

stroke double-acting engine, the former being less complicated than, and at least as efficient as, the latter. For still larger powers the two-stroke double-acting engine is considered to be the logical line of development. Experimental engines of this latter type are being tested, and it is to be expected that a reliable two-stroke double-acting engine will be produced. There are difficulties involved in applying the oil-engine to high-powered war vessels, and a warning is expressed against applying it indiscriminately or without full consideration of its suitability for the service.

The most important stresses to which the liners, pistons, and covers are subjected are those resulting from temperature, and the real safe continuous power rating of an internal combustion engine is therefore largely dependent upon the heat flow through the liners, etc. The maximum power which can safely be developed thus depends upon the working fluid temperatures, and in order to limit the latter without reducing the mean pressure, attention must be given to the efficiency of combustion and volumetric efficiency. The efficiency of combustion is mainly dependent upon the shape of the combustion space and the movement of the air within that space. A compact combustion space is desirable, as this enables

a lower compression ratio to be adopted, and the hemispherical-cavity form is considered to be the best. Whether airless or blast injection is adopted, any movement of the air in the combustion space which causes the globules of fuel to collide with each other or with the walls of the combustion space is to be avoided.

If two engines develop the same mean pressure, that with the lower volumetric efficiency must necessarily be hotter. The crank case engine is a very simple type, but it has a low volumetric efficiency and is consequently a hot and low duty engine. The four-stroke engine has a higher volumetric efficiency than the two-stroke engine because of its more effective scavenging. The introduction of port scavenging simplified the two-stroke engine at the expense of volumetric efficiency, but recent improvements have largely counteracted this. In four-stroke engines the opposed piston type is considered to have nearly as high a volumetric efficiency as the single-piston engine. Heating the induction air has an adverse effect upon volumetric efficiency. Supercharging is receiving considerable attention, but its adoption will only be justifiable if it enables higher mean pressures to be attained without increasing cycle temperatures.

Direction Finding in Navigation.

IT is of great importance to aircraft to know exactly the direction in which they are travelling, and hence direction-finding equipment has been elaborated. This not only takes up much of the limited space available but is often also difficult to operate. The Air Ministry has recently developed a new method of direction finding in its design establishment at Biggin Hill. This was described on Jan. 4 to the Institution of Electrical Engineers by Messrs. T. H. Gill and N. F. S. Hecht.

The chief object of the method is to replace the direction-finding equipment on the aircraft by something very much smaller and easier to operate. A loop aerial is employed at the station, the energy radiated from the loop being a maximum in one direction and a minimum in another. The loop rotates about a vertical axis at a speed of one revolution per minute and sends out a continuous signal. This signal is interrupted when the line of minimum radiation is in the true north direction and a special Morse signal is transmitted at that moment. This enables the observer to start a chronograph. He can then find the interval between the north signal and the instant at which he is receiving minimum radiation. He thus obtains his bearing.

From the results obtained it was found that bearings could be determined with an accuracy at least equal to that obtained by any other radio method of direction finding. For the accuracy necessary for aerial navigation, this method gives a range of 200 miles.

The Air Ministry having found the 'rotating beacon' method of great use for aircraft, the Radio

Research Board has made a series of experiments to find out if it would be equally useful for navigation. The results of these experiments were communicated to the Institution of Electrical Engineers by Messrs. R. L. Smith-Rose and S. R. Chapman at the same meeting.

The rotating-loop beacon was installed near Gosport and a calibration was carried out at fixed points in various directions up to a distance of 60 miles. It was found that the observed bearings were subject to a permanent deviation due to land effects. This permanent deviation was not greater than one or two degrees. At distances exceeding 60 miles, radio bearings got by this method were found to be subject to night effects similar to those obtained in radio direction finding. The errors were not serious, however, until the range exceeded 90 miles oversea. Even at great distances a fair accuracy can be obtained by taking the average value of a series of readings made in about ten or fifteen minutes. It was concluded that, up to 50 miles, the rotating beacon method gives accurate readings.

Compared with the ordinary direction-finder as used on board ship, this method has several advantages. It is independent of the steadiness of the ship, and also of the accuracy with which the ship's head is given by the compass reading at the instant of observation. No correction or compensation corresponding to the quadrantal error associated with the ship's direction-finder is necessary. It was proved, however, both theoretically and experimentally, that the limitation of the accuracy by night effects applies equally to both methods.

School Natural History.

THE annual report of the Marlborough College Natural History Society, the 75th in series, shows evidence of considerable vigour under the presidency of Mr. L. G. Peirson, who is clearly a naturalist of wide attainment. The area of work is defined as ten miles from the College as centre. All the various sections (Astronomy, Archaeology, Ornithology, Botany, and Entomology) seem to have

vigorous boy members with to each a master having the same hobby. This year the most notable record is that of 558 species and varieties of flowering plants—evidence of close raking, though the surrounding country is singularly varied with its forest and great downs, its chalk hills and lands of high cultivation, its water meadows and valleys of rocks. It is the only place where the Icterine Warbler has been

known to breed in England, and perhaps this is true of the Sand Grouse, which once seemed to bid fair to become a permanent resident of Martinsell, drinking from its dewponds.

