

Mr. Osbert H. Howarth gave a magnificent series of new views of the Cordillera of North America, in illustration of a paper on the Sierra Madre of Mexico, from which he had just returned. Mr. D. G. Hogarth summarised the result of his recent journey in the valley of the Euphrates. The river was found to be so difficult of passage as to form a natural frontier of the most effective kind. Very fine remains of Roman bridges, aqueducts, and forts were found and photographed. Mr. Weld Blundell, just returned from an even more adventurous journey in the Libyan Desert, gave a paper full of interest describing his observations and photographs. Dr. A. Markoff gave a comprehensive general description of Russian Armenia. Travel papers of minor importance, but no less popular on that account, were read by Mr. W. H. Cozens-Hardy on Montenegro, and by Miss Baidon on a visit to New Guinea.

An animated discussion was also called forth in connection with a valuable paper by Mr. Somers Clarke, on the geography of Lower Nubia. He vividly described the scenery and present economic state of the site of the proposed great Nile reservoir. He said that the Wadi Kenus, the abode of the Beni Kensi tribe, is nearly coincident with the projected Nile reservoir, and if the proposed scheme is carried out the population to be displaced numbers about 30,000, inhabiting a cultivated area of some 10,000 acres. Population in the Ptolemaic times must have been greater, as there are tracks about Korti and Dakkeh, once under cultivation, now abandoned. In the Dodeka-Schoenus there is a number of temples and remains of antiquity, a further proof of considerable population; and the district is protected by a line of forts, some of very high antiquity, others of later date. The existence of Egyptian civilisation side by side with the ruder customs of the natives, is especially to be observed in the method of burial. The present inhabitants on the course of the Nile valley from Assuan to Wadi Halfa exhibit very slight variations in modes of dress, particularly among the women. Men go to Cairo, women stop in the villages, so that the men adopt the ordinary dress of fellahin in Egypt. The manner of building houses from lumps of earth, crude brick, with flat wooden or vaulted brick roofs, constructed in the same way as those used by the ancient Egyptians, was noticed. Reed shelters are also in use. Not only the unique antiquities but the present people, with all life, animal and vegetable alike, are affected by the projected reservoir. In view of the contemplated destruction it is of the utmost importance to make an exhaustive scientific investigation of the valley before it is submerged.

Mr. Norman Lockyer, in commencing the discussion on this paper, said that if the dam were constructed it might after all, if preceded by an exact scientific survey, prove to be a blessing in disguise even to Egyptologists, and that the advancement of science and the advancement of Egypt might proceed hand in hand.

Papers of more technical interest were contributed by several authors. Mr. A. Montefiore sent a detailed account of the equipments of the Jackson-Harmsworth Arctic expedition; Mr. John Thomson gave an account of the methods of photography best adapted for the use of travellers; and Mr. B. V. Darbishire showed a new method of representing the surface configuration of the British Islands. Mr. G. G. Chisholm initiated a valuable discussion on the spelling of geographical names, the purpose of which was to show that the indispensable preliminary requirement, with a view to the end stated, is to have an adequate scheme of orthography, making up for the deficiency of such signs by clear rules to be followed with respect to the sounds for which signs are lacking. To leave it to the individual judgment to decide what is the nearest sound represented in the scheme to one for which no express provision is made, is bound to lead to confusion. The inadequacy of the latest version of the Royal Geographical Society's scheme from this point of view was pointed out, and suggestions of remedies made. The addition of some subordinate rules likely to promote the efficiency with which the scheme is carried out was recommended. Attention was drawn to special difficulties in connection with Russian and Greek names, and reasons given for entertaining the hope that, with the aid of Oriental scholars, special rules might usefully be framed with regard to the spelling of Chinese and Indo-Chinese names. Finally, it was urged that, once an adequate scheme clearly expounded is adopted, it would be of great importance to make special arrangements to secure the co-operation of all contributors to the *Geographical Journal* and other geographical periodicals,

of publishers and authors, and, above all, of the newspaper press towards getting the scheme carried out.

Mr. H. Yule Oldham attracted much attention to his statement of evidence, from a MS. map at Milan, of date 1448, of the discovery of Brazil before that date. In the long discussion which followed, the evidence was criticised by several speakers who were reluctant to accept it without more ample proof.

Colonel Feilden read a brilliant paper on current polar exploration, in which he explained the position of the various expeditions now in the field, and expressed a strong opinion as to the folly of inexperienced travellers adventuring themselves lightly into regions so fraught with danger.

