be otherwise compatible with their business requirements. As it is, there appears to be no such inducement in England for anyone to initiate, undertake, and publish original work, whether on stability, stream lines, propellers, motors, or strength of materials. Indeed, there are very strong inducements for having such work undone, unwritten, and unpublished.[1]

The next two chapters deal, respectively, with the dirigible balloon and the flying machine. In the former we have an illustrated historic description, tracing the gradual progress that has been made in dirigibles since the first idea of one was suggested by Franklin in 1784; while in the latter the evolution of the power-driven machine from the mere glider is briefly but sufficiently well discussed. "The Future of Aërial Navigation" is a subject on which anyone with an imaginative mind can write something which people will read with eagerness, and this being the case, we think that Mr. Rotch has been wise in only devoting twenty pages to it, in preserving the historic order, and in giving numerous references to what has been written. The book is, of course, much smaller and less compendious than Mr. Turner's.

(4) That such English people as are able, in spite of their national disabilities, to undertake *original work* find their efforts appreciated in Germany is well shown by the publication, by the Teubner Press, of a translation of part i. of Mr. Lanchester's book within a comparatively short time of its appearance in England. The English preface is dated October, 1907, the German preface, by Prof. C. Runge, August, 1909, none too long for the work of the translators and printer. We cannot do better now than quote from Prof. C. Runge's German preface in the following terms:—

"The present book contains so many important original ideas and investigations for the development of free flight that German engineers and men of science will be grateful to the publishers for having provided a translation of it.

The author has in some places altered the text, and in others the text has been altered by the translators in consultation with the author, so that the translation may be regarded as a revised edition. A complete retrospect of existing literature was, however, not attempted; this would have altered the character of the whole book and necessitated completely re-writing it, which was not contemplated by the translator.

For men of science the principal charm of the book lies in the ideas on fluid resistance, and the expression of these by exact mathematical formulæ should be the next problem of hydrodynamics."

Does not the last sentence confirm what has been stated above as to the need of prizes for which mathematicians as well as physicists and engineers are eligible?

G. H. BRYAN.
E. H. HARPER.

PROF. K. J. ÅNGSTRÖM.

BY the death of Prof. Knut Johan Ångström, physical science has lost a conscientious and capable worker, in a field which requires long and continuous experience before success can be achieved. For this reason his departure will be felt more severely than that of many men, who perhaps have gained a greater reputation, but have been fortunate enough to interest others in the line of research they have been pursuing.

Knut Ångström bore an honoured name. Those who still remember the early days of spectrum analysis know how much that science owed to the pioneer work of his father, Anders Johan Ångström, whose map of the solar spectrum remained until Rowland's time the standard to which all wave-lengths were referred.

The son was born on January 12, 1857, and received his school and university education at Upsala, where he spent almost his entire life. He was appointed assistant in the physical laboratory of that university in 1882, graduated as Doctor of Philosophy in 1885, and became lecturer in physics in the same year. In 1895 he was appointed to the chair of physics, and at the time of his death occupied the position of pro-rector of the university.

So far back as 1889 we find Knut Ångström investigating absorption phenomena in the infra-red by means of the spectro-bolometer, and during the following two years he obtained valuable results on the absorption spectrum of carbonic oxide, carbonic acid, and marsh gas. He also discovered the similarity in the characteristic absorption of the same substances (ether, benzene, bisulphide of carbon) in their liquid and gaseous states.

We owe to him, further, a valuable investigation on the infra-red absorption of aqueous vapour, carbonic acid and ozone. All these gases are constituents of our atmosphere, and the effect of the two latter on the temperature of the earth may be considerable, not so much because they absorb a certain portion of the solar radiation, but chiefly on account of their much greater comparative influence in preventing the heat radiated from the earth from being dissipated into space. An interesting and instructing controversy took place in connection with the effect of carbonic acid. Arrhenius in 1896 had given a very ingenious explanation of the Glacial period by assuming that the quantity of carbonic acid in the atmosphere had increased since that time. If it be assumed that the absorption is proportional to the total quantity present, it can indeed be shown that a small variation in quantity would exercise a very considerable effect on the temperature; but, as pointed out by Knut Ångström, the proportionality between absorption and quantity only holds when the quantities are sufficiently small, and he showed that the quantity of carbonic acid in the atmosphere must be reduced to about 20 per cent. of its present value before an appreciable effect in the total absorption can take place.

In the course of the further discussion of the subject Ångström carried out important observations on the effect of pressure, and showed that by increasing the pressure, but diminishing the thickness of the layer so that the total quantity of absorbing material remains constant, a marked increase of absorption is noticed at the higher pressure. It follows that in order to find by optical means the quantity of carbonic acid in our atmosphere, it is not sufficient to determine the amount of gas necessary in our atmosphere, it is not sufficient to produce the same absorption as shown by the atmosphere, but account must be taken of the conditions of pressure. Observations on the absorption of ozone also led to the interesting result that there must be considerable quantities of that gas in the upper regions of the atmosphere.

Knut Ångström's name has become more particularly associated with recent researches in the measurement of solar radiation. He constructed an instrument, the essential portions of which consist

[1] Mr. Alexander has offered a prize of 1000*l.* to the Aërial League for the best and most trustworthy motor of 20 h.p. capable of running unattended for twenty-four hours. While fully appreciating the importance and value of such prizes, it should be pointed out that the worker who attempts to penetrate more deeply into the *thermodynamics* or *general theory* of the internal combustion engine, with the view of paving the way for future improvements, has no prospect of reward, whereas the successful competitor for such a prize *may* have other prospects of a return for his exertions in the form of patents.

of two strips of platinum blackened at the front surface and carrying a thermo-junction at the back. One of these is exposed to the radiation to be measured, while an electric current passes through the other. This electric current is regulated until the two thermo-junctions are at the same temperature. The intensity of the current necessary for this purpose gives a measure of the radiation after certain corrections have been applied. The use of the instrument is simple and convenient, and found so much favour with observers well qualified to judge that the International Union of Solar Research recommended it as a standard for measurement of solar radiation.

