Sir John Murray and Mr. Robert Irvine discussed the distribution of albuminoid matter and saline ammonia in sea-water; and Sir John Murray with Mr. F. P. Pullar exhibited and described the sounding-machine they employed in their bathymetrical survey of the fresh-water lakes of Scotland, and gave an account of the configuration of the beds of the lakes of the Loch Katrine group. The authors expressed their intention of extending the work to the other lakes in Scotland, although they felt that it was rather for the nation than for individuals to carry out work of the kind.

OTHER PAPERS.

Colonel Sir John Farquharson, late Director General of the Ordnance Survey, gave an account of the progress of the work of that department during the last twelve years, and exhibited a number of illustrative diagrams and specimen maps. He said that during the twelve years (1887-99) there have been probably more changes made in the character of the work done by the Survey than in any other equal period of its history; and, as regards the areas covered by its operations, they have been largely in excess of the areas covered during any previous equal period. This is, of course, due to the fact that revisions have now largely taken the place of original surveys. The most important advances made were:—

The progress (to completion in 1890) of the original cadastral survey of England and Wales, including the 6-inch surveys of uncultivated districts. The progress made on re-surveys for the larger scales of various counties of England and Scotland which had been originally surveyed for the 6-inch scale only; and the progress made on the revision of the original cadastral surveys of England and Scotland, whether on the 25-inch or 6-inch scale. The progress made on the re-survey of Ireland for the $\frac{1}{2500}$ or 25-inch scale. The progress made on the completion of the original new series engraved 1-inch maps of Great Britain and Ireland, both in outline and with hills. The progress made on the revision of the new series of 1-inch engraved outline maps of Great Britain and Ireland, and the commencement of the issue for Scotland and the North of England (and for Ireland ultimately) of the same revised 1-inch map with hills in brown by double printing. The progress made with coloured 1-inch maps of the South of England. The progress made with maps on scales smaller than 1 inch to a mile.

A short account was given of the nature, causes, and results of the changes made since 1887 in the system of carrying out the survey, some of which were due to the reports of committees, or suggestions from the general public, while others have been necessitated by the changes which have taken place in the character of the work done by the Department.

The Ordnance Survey Department, in 1887, published town maps at the cost of the State, on the scales of 10 feet ($\frac{1}{500}$) and 5 feet ($\frac{1}{1056}$) to a mile. It does so no longer. The reason for this change was stated. The sales of the Ordnance Survey maps were in 1887 in the hands of the Stationery Office; they are now in the hands of the Ordnance Survey Department itself. The reasons for and results of this change were stated.

Some remarks were also made as to the organisation and superintendence of the department and of its work; as to the use made of the Ordnance Survey maps by other departments of the State and by the public generally; and as to the important work which still remains to be done by the Ordnance Survey.

Mr. Vaughan Cornish described the sand-dunes bordering the delta of the Nile dealing with the ripples, sand-dunes, and dune-tracts in turn.

Ripples.—The author had previously measured twelve wind-formed ripples in the blown sea sand on the Dorset coast. The average ratio of length to height was L/H = 18·4. The least height was ·06 inch, and the greatest ·34 inch. These measurements were, for the most part, of one or two individual ripples. Mr. E. A. Floyer measured six of the largest kind of ripples on the El Arish route, and obtained L/H = 17·7 with H from 6 to 10·6 inches. The author measured thirty-seven *consecutive* ripples to leeward of a sand-dune near Ismailia. The ripples had an average height of 1·43 inches, and the average L/H was 16·57. The appearance of these was intermediate between that of ripples where accumulation is rapid (which never grow large), and the large and nearly symmetrical ripples (? analogous to sastrugi), as much as 11 feet in wave-length, the formation of which is apparently accompanied by a considerable lowering of the general level.

Dunes.—A tract of a few hundred acres of small, but true, dunes (not ripples) on a sandy foreland, exposed during the fall of the Nile, afforded an opportunity for similar measurements.

Higher and lower dunes succeeded one another, and, viewed transversely, the ridges were strongly undulating. Nevertheless, a line having been marked out in the up-and-down-wind direction, the *average* L/H for twenty-four consecutive dunes was found to be 18·04, average height 20 inches. Another set of measurements taken near the same line on the succeeding day gave L/H = 17·89 for twenty-three consecutive dunes. Apparently the ridges are formed of the nearly uniform (L/H = 18) shape, and lateral inequalities are subsequently developed in the manner explained in the *Geographical Journal*, June 1898, pp. 637-9, but these do not affect the *average* L/H. The author hopes to make similar measurements of trains of larger dunes.