Mr. E. G. Ravenstein presented a discussion of the climatology of tropical Africa, resulting from the observations collected by the Committee on African Climate appointed some years ago. The results present the first satisfactory generalisations on the tropical climates of Africa, but its scope cannot be conveniently summarised. Mr. Theodore Bent gave an admirably illustrated account of his recent visit to the Hadramut in Southern Arabia. The proceedings of the Section were assisted by several eminent foreign geographers, amongst whom Prof. Vambery, of Budapest, and Prof. Guido Cora, of Turin, took a leading place.

#### MECHANICS AT THE BRITISH ASSOCIATION.

THE sittings of Section G, at the recent meeting of the British Association at Oxford, were held in the Common Hall of Keble College, which afforded more than ample accommodation for the purpose.

We have already printed the presidential address of this Section. Prof. Kennedy, who some time ago resigned his chair, was one of the pioneers of the modern movement towards technical education in mechanical engineering, and it was natural, therefore, that he should largely deal with the training of engineering students in his address.

There was a very long list of papers down for discussion at the meeting. The first sitting was held, according to custom, on the Thursday, and the Section met on the Friday, Saturday, Monday, and Tuesday following, that is to say, from August 9 until August 14. With so long a list of papers to deal with, we can do no more in the space at our command than simply refer to some of them by name, and we therefore give the following, which is a complete list of the papers read:—

*Thursday.*—(1) Some reminiscences of steam locomotion on common roads, by Sir F. J. Bramwell, F.R.S.; (2) bore-hole wells for town-water supply, by H. Davey.

*Friday.*—(1) Joint meeting with Section A:—(a) On integrators, harmonic analysers and integrators, and their application to physical and engineering problems, by Prof. O. Henrici, F.R.S.; (b) note on the behaviour of a rotating cylinder in a steady current, by Arnulph Mallock; (c) on the resistance experienced by solids moving through fluids, by Lord Kelvin, P.R.S.; (d) discussion on flight, in which Lord Rayleigh, Mr. Langley, Mr. Maxim, and others took part; (2) the strength and plastic extensibility of iron and steel, by Prof. T. Claxton Fidler; (3) tunnel construction by means of shield and compressed air, with special reference to the tunnel under the Thames at Blackwall, by M. Fitzmaurice.

*Saturday.*—(1) On methods that have been adopted for measuring pressures in the bores of guns, by Sir Andrew Noble, K.C.B., F.R.S.; (2) the most economical temperature for steam-engine cylinders, by B. Donkin.

*Monday.*—(1) Signalling through space, by W. H. Preece, F.R.S.; (2) some advantages of alternate currents, by Prof. S. P. Thompson, F.R.S.; (3) continuous current distribution of electricity at high voltage, being a description of the lighting of the city of Oxford, by T. Parker; (4) a special chronograph, by H. Lea; (5) a direct-reading platinum pyrometer, by G. M. Clark.

*Tuesday.*—(1) Report of committee on dryness of steam, by Prof. W. C. Unwin, F.R.S.; (2) the temperature entropy diagram, by H. F. Burstall; (3) the hunting of governed engines, by J. Swinburne; (4) engineering laboratory instruments and their calibration, by Prof. D. S. Capper; (5) lighthouse apparatus and lighthouse administration in 1894, by J. Kenward; (6) on spring spokes for bicycles, by Prof. J. D. Everett, F.R.S.

Sir Frederick Bramwell's paper was one of considerable interest, the veteran engineer described the experience of his youth when he was a protégé of Hancock, who was then running a steam carriage for ordinary purposes of carrying passengers on the public roads. Sir Frederick stated how he used to travel from work to his home when an apprentice, Hancock generally giving him a lift on his return journey with the steam carriage. Under the existing state of the law steam locomotion of this nature is, of course, an impossibility, the restrictions which have been put on this method of transportation being absolutely prohibitive. These restrictions were brought about in consequence of the introduction of traction engines, as we now see them on our country roads. The pace of steam-propelled vehicles is limited to three miles an hour, and it is necessary that a man should walk in front of the engine with a red flag; naturally such regulations make the carriage of passengers out of the question.

This is much to be regretted, for steam carriages, as has lately been proved by continental experience, can be made both safer and more expeditious than those drawn by horses. They are more under control, being easily stopped and turned, and they are naturally far cheaper.