The Society as its serious task records the meteorology of its area, the dates of flowering of plants, of appearances of all kinds of insects, and of the laying of eggs by birds, with other similar information. The splendid old records of Preston and of Smith, of Everard im Thurn, and above all of Edward Meyrick, allow comparisons of the organisms of forty to fifty years ago with those found to-day; but they are to some degree deceptive, as the area for intensive study was practically ten miles in diameter then, while it is now twenty. For purely scientific purposes there should be subdivisions into ecological regions, and this is being attempted by similar societies elsewhere. We believe, however, that boys are gregarious creatures and prefer mass rather than individual studies, and that such changes, if forced, may drive the work entirely into the hands of masters—an action which would kill the object of the Society to suggest natural history to the greatest number of boys as likely to be a delightful hobby in after life.

Clearly, with the boys as first object in view, the Society no longer publishes the research work of one of the masters—A. G. Lowndes—but this is a gain to science, not a loss, as it is readily accepted in specialist journals. He and his pupils keep and breed many animals and plants from ponds, playing with the pH of the water and attempting to correlate form with its variation. The technique is excellent, and Lowndes's work, in proving the negation of Labbé's results on many species of Cyclops, is important. To the boy a live animal is the thing, and we should like to see more records of the keeping and breeding of insects, worms, snails, and all invertebrates in the records of the different sections; indeed, we hold that the museum of every natural history society requires a separate gallery for such work on living animals, and we believe it would prove the popular section of its exhibits.

University and Educational Intelligence.

CAMBRIDGE.—Mr. W. B. R. King, Fellow of Magdalene College, has been awarded the Sedgwick Prize for an essay on "Contributions to the Geology of some District in which Sedgwick worked." The subject announced for the next award is "A Petrological or Stratigraphical Study of a Rock Group."

EDINBURGH.—At a meeting on Jan. 23, the University Court received, with very great regret, intimation from Sir James Walker of his intention to retire from the chair of chemistry at the end of the current academical year. It was resolved to record the high appreciation of the Court of his long and distinguished service to the University.

The status of University lecturer was conferred upon Dr. Alexander Lauder, head of the Chemistry Department in the Edinburgh and East of Scotland College of Agriculture, in recognition of the responsible part which he has long taken in the teaching of chemistry in the curricula for degrees in agriculture and forestry.

The Court received with gratification intimation of a bequest by the late James Sanderson, Galashiels, of five shares of the residue of his estate, to be applied for the advancement or promotion in the University of technical and scientific study and research in the chemistry and engineering branches of the Faculty of Science. The amount of the bequest is estimated at about £35,000.

The offer was accepted of an endowment con-

tributed by former students and others associated with the work of emeritus Prof. Robert Wallace, for the foundation of a University prize, to be known as the "Wallace Prize," to be awarded to the best degree student of the third year in agriculture not holding a Vans Dunlop or Steven Scholarship.

NOTTINGHAM.—In view of the fact that the new buildings, which are being erected by Sir Jesse Boot, Bart., in the University Park, will be opened by H.M. the King in July next, the authorities of University College are contemplating in the near future an appeal to increase the endowment fund of the College. Two members of the Council of the College, Mr. H. F. Lancashire, J.P., and Mr. G. Spencer, J.P., have announced their intention of endowing a chair by a joint gift of £20,000. Mr. Lancashire, who has been on the Council of the College since 1917, and was in 1926 elected a vice-president of the Court of Governors, is managing director of Messrs. J. B. Lewis and Sons, Ltd., hosiery manufacturers of Nottingham and Ilkeston. He took an active part in the reorganisation of the Textiles Department of the College in 1920, and has been for some years chairman of the Textiles Advisory Committee. It is no doubt due to his untiring energy that University College, Nottingham, now possesses possibly the finest hosiery laboratory in Great Britain. Mr. George Spencer, who was elected a member of the College Council in 1923, is head of the firm of Messrs. George Spencer and Co., hosiery manufacturers, of Nottingham, Hucknall, and Lutterworth. Mr. Spencer has for many years taken a great interest in the work of the College, and is one of the two trustees of the Revis Bequest, whereby the College acquired a sum of approximately £49,000, the interest on which is to be devoted to the provision of scholarships and studentships.

The new buildings occupy a commanding position in the new University Park, and will provide accommodation for the Faculties of Arts, Pure Science, and Economics and Commerce. The Applied Science Faculty will remain at the old building in Shakespeare Street, with the exception of the Heat Engines Laboratory connected with the Engineering Department, for which provision is being made in a special block of the new buildings. A hall of residence, accommodating eighty women students, is being erected in the University Park, and it is hoped that this will be ready for occupation during the ensuing session. The playing fields of sixteen acres are situated in the Park, within a few minutes' walk of the University and the Hostel. Sir Jesse Boot bore the cost of the laying out of these, and also of the erection of the sports pavilion and the women's hostel.

OXFORD.—It is understood that during the next two terms the problems presented by the congested state of the Bodleian Library will be seriously considered by the Hebdomadal Council. The principle of separate faculty libraries has already been accepted in the case of Law and Natural Science. Novels are shelved in cellars far removed from the main library, so there are precedents for the separation of that vast mass of 'deposited' literature, much of it of doubtful value, that at present dilutes, and renders difficult of access, the more valuable portions of the library.

A lecture delivered on Jan. 26 on "Isocrates in England" in ancient Greek by the Public Orator is in the nature of a revival of a lecture founded in 1583, the year in which Galileo watched the pendulum in the Duomo at Florence. It was noticeable that the lecturer does not include natural science among the subjects to be taught to boys between 16 and 18 years of age; evidently pendulums are still swinging.

Dr. F. A. Dixey, late Sub-Warden, Wills Medical Fellow and Bursar of Wadham College, has been elected to an emeritus fellowship.