The straight, slipping lee cliff of dunes is caused by the undercutting of the eddy. In the dunes near Ismailia a progressive development of the profile form was observed. At first both windward and lee slopes are very gentle, and the highest point is near the middle. The summit apparently moves to leeward, and the lee slope becomes steeper; a slipping cliff is formed on the upper part of the lee slope. This pushes back towards the summit, and the windward slope grows steeper. Finally, windward and average leeward slope become of nearly equal steepness, and the top of the cliff coincides with the summit of the dune.

Dune Tracts.—The condition for formation of a dune tract in a sandy district is that the rate of travel of the sand should be locally diminished without a corresponding diminution in the supply of sand. The persistence of such a condition may cause a stationary dune massif without fixation.

In the sandy district visited by the author the formation of a dune tract or dune massif appears to be chiefly determined by the presence of ground moisture, which gives coherence to the sand. Thus the boundaries of these massifs frequently appear inexplicable when an explanation is sought in the wind. Within the bounds of the massif, however, the modelling of the surface is explicable by the action of the winds. In the neighbourhood of Helwan, wind erosion of limestone and other rocks is very active over areas where there are no dunes. An examination of the wind-formed detritus showed a quantity of sand-sized particles sufficient for the formation of dunes; and the explanation of their non-formation seems to be that the sand-sized particles are too small a *proportion* of the whole. According to this line of reasoning, dunes will only be formed where dust formation proceeds slowly, for if dust be produced rapidly the proportion of sand-sized particles remains low.

Travel papers, for the most part accompanied by graphic illustrations, were contributed by Mrs. W. R. Rickmers on the rarely visited region of Eastern Bokhara, by Mr. W. R. Rickmers on the Karch-Chal mountains in Transcaucasia, by Dr. H. O. Forbes on the island of Sokotra, by Mr. O. H. Howarth on the province of Oaxaca in Mexico, by Dr. A. C. Haddon on some geographical results of the recent Cambridge anthropological expedition to the Malay Archipelago and New Guinea, and by Captain Wellby on a remarkable journey through the western borderlands of Abyssinia. Mr. E. Heawood contributed a paper on the date of the discovery of Australia, in which he brought forward evidence for discrediting the rumours of the discovering of Australia in the fifteenth century or the early part of the sixteenth.

The eighth report of the Committee on the Climatology of Tropical Africa was presented, giving records from forty stations.

MECHANICS AT THE BRITISH ASSOCIATION.

MEETING under the presidency of Sir William White, Chief Constructor of the Navy, naturally the papers which came before the Section dealt mainly with marine engineering, canal and harbour works, and allied subjects.

Owing to the energy of the President a very complete programme was secured; and the papers read and discussed were certainly considerably above the average. The attendance at the sectional meetings was also much better than usual.

On the opening day, after the presidential address, a paper by Messrs. Coode and Matthews on the Admiralty harbour works at Dover was submitted to the Section. It was taken early in the programme in order that the engineers present at the meeting who naturally wished to carefully inspect the

magnificent works now in progress at Dover, which will render that port one of the finest in the kingdom, should hear beforehand an account of what it is intended to do from the engineers responsible for the design. In the discussion the difficulties which have been brought about by the more rapid advance of the Commercial Harbour Pier, as compared with the extension of the Admiralty Pier, were much in evidence; but this, after all, is only a question of a more or less ephemeral character, and it is a pity that the discussion did not turn more upon the merits of the particular plan which has been adopted in the construction of this great harbour. It is noteworthy that the general scheme of the present plan differs but little from previous proposals; only that additional deep-water space has been obtained.

If the sanguine expectations of the people of Dover are in any way fulfilled, Dover on the completion of these works will prove a formidable rival to Southamption; before, however, any such rivalry can become serious, Dover must be provided with a railway service on an entirely different scale from that now supplying the wants of the town. The service is inadequate; it is frequently unpunctual, and contrasts most unfavourably with the splendid service which the South-Western Company have organised between Southampton and London.