Since then the instrument has shown itself liable to certain systematic errors which render further experimental investigations necessary. Its intrinsic merit is, however, so great that it is pretty certain that it will re-establish its reputation, but it is much to be regretted that Prof. Ångström's experimental skill is no longer available for the purpose. When the International Union of Solar Research made its recommendation, it was well aware that for a complete determination of the solar constant it is necessary to divide the spectrum into portions sufficiently homogeneous to allow the application of Lambert's law, but such complete determinations need only be carried out in one or two places. Abbot is doing excellent work, and if this be repeated at another station, say in India, the ground will be pretty well covered. In addition to these standards, we require, however, some instrument which is easily transported, and serves to record the radiations received at different times and in different localities. Ångström's pyrheliometer promises to serve that purpose admirably, as soon as more ready means have been found to standardise it easily from time to time, or to obtain a more permanent absorbing surface of the platinum strips. The coloured glasses which Ångström recently used to absorb parts of the spectrum chiefly affecting the absorption of aqueous vapour or carbonic acid will probably increase considerably the utility of the instrument.

It remains to notice an important contribution of Ångström's in the field of radio-activity. He measured, by means of a Bunsen ice calorimeter, the heat set free in a given time by radium salts, and found it to be constant and independent of the substance in which the radium is placed.

Ångström's charming personality endeared him to all with whom he came into contact, and we condole with Swedish science and the University of Upsala in the loss they have sustained. ARTHUR SCHUSTER.

NOTES.

WE notice with great regret the announcement of the death of Prof. Alexander Agassiz, on Monday, at seventy-four years of age.

SIR JAMES DEWAR, F.R.S., has recently received two foreign diplomas, namely, that of Doctor, *honoris causa*, of the University of Brussels, and that of honorary member of the American Chemical Society.

THE Oceanographical Museum at Monaco, established by the Prince of Monaco, was opened on Tuesday by the Prince in the presence of representatives of European Governments and scientific societies. An article upon the museum and the opening ceremony will appear in a later issue of NATURE.

THE third International Physiotherapeutic Congress was opened by President Fallières on Tuesday at the School of Medicine, Paris. A large number of members of the French Government and of the Diplomatic Corps in Paris, including the British and American Ambassadors, were present at the ceremony.

THE council of the South African Association for the Advancement of Science at a recent meeting resolved by a unanimous vote to offer the presidency of the forthcoming meeting in Cape Town to Dr. T. Muir, C.M.G., F.R.S., and he has accepted the invitation to occupy that office. The actual date of the meeting has not yet been fixed.

LORD KINNAIRD will preside at the dinner to Sir John Murray on Tuesday next, April 5, in connection with the *Michael Sars* expedition for the exploration of North Atlantic waters. The dinner will be held at the Criterion Restaurant, and tickets may be obtained from the honorary secretary of the Atlantic Union, 13A Cockspur Street, S.W.

AT a meeting of the National Geographic Society at Washington on March 26, President Taft presented the gold medal of the society to Sir Ernest Shackleton, and in doing so he remarked:—"It is evidence of the society's high appreciation of the marvellous work you have done in the cause of science, of the endurance, courage and intelligence you have shown in the pursuit of a definite object." On March 28 the explorer was presented with the Cullum gold medal of the American Geographical Society, New York.

ON March 23 the Mayor of Doncaster, Councillor Halmshaw, formally opened a municipal museum at Doncaster, for which purpose some of the rooms in a fine mansion, known as Beechfield, have been set apart. These are devoted to specimens illustrating local geology, archæology, and natural history. Mr. T. Sheppard, of Hull, who a short time ago was asked by the Doncaster Corporation to report on the lines the museum should take, was called upon by the Mayor to give an address. In this he dwelt more particularly upon the educational advantages of museums, and the necessity of provincial museums being of local interest. Subsequently the visitors were conducted round the collections, which reflected great credit upon the curator, Dr. Corbett.

ON Tuesday next, April 5, Dr. A. Harden will begin a course of three lectures at the Royal Institution on "The Modern Development of the Problem of Alcoholic Fermentation"; on Thursday, April 7, Dr. T. G. Longstaff will give the first of three lectures on "The Himalayan Region"; and on Saturday, April 9, Mr. W. W. Starmer will commence a course of three lectures on "Bells, Carillons and Chimes" (with musical illustrations). The Friday evening discourse on April 8 will be delivered by Prof. Percival Lowell, on "Lowell Observatory Photographs of the Planets"; on April 15 by Prof. W. J. Pope, on "The Chemical Significance of Crystal Structure"; and on April 22 by Mr. T. Thorne Baker, on "The Telegraphy of Photographs, Wireless and by Wire."

AFTER a number of slight earthquake shocks, an active eruption of Mount Etna commenced on March 23. Signor Ricco, the director of the observatory there, reported in a telegram from Nicolosi, a suburb of Belpasso, that the lava was advancing on March 24 in a stream more than 1500 feet wide, at a rate of upwards of 60 feet an hour. On March 25 he reported that the violence of the eruption had increased notably during the night, and that quantities of scoriæ were being thrown up, accompanied