To return, however, to Sir Frederick Bramwell's paper, the details of the early road steam carriages possess considerable interest at the present time, as pipe boilers were used in nearly all of them, and now that the water-tube boiler is coming to the front so rapidly, it is interesting to see what was done by the pioneers of steam engineering. Many inventors whose brains are active in this field would do well to study the earlier records, for old types are now being reinvented at an expenditure of much useless brain work and anxiety.

The second day of meeting of Section G (Friday, August 10) was a very busy one, a joint sitting having been arranged with Section A. Four subjects were down for discussion, as stated in the above list of papers.

Prof. Henrici's contribution was one of great interest, as also was Mr. Mallock's note on the behaviour of the rotating cylinder. Lord Kelvin also gave a valuable lecture on the resistance of solids moving through fluids.

Public interest, however, was chiefly centred in the paper read by Mr. Maxim, in which he described his flying machine. To hear this part of the transactions a large number of members flocked into the hall, many of them being ladies. Some of the members present did not appear to take much interest in the more abstruse subjects dealt with by the previous lecturers, and their want of attention made it a little difficult to follow the first three speakers.

Two papers, relating purely to Section G, were taken on this day; the first was Prof. Fidler's monograph on the extensibility of iron and steel, a valuable contribution which, however, was read to a very thin audience.

The author pointed out that the stress-strain diagram of ductile material as autographically drawn does not indicate any definite relation between tensile stress and plastic strain. The unit stress varies in different parts of the bar; the elongation measure by the diagram being that of the whole bar. The author's experiments indicated that the plastic extensibility under any given stress is nearly the same in all segments of the bar's length, even when the ultimate elongation varies. Volumetric measurements of the successive segments indicate that there is no sensible telescopic shear, and justify the general application of the assumption of unchanging volume. It might at first sight be supposed that a bar of uniform plastic extensibility ought to draw out uniformly over its whole length, but beyond a certain critical point a uniform extension is almost impossible. In order to illustrate these points in a bar of mild steel a diagram had been prepared. The law of plastic extension is determined by the curve, fixed mathematically the curves of the plastic limit, and it fixed also the breaking weight per square inch of original area. In regard to the possibilities of deformation in a bar of nearly uniform extensibility, as the plastic limit is approached the slightest irregularity in section or in extensibility tends to precipitate the formation of a contracted region, and beyond that limit the further extension of the bar and the further contraction of area will be confined to the same region. For stresses below the plastic limit the probabilities of deformation might be examined by considering the relative time rates of extension at two elements which may have been unequally stretched, and at first the tendency is theoretically in favour of preserving the cylindrical form of the bar. But beyond the plastic limit these conditions

are reversed, and the tendencies are all in favour of precipitating the most rapid contraction of area at the point where any contraction already exists. Referring to the yield-point, sudden elongation takes place at different stresses in the different segments, while in any one short element it seems to be instantaneous. If the yield is arrested midway and the bar examined, it may be found that the elongation has been completed in some segments and not commenced in others.

In the discussion which followed, Profs. Unwin, Ewing, and Hele-Shaw and Sir Benjamin Baker took part. Prof. Hele-Shaw pointed out that certain bronzes, unlike steel, would contract in several places at once.

Mr. Fitzmaurice's paper on the Blackwall Tunnel gave an interesting description of that important work, now being carried out under Mr. Binnie, for the London County Council.

Two papers only were read on Saturday of the meeting. The first an extremely interesting contribution by Sir Andrew Noble, of Elswick. The author referred to the early experiments of Count Rumford to ascertain the pressures in the bores of guns, and pointed out the errors into which that investigator was led. He referred to the researches of Robins, Cavalli, Rodman, and those of the Prussian Artillery Committee of 1854. He also gave details of experiments made by himself, from which it would appear that with projectiles of increasing weight very different results are obtained, in regard to pressure, with modern slow-burning powders than with the older fine grain powders.

Mr. Bryan Donkin's paper was also one of considerable interest, and gave details of an extensive series of experiments made by the author. He pointed out that in most cases cylinder walls of engines are much colder than the steam, and often one-half the weight of steam is condensed during admission. The details of this will be published later, and at greater length, in the Proceedings of the Institution of Mechanical Engineers. It may be said generally, that throughout the experiments an increase of economy with hotter walls was always verified.

On Monday the proceedings were largely devoted, according to custom, to electrical engineering.

Mr. Preece's paper, on signalling through space, was of a very popular nature, and attracted a large audience. He described the operations which took place at Kilbrannan Sound. It is satisfactory to know that the Post Office authorities are introducing metallic returns wherever possible for telephone circuits.