The other paper taken on the opening day was one descriptive of a process for rendering wood non-flammable. Specimens of wood treated by this process were exhibited, and a practical demonstration of its non-flammability was given at the meeting. The President mentioned in the discussion that the Admiralty have not been satisfied with other people's experiments; they have themselves experimented on wood treated in this way, and have satisfied themselves that the process is a successful and valuable one. It is, however, not only in ships of war, but also in passenger steamers and in the gigantic modern hotels that the use of non-flammable wood will have its application, in spite of the extra cost of the finished wood when treated by this process.

On Friday a paper prepared by Sir Charles Hartley, descriptive of the engineering works of the Suez Canal, was read by Sir John Wolfe Barry in the absence of the author. This paper was one of the greatest interest, giving a complete history of the engineering features of the canal, of the enormous growth of the traffic through the canal, and of the gradual steps which have been taken to provide for that increased traffic, both by widening and deepening the original cutting. How great a change has been brought about in the time of transit by the use of the electric light for enabling night passages to be made can only be realised by a study of the figures given by the author as to the present time of transit compared with what it was ten years ago.

The second paper on Friday was the one that proved, perhaps, the most attractive of all on the programme of the Section. It was a short paper by Mr. Parsons, with details of the fast cross Channel and Atlantic liners which he proposes should be driven by his steam turbines. Models of the proposed vessels were shown, and a working model of a set of steam turbines to show how simple it was to run astern.

Considering how frequently the wildest statements are made as to the possible speed of mail steamers and smaller fast passenger boats, it is noteworthy that Mr. Parsons proposes quite moderate speeds in his liners and cross-Channel steamers. This paper was made more interesting from the figures which the President had given, in his address to the Section, on the question of the relation of power to speed and displacement.

The President had shown conclusively how impossible it was to apply results deduced from small vessels to large vessels; and his calculations as to the enormous power required to drive one of the large vessels at high speeds show that we have little hope of obtaining such speeds with present conditions.

Mr. Parsons in his paper fixed the speed of his cross-Channel boat at thirty knots, and although the boat is only to have a 1000 tons displacement, it will require 18,000 horse-power to maintain that speed. He did indeed hint at an express-Channel steamer which should attain a speed of forty knots, but only at the expenditure of 50,000 horse-power: figures which are likely to damp the enthusiasm of any ship-owner or ship-builder. His Atlantic liner was to have a displacement of 18,000 tons and a speed of twenty-six knots, with an indicated horse-power of 38,000.

The paper which followed Mr. Parsons' was an extremely interesting and valuable one by Mr. Mark Robinson, on the Niclausse water-tube boiler. It came as a natural corollary to Mr. Parsons' paper, because Mr. Parsons had stated in his communication that his proposed steamers would be fitted with the water-tube type of boilers. The interest which has been aroused, and the controversy which has arisen over the introduction of water-tube boilers into the Royal Navy also made this paper one of considerable importance. The author only described fully the particular type of boiler with which he was most familiar, namely, the Niclausse; but the general conclusions and the general results apply equally to all boilers of this type.

Mr. Robinson pointed out in his paper that the Niclausse boiler as now made in this country, or rather as it will be constructed in this country when the plans now being made are completed, is very different from the Niclausse boiler which was fitted into one of the ships of the navy some years ago.

For reasons which are quite satisfactory the Admiralty have not yet been able to satisfactorily test these Niclausse boilers; and now in view of the great changes in the mechanical details of this type of water-tube boiler, interest in the results of their tests will be more or less discounted.

There is no doubt that this boiler will be one of the most satisfactory in its mechanical details of all the water-tube type, and will have a great future, both for sea-going purposes and on land as well.

One set of figures given by the author to show the advantage of the extremely short time required for removing and replacing a tube or tubes is worth quoting. In one instance the boilers were blown down, three tubes removed and replaced by others, and pressure got up again in thirty-five minutes from the time the operation started.

The concluding paper on Friday was one by Captain Lloyd, describing a method which has been developed at Elswick for discharging torpedoes below water from the broadside of a ship when steaming at a high speed. The problem, a most difficult one in all its mechanical details, has been successfully surmounted, and a considerable number of these submerged tubes have been already fitted, and a large number are in the process of fitting at the present time. The paper was, of course, a highly technical one; but the admirable diagrams which had been prepared rendered it easy to follow the working of the mechanism from the firing of the cordite charge to the exit of the torpedo from the tube.

