service rendered to the vessel, and not the freight-earning power as the basis of assessment. Mr. White differs, however, from Mr. Rothery in the mode in which the space occupied by the vessel should be measured. He considers that for all practical purposes this space is equal to the parallelopipedon formed by the extreme length, extreme breadth, and the mean draught, and consequently thinks that "parallelopipedon tonnage," as it is called, has much to recommend it. The possibility of berthing other vessels at the same dock or wharf is not sensibly altered by the under-water shape, consequently the above seems a fair measure of service rendered.

Mr. White does not consider that the above proposal would lead to the adoption of a box-shaped type of vessel. He thinks that the cost of propulsion of a steamer would effectually check any such tendency.

Mr. White concludes his most able paper by the following piece of advice, which we trust may be taken to heart by whatever government finally undertakes to revise the tonnage laws.

"In conclusion, I would venture one remark respecting the course of procedure which promises to give the best results, if a revision of the tonnage law is decided upon. Valuable as the labours of committees and commissions may be in testing the feeling of those interested in shipping, and putting on record the opinions of competent authorities who view the subject from different standpoints, it does not appear that a satisfactory revision can be looked for in this direction. The precedent to be found in the preparation of the law of 1854 seems to be a good one. Following after the work of the commissions came the careful, extensive, and laborious inquiry of Moorsom, a scientific expert, having a thorough acquaintance with the subject, and placed in direct communication with the shipping community. If the long-talked-of Central Council or Advisory Board should be constituted to deal with matters relating to the mercantile marine, and if it should be assisted by a competent scientific staff of naval architects, we may hope that, among other much-needed action, will be included the revision of the tonnage laws in a sense that will give more general satisfaction than could otherwise be obtained."

THE NAVAL AND MARINE ENGINEERING EXHIBITION

THE Exhibition which Mr. Samson Barnett, jun., has opened at the Agricultural Hall, and which closes to-day, contains a very large number of objects connected directly and indirectly, and sometimes even totally disconnected with naval purposes. The collection is by no means totally devoid of novelties and of objects of considerable scientific interest. The Exhibition contains numerous models of recently-built war and merchant ships, a few small marine engines and boilers, and portions of large-size marine boilers, together with fittings of engines and boilers in great variety. There are also several specimens of steam steering gear, ships' telegraphs, steam capstans, cranes, and machinery generally for loading and unloading vessels, boat-lowering apparatus, life-saving appliances, dredging gear, and refrigerating appliances. Naval artillery was not well represented, but Messrs. Hotchkins and Co. exhibited some fine specimens of their beautiful revolving cannon, which have been adopted in the navies of several foreign governments, notably in those of France, Germany, Russia, and Italy.

The ships' models are as a rule very deficient in interest, in spite of the fact that they represent many of the most famous of modern vessels, such as the *Devastation* and *Polyphemus*, among men-of-war, and the *Servia*, the *City of Rome*, and the *Ravenna* amongst passenger steamers; for they were mostly half models of the outsides of the vessels, which, though they give a very good idea of the exterior form, afford no information as to the construction, the interior arrangements, or the engines and boilers. This is somewhat disappointing when we remember what strides have been made in recent years in the construction of iron ships.

In the Department of Marine Engines and Boilers there was a remarkable absence of models, or even of drawings of the very fine engines with which our first-class war and merchant steamers are now fitted. By far the most important objects exhibited in this section were the magnificent flanged front plates of boilers, one of these being fifteen feet in diameter, and made in a single piece, with three flanged openings for furnaces, from a single 3-ton ingot of Siemens' steel. The same firm also exhibited several specimens of Fox's corrugated furnaces, an invention which has conferred the greatest benefits on the cause of steam navigation, by rendering possible the use of the very high boiler-pressures which are so essential to economy of fuel. Mr. David Joy also showed a model of his own celebrated valve-gear, which has given such excellent results with locomotives at Crewe, and which will doubtless soon become favourably known to marine engineers. This valve-gear is probably the most serious competitor to the old link-motion driven by eccentrics, first adopted by Stephenson for locomotives, and which has remained in pretty general use up to the present time. Mr. Joy's motion, besides being simpler, effects a better distribution of the steam, in many respects, than the link-motion.

Amongst the most interesting features of the Exhibition were the refrigerating machines. Of these there were four, exhibited by Messrs. Bell-Coleman, Messrs. T. Pigott and Co., the Haslam Foundry and Engineering Company, and Messrs. J. and E. Hall. As we have so recently described the principle of action of these machines, it will not now be necessary to go into details. It may, however, be mentioned that they are at the present moment being used by the Peninsular and Oriental, the Cunard and the Orient Steam-ship Companies, and also by the London and St. Katharine Dock Company, and the Orange Slaughtering Company. The successful application of mechanical refrigeration to the preservation of fresh meat and other provisions, is a subject of such immense importance, that we are not surprised at the great interest excited by these machines.

Amongst the miscellaneous exhibits we can specially mention the numerous collapsible and other life-boats, and the boat-lowering apparatus, some of which are really admirable. Also the wire-rope rigging, and the stout wire torpedo nets, exhibited by Messrs. Bullivant and others.

It seems a pity, considering the great amount of interest which has been excited by this Exhibition, that it should only remain open for ten days.

TOTAL ECLIPSE OF MAY 17

WE have given from time to time, in the Astronomical Column, particulars of the approaching total eclipse, pointing out that it is visible at a point on the Nile, in lat. 26° 32′ N. We are glad to be able to state, that an expedition left this country yesterday with the view of obtaining photographic and spectroscopic observations. The expedition has been organised by the Science and Art Department and the Royal Society combined, on the recommendation of the Solar Physics Committee.

The expedition sails to Suez in the Peninsular and Oriental steamship *Kaisar-i-Hind*, and a good idea of the local arrangements made will be gathered from the accompanying article, which we reprint from the *Daily News* of yesterday :—

May 17, 7 a.m., sun eclipsed, visible at Greenwich. Thus runs the records in our pocket-books. So short,