limits reach a height of 12,349 ft. above sea level. On one side of these mighty mountains lies the smiling province of Canterbury, while on the other side is the timber country of Westland. These Alps have always been an obstacle to communication between the two provinces. Years ago the Maoris braved the dangers of the mountain passes in their search for greenstone, and later, when gold was found in Westland, white men from Canterbury risked their lives to reach the goldfields. About 60 years ago a road was built across the mountains by way of a rocky defile, known to-day as Arthur's Pass.

As time went on, the need of some easier and quicker means of communication between the two provinces became more acute, and it was decided that a railway must be built. In due course a line was begun, and little by little it crept from both sides up the mountain range. The higher it reached, the greater became the engineering difficulties. Many short tunnels were made and lofty steel viaducts constructed across foaming torrents. At

last there remained only a comparatively short distance to be dealt with, but within that space was the most difficult part of the whole undertaking. Fifteen years ago miners commenced—first on the western side and shortly afterwards on the eastern—the enormous task of cutting their way through the solid rock. Drilling machines were used for boring holes, and then great masses of rock were blasted away with dynamite. In this way the miners gradually forced their way into the heart of the mountain.

During the War, work on the Otira tunnel, as it is called, was hindered by scarcity of men, and it was not until ten years after the tunnel was commenced that one day the miners working on the eastern side heard the sound of blasting on the western side. Next the drilling machines were heard through the wall of rock still remaining, and a few weeks later a workman on the eastern side suddenly saw the pick-axe of a workman on the other side coming through the rock. When the barrier was finally cut through, the men on one side shook hands with their fellow-workmen on the other side.

The accuracy of the engineers' plans and calculations for this tunnel was remarkable. In a distance of over five miles the difference in level of the two headings was only  $1\frac{1}{2}$  in., and the difference in direction only three-quarters of an inch.

Although the tunnel cuts off the top of the mountain, it runs up a fairly steep slope from the western to the eastern side. A steam engine puffing up this incline would fill the tunnel with smoke, causing discomfort to travellers on the train, and for this reason electric locomotives are employed.

HAROLD GRIFFITHS (New Zealand).

## To Contributors

Many of the letters that the Editor receives every day contain at least one point of general interest, which, if written out in the form of a short article, would appeal to readers of the "M.M." We invite our readers to submit such articles for this page, and if of general interest they will be published as opportunity permits. The articles may deal with such subjects as new ideas for making something; new methods of doing things; accounts of some unusual occurrences or incidents, such as what it feels like to be in a sand-storm, or to win a cup on sports day, each of which experiences formed the subject of two recent letters.

Articles should not be longer than 500 words, and they should be written as neatly as possible and on one side of the paper only. Those articles that are published will be paid for at our usual rates. If desired, illustrations may be sent, either drawings, photographs, or rough sketches. No reader should hesitate to send in an article because he may not be very good at composition or cannot sketch any diagrams necessary to illustrate it. If he states the facts clearly and sends rough drawings we will have his article put into shape, if necessary, and finished drawings made by our artists ready for publication.