Saturday was fixed by the authorities as the day upon which the French Association would pay their official visit to the British Association, and the paper which was read before the Section, reinforced by a considerable number of French engineers, was one by a distinguished French engineer, M. Alby, describing the construction and erection of the Alexander III. bridge over the Seine in Paris. This bridge forms part of the Great Exhibition of 1900, and is situated on the line of the Great Avenue which will connect the Champs Elysée with the Esplanade des Invalides. Æsthetical considerations, therefore, have played a most important part in the design which has been adopted. A low-arch form of bridge was the only acceptable one, and the great horizontal thrust produced by such a type of arch has given the engineer a very anxious task in the design of his abutments. A full description of the bridge was given, and of the costly but necessary temporary structure or travelling bridge, as the author termed it, by means of which the erection of the bridge proper has been carried out. During next year engineers will have an opportunity, when visiting the Exhibition, of admiring the beauty and harmony of the design, and the skill with which the great difficulties met with have been overcome.

Monday, as usual the electric day, was not in this instance productive of anything very striking. Perhaps the most interesting communication was one by Mr. Cowper-Coles on some recent applications of electro-metallurgy to mechanical engineering. The author described a very beautiful process for the electrolytic manufacture of projectors for search lights for naval and military operations. A projector made by this process was exhibited to the meeting, and figures were given to show that the fine coating of palladium used protects the silver-faced projector from any injury owing to the intense heat of the arc-light, the pure silver face being found to tarnish very rapidly in consequence of the intensity of the heat.

Some brief notes by Mr. A. Siemens on electrical machinery on board ship were interesting because they gave the President the opportunity of refuting the common notion that we are

behindhand in the application of electricity to ammunition hoists and other purposes in our navy. The President pointed out that in matters of this kind the opinions and the wishes of those who have to work the appliances must be taken into account.

The concluding day was devoted to several papers of extreme interest. The business was begun with the consideration of a paper by Mr. Thornycroft on recent experiences with steam on common roads. After dealing with the impediment to progress due to the Locomotives on Highways Act of 1896, and making suggestions as to the steps which should be taken to remove these obstacles in future legislation, the author gave an extremely valuable *résumé* of his own work in this field of mechanical science. He described the different types he has built since 1896, and the chief changes in the mechanical details which experience has convinced him to be necessary. He has built vehicles both for heavy goods traffic and for passenger traffic, and has adopted a method of chainless transmission in his most recent type. The author in conclusion pointed out that, after all, in motor work a good deal depended upon the care and intelligence of the driver employed.

A paper by Mr. Edward Case, who, we regret to say, died only a few days after the paper had been read, descriptive of the Dymchurch sea-wall and the reclamation of the Romney marshes, was next taken. These reclamation works are of great antiquity; in modern times the erection of high groynes for the protection of the wall brought about that which they were expected to prevent, namely, the undermining of the wall. Mr. Case decided, when he took over control in 1890, to adopt an entirely different system, and since 1894 a number of low groynes have been run out; the result of which has been to raise the level of the fore-shore as much as 8 feet at the east end of the wall. These groynes have been constructed in such a way that they can be gradually raised as the level of the beach gets higher, at a very trivial expense and with very little difficulty.

The Section meeting was, as has been stated before, an extremely successful one: the quality of the papers being high, the discussions good, and the attendance throughout thoroughly satisfactory. There can be no doubt that a great deal of this was due to the energy and the interest taken by the President in the work of the proceedings. It is too often forgotten by Presidents of Sections that the success of any particular Section is almost entirely in the hands of its President.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The 204th meeting of the Junior Scientific Club was held in the University Museum on Friday, October 20. Mr. Hartley (Balliol) read an interesting paper on the history of the discovery of the law of isomorphism.—Owing to the length of important private business Mr. Gibson (Ch. Ch.) was unable to read his paper on the retention of food by plant soils, as announced. The following are the officers for the ensuing term:—J. T. Mance (Balliol), pres. H. E. Stapleton (St. John's), chem. sec. C. H. Barber (non-coll.), biol. sec. F. W. A. Fleischmann (Magd.), treasurer. F. W. Charlton (Merton), editor.