Prof. Sylvanus Thompson's paper was in praise of alternate currents. The author expressing his opinion that the alternate current system would entirely supersede continuous currents for lighting and power distribution purposes. The continuous current being superior for electrolytic purposes alone. Mr. Preece supported the paper, whilst Prof. Kennedy and Mr. T. Parker took entirely different views.

Mr. Parker's paper was an excellent description of the electric lighting in the city of Oxford. Mr. Lea described a special form of chronograph he had had made to his own designs. Mr. Clark's paper was also one of value, and should be studied in the original by those interested in the measurement of high temperatures.

Tuesday's proceedings commenced with the reading of the Report of Prof. Unwin, of the Committee on the Dryness of Steam. This is a long and valuable report, but as it will appear in full in the Transactions of the Association, it is not necessary we should deal with it on the present occasion.

Mr. Burstall, in his paper, and by aid of a model which he exhibited, has given a new means of illustrating the temperature entropy diagram. This model will doubtless be seen on future occasions. Considerable ingenuity has been shown in its construction. Mr. Swinburne's paper was one of practical interest to engineers, whilst Prof. Capper's contribution on the calibration of laboratory instruments will prove of value, and is worthy of passing notice. The author stated that the reliance to be placed upon observations made with measuring instruments evidently depends upon the accuracy with which those instruments record. Neglect of this fundamental truth often leads to inaccurate and erroneous deductions from experiments which are themselves of the highest scientific value; not infrequently the whole value of observations may be destroyed by insufficient care in the calibration of the instruments used. The subject is therefore one of some importance. The author described the chief sources of error in some of the most common engineering

investigations, and their probable value, and pointed out some of the possible methods of correction where such exist. For example, in engine trials there are many possible sources of error. Most of these may be reduced in percentage value by continuing the trial for a sufficient period. But this is not the case with errors which may occur in the indicators, gauges, or spring balances used in the determination of power. In these, unless properly calibrated before trial, very serious errors may be introduced, amounting in some cases to 5 or 6 per cent. of the total power indicated. It is therefore, he said, absurd, even if proper precautions have been taken, to rely upon horsepower measurements to two places of decimals. With regard to tension and compression experiments with standard 10-inch bars, calibration of the testing machine is extremely difficult, and can in general only be carried out over a small portion of the range of the experiments. Deductions have therefore to be made from the less to the greater, with the result that small errors in the calibration will tend to be magnified. Vertical testing machines have fewer sources of error, and can be calibrated with more certainty, than horizontal machines. Extensometers are, however, much more easily applied to a horizontal bar than a vertical, and variable jockey weights, which are requisite if the same accuracy is to be maintained at low loads as at high, are also more readily adapted to horizontal machines. Extensometers can be made and calibrated well up to the accuracy of the testing machine. With standard bars and a measuring instrument true to the ten-thousandth of an inch, the modulus can be relied upon to the second significant figure. It is doubtful if more can be obtained without very special construction and calibration of the testing machine. The difficulty in bending experiments, again, lies in the accurate application of load. Unless the beams are very short or of unmanageable cross-sections, the load measurement must be very delicate if readings approaching the accuracy of those in tension are to be obtained. It is possible that some of the discrepancies in published beam experiments may be due to this cause. The paper dealt briefly with other cases where calibration is specially needed.

Mr. Kenward's paper was of value, both from an historical and a practical point of view. It was illustrated by a number of drawings and photographs.

#### ANTHROPOLOGY AT THE BRITISH ASSOCIATION.

THURSDAY, August 9.—Dr. E. B. Tylor read a paper on the distribution of mythical beliefs as evidence in the history of culture. The author showed that the wide distribution of several mythical beliefs, such as the idea of souls being weighed in a spiritual balance, and that of the Bridge of the Dead, gave evidence of connecting links between the great religions of the world. The theory that the pre-Columbian culture of America took shape under Asiatic influence was supported by evidence of a similar nature. Thus, in the religion of ancient Mexico four great scenes in the journey of the soul in the land of spirits are depicted in a group in the Aztec picture-writing known as the Vatican Codex: first, the crossing of the river of death; second, the passage of the soul between two mountains that clash together; third, the soul climbing up a mountain set with sharp obsidian knives; fourth, the dangers resulting from these knives being carried about by the wind. There is a close resemblance between these Mexican pictures and certain scenes from the Buddhist purgatory depicted on Japanese temple scrolls. Here are seen, first, souls wading across the river of death; second, souls passing between two huge iron mountains, which are pushed together by demons; third, souls climbing the mountain of knives, whose sharp blades cut their hands and feet; fourth, knife-blades flying through the air. Dr. Tylor also referred to Humboldt's argument from the calendars and mythic catastrophes in Mexico and Asia, and to the correspondence in Bronze-Age work and in games in both regions, and expressed the opinion that the evidence was sufficient to justify anthropologists in considering that ancient American culture was due to a great extent to Asiatic influence.

