

ciated as it is with a spectrum of early, though somewhat peculiar, type, has an important significance in relation to some of the suggested explanations of the tardy motions of isolated helium stars.

### THE INSTITUTION OF NAVAL ARCHITECTS.

THE spring meetings of the Institution of Naval Architects were held on April 12 and 13, at the Royal Society of Arts. The Marquis of Bristol's term of office as president has now expired, and he has been succeeded by the Earl of Durham. The institution scholarship has been awarded to Mr. T. S. D. Collins; a donation of 100*l.* has been made to the scholarship fund by the Earl of Durham; the annual gold medal has been awarded to Mr. A. W. Johns, and the premium to Mr. J. L. Kent, for papers read before the institution. The following members of the institution have been appointed to the Board of Trade Committee to consider the position of shipping and shipbuilding industries after the war:—Sir A. A. Booth (chairman), Sir Archibald Denny, Mr. W. S. Abell, and Mr. James Readhead. A presentation was made to the retiring president.

In the course of the Earl of Durham's address, he said that one paramount duty was before the whole nation—to prosecute the war until a satisfactory end was reached. Our naval architects had no better pride than to turn out everything destined for the Navy of the best possible quality. When the end of the war came he felt sure that the institution would be able to claim having done its share in the work.

Sir Philip Watts read a paper on the load lines of merchant ships, and the work of the Load Line Committee (1915). This paper consists largely of a historical summary, starting with the earliest recorded regulation, which appeared in Lloyd's Register book in 1774. The remainder of the paper gives the gist of the report of the Load Line Committee, presented in a form convenient for the purposes of the institution. Mr. W. S. Abell followed with a paper on some questions in connection with the work of the Load Line Committee. The question principally discussed is the formulation of a suitable standard of structural strength which might be adopted internationally for the necessary tests which it is desirable to lay down in order that the freeboard assigned shall not be so small as to bring undue strains upon the structure of a vessel. The rules of the registration societies have been developed from experience, and should form the basis of any analysis having for its object a general average of experience with ship structures at sea. The method adopted was to analyse the rules of the principal societies in terms of  $I/y$ , and the principal dimensions of the vessel with the view of obtaining a standard of longitudinal strength which would express rationally the minimum requirements found necessary from successful sea experience. In this way formulæ were found for the standard of longitudinal strength, the thickness of side plating, frame spacing, and the strength of hold frames. This paper is a valuable summary of some interesting work on the strength of ship structures.

Dr. C. H. Lees read a paper on the laws of skin friction of a fluid in stream line and in turbulent motion along a solid of great length. In this paper Dr. Lees shows how to reduce the problem of a very long body of rectangular or elliptical section towed along a wide tube filled with liquid, to the simpler problem of a long circular cylinder towed along the same wide tube, so long as the liquid moving past the body is in stream-line motion. Comparison of results calculated for the equivalent cylinder and Froude's boards shows

very fair agreement for the last 34 ft. of the boards. The agreement is sufficiently close to show that there is in all probability an intimate connection between the frictional resistance of the after portion of a long towed body and that of water flowing through a pipe. It seems desirable that experiments should be made with the view of determining to what extent the propositions with regard to bodies of equivalent resistance in stream-line motion may be carried over to eddying motion, and, if it should prove they cannot be, to determine the corresponding propositions for eddying motion.

Mr. G. S. Baker contributed a paper on the skin friction resistance of ships, and our useful knowledge of the subject. The data for the friction of rough surfaces have been increased very considerably in the last few years. Most of the data are derived from model experiments, but in some cases authentic data for ships are available. One model of fine form, 16 ft. in length, tested in the National Tank, showed that plate edges increased the frictional resistance 3·7 per cent. The plates on the model represented 4-ft. strakes of  $\frac{3}{4}$ -in. plating on a 400-ft. ship. A plate, 20 ft. by 2 ft., tested in the Washington tank after immersion in Chesapeake Bay for two months (July and August, 1914) showed an increase in resistance over that of a smooth surface of about 50 per cent. The fouling and resistance went on increasing up to the month of December, when the resistance stood at about 220 per cent. increase over that for a smooth surface, and remained at that figure for some months. This suggests that a good time for cleaning and painting the bottoms of coasting ships, working at about this latitude, is October and November, as there is little growth in cold water for the next few months. Presumably there would be a period about May and June when the temperature had reached a point favourable for growth, when a new coat of paint would prevent the adhesion of growth to the surface.

In a paper on the subdivision of merchant vessels and the Reports of the Bulkhead Committee, 1912-15, Sir Archibald Denny suggests that, after the war is over, an interesting paper might be written dealing with the mass of information which will no doubt be available as to the behaviour of vessels damaged either sufficiently or insufficiently to sink them. It is interesting to know that many vessels have survived torpedo and mine attack, even when the damage was of a very extensive character. Thus the *Nigretia* struck a mine abaft the fore peak, and had a hole 40 ft. by 16 ft. blown in her, but she was saved by No. 2 bulkhead. The Germans also have not always realised the difficulty of sinking an oil-carrier, especially if she is running light—*vide* the *Artemis*. The tests made by the Bulkhead Committee on large tank bulkheads are described in a paper by Mr. J. Foster King. Drawings showing the deflection records and photographs of the bulkheads are included. In all, fourteen papers were read and discussed.

### DANISH LABOUR ON BRITISH FARMS.

THE Board of Agriculture proposes to relieve the present shortage of labour on the farm by arranging for the introduction of agricultural workers from Denmark. In this connection attention may be directed to an exceptionally interesting article by Mr. J. Robertson Scott in the January number of the *Quarterly Review*.

The wonderful development of rural life in Denmark is largely due to the absence of coal and iron. Having practically no manufacturing industries, the Danes