The examiners have notified to the Vice-Chancellor that they recommend for election to the Burdett Coutts scholarship, which is of the annual value of about 115*l.* and tenable for two years, Mr. J. B. Scrivenor, Commoner of Hertford College. They also recommend that Rev. E. C. Spicer, Commoner of New College, be appointed an extra scholar, to retain his scholarship for one year.

CAMBRIDGE.—St. John's College has once more shown its appreciation of scientific merit by electing to fellowships Mr. J. J. Lister, University Demonstrator of Comparative Anatomy, and Mr. A. C. Seward, University Lecturer in Botany. Mr. Lister, who has done important work on the *Foraminifera* and other groups, is a nephew of the President of the Royal Society, and son of Mr. Arthur Lister, who was last year elected a Fellow of the Society. Mr. Seward is a Fellow of the Royal and Geological Societies, and has attained a high position as an authority on fossil plants. The first volume of his treatise on this subject was reviewed in NATURE (December 15, 1898). He has held the Harkness Studentship in Palæontology, and gained the Sedgwick Geological Prize in 1892. Both gentlemen are Masters of Arts of the College of some years' standing, and have been elected out of the ordinary course.

Mr. J. L. Tuckett, Fellow of Trinity College, has been appointed an additional Demonstrator of Physiology by Sir M. Foster.

Prof. G. Sims Woodhead has been elected to a Fellowship at Trinity Hall.

THE details of the reorganisation of the Education Department and the transference of its duties to the new Board of Education are under consideration by a departmental committee; and the committee of the City and Guilds of London Institute have signified their willingness to give any help which may be needed to secure the proper recognition of technological teaching in the arrangements about to be made. Reference to this matter is made in the report of the examinations department of the Institute issued a few days ago. It is remarked that, having regard to the Institute's close connection with technical teaching in all parts of the country, no organisation of education can meet existing requirements which does not take into consideration the educational work now under the immediate direction of the Institute. The report further states that the committee fully recognise how desirable it is to avoid, as far as possible, any overlapping in the organisation of the classes and examinations directed respectively by the Science and Art Department and by the Institute; and they are of opinion that, with the view to the due encouragement of practical instruction in the technology of the different trades in which artizans are employed, the teaching of technology should be placed on the same basis, with respect to State aid, as that of science or art.

MR. A. E. BRISCOE, the principal of the West Ham Municipal Institute, sends a few particulars of the loss caused by the disastrous fire which occurred a few days ago. The whole of the upper floor of the building, including the chemical, art and women's departments, the engineering and physical lecture theatres, the drawing office and the engineering laboratories have been completely gutted. The chemical and art departments are the greatest sufferers, but there is not much to choose between them and what has happened to the others. The electrical and physical laboratories were flooded by the water, and a great many expensive instruments have been damaged by water; but the galvanometers and some of the other expensive things were on shelves covered by dust-covers, so that they have escaped damage. The expensive machinery in the engine and dynamo laboratories and in the engineer's workshop has not suffered by fire, but, of course, tons of water have fallen upon it, and a very great amount of damage has been done. The institute was covered by insurance to the extent of 47,000*l.*, and it is believed the total damage will not reach this amount. Of course, nothing can compensate for the large amount of work that has been done by the staff in the equipment of the institute, and will now have to be done all over again. Though the borough is not a rich one, it is satisfactory to know that the institute will be rebuilt and probably enlarged, as the classes were already too great for the accommodation. The fire commenced in the advanced chemical laboratory, but the origin is absolutely unknown. The building had not been used for thirty-six hours prior to the outbreak.

SCIENTIFIC SERIALS.

Symons's Monthly Meteorological Magazine, October.—Meteorological extremes. II. Temperature. Mr. Symons has collected a large amount of useful information upon this subject from all trustworthy sources. For yearly mean temperatures preference is naturally given to Dr. Buchan's isothermic charts published in the *Challenger* volume, "The Circulation of the Atmosphere." The highest yearly isotherms are 85°, and these occur only in three localities, the largest covering a portion of Central Africa, bounded on the north by latitude 18° N. Two smaller areas exist, one in Central India and the other in the northern portion of South Australia, respectively in latitude 15° N. and 15° S. The absolute range of the shade temperature in the northern hemisphere, and probably in the world, is 217°·8, depending on the absolute maximum of 127°·4 in Algeria, July 17, 1879, and the absolute minimum of −90°·4 at Verchoiansk, Siberia, January, 15, 1885. The hottest region is