Dr. Beddoe read a paper on complexional differences between the Irish with indigenous and exotic surnames. The author showed that dark hair and light eyes are much more prevalent among the former class of Irishmen than among the latter.

The following reports were also read:—Report of the Anthropometric Laboratory Committee, report of the Ethnographical Survey Committee, report of the Anthropometry in Schools' Committee.

Friday, August 10.—The greater part of the day was devoted to a joint discussion with the Geological Section on the plateau flint implements of North Kent. The discussion was opened by Prof. T. Rupert Jones, in a paper in which he expressed general concurrence with the views of Prof. Prestwich as to the genuineness and antiquity of the implements found in the plateau gravels. He argued that the gravel in which the flints were found must have been of pre-Glacial Age. Mr. Whitaker could not admit that there was any good evidence to connect the men who worked the flints with pre-Glacial or even with glacial times, as there were no deposits of undoubted Glacial Age in or near the district. Mr. Montgomerie Bell stated his reasons for believing that the collections of flints from the plateau gravels were of human handiwork. He said that all the evidence pointed to the working of a race of men with strongly-developed body but weakly-developed mind, and this was exactly the conclusion we should expect. Sir John Evans said that the evidence as to the Palæolithic Age in Suffolk being locally post-Glacial was irrefragable, and that the principal outcome of the recent discoveries was, to his mind, the fact that the existence of palæolithic man could be carried further back in time than the valley gravels, inasmuch as his implements are now found in gravels on plateaus at far higher levels. General Pitt-Rivers contended that a single bulb of percussion was not in itself sufficient to prove human workmanship. The bulb of percussion shows the direction in which the blow was given, but any hard knock would produce it, and it was necessary that two or three blows at least should have been given in some definite direction in order to prove design on the part of the fabricator. Dr. H. Hicks, Prof. Boyd Dawkins, Sir Henry Howorth, and Lieut.-Colonel Godwin Austen also took part in the discussion. Mr. H. Stopes read a paper on the evolution of stone implements, and the following reports were presented:—Report of the Prehistoric and Ancient Remains in Glamorganshire Committee, report of the Elbolton Cave Exploration Committee, report of the Explorations at Oldbury Hill Committee.

Saturday, August 11.—Mr. Arthur Evans read a paper on the discovery of a new hieroglyphic system, and pre-Phœnician script in Crete. During the exploration of the ancient sites of Central and Eastern Crete, the author had succeeded in bringing to light a series of stones presenting pictographic symbols of a hieroglyphic nature, and was now able to put together over seventy symbols belonging to an independent hieroglyphic system. More than this, he had discovered partly on stones of similar form, partly engraved on prehistoric vases and other materials, a series of linear characters, a certain proportion of which seemed to grow out of the pictorial forms. As in the case of the Egyptian and Hittite symbols, the Cretan hieroglyphics fell into certain distinct classes, such as parts of the human body, arms and implements, animal and vegetable forms, objects relating to maritime life, astronomical and geometrical symbols. Some of them belonged to that interesting class of pictographs which is rooted in primitive gesture language. The symbols occurred in groups, and there were traces of a boustrophedon arrangement in the several lines. The comparisons instituted showed some interesting affinities to Hittite forms. The linear and more alphabetic series of symbols fitted on to certain signs engraved on the walls of what was apparently a Mycenaean palace at Knôsos, and again to two groups of signs on vase handles from Mycenæ. It was thus possible to construct a Mycenaean script of some twenty-four characters, each probably having a syllabic value. The author gave reasons for believing that the Philistines, who, according to unanimous Hebrew tradition, came from the Mediterranean islands, and who were actually called Krethi in the Bible, in fact represented this old indigenous Cretan stock, and that they had here the relics and the writing of "the Philistines at home."

Mr. Arthur Evans exhibited a number of prehistoric objects collected during his journey and explorations in Central and Eastern Crete.

Mr. H. Balfour, in a paper on the evolution of the bow as a musical instrument, gave the aboriginal races of Africa and India the credit of providing us with the prototype of many of our best string instruments.