R. Jones and Mr. A. R. Selwyn; the Secretaries are Dr. G. M. Dawson, Messrs. F. Adams, W. Topley (Recorder), and W. Whitaker.

The International Geological Congress meets at Berlin in September, and this will prevent many Continental geologists from going to Montreal; Dr. Richthofen, however, will probably be present, and will communicate a paper on some comparisons between the geology of China and North America. It is hoped that others may also arrange to come.

Meeting in the typical Laurentian country, it is only to be expected that the Archæan rocks will receive much attention. Amongst the papers sent or promised are the following:—Prof. Bonney, on the Lithological Characters of the Archæan Rocks in Canada and Elsewhere; Mr. Frank Adams, on the Occurrence of the Norwegian "Apatitbringer" in Canada, with a few Notes on the Microscopic Characters of some Laurentian Amphibolites; Dr. T. Sterry Hunt, on the Eozoic Rocks of North America.

On Palæozoic Geology and Palæontology generally the following are expected:—L. W. Baily, on the Acadian Basin in American Geology; E. W. Claypole, the Oldest Known Vertebrates—an Account of some Fossils recently discovered in the Silurian Rocks of Pennsylvania; Mr. J. H. Panton, of Winnipeg, Geological Gleanings from the Outcrops of Silurian Strata in the Red River Valley, Manitoba.

Principal Dawson will give a Comparison of the Palæozoic Floras of North America and Europe, whilst Mr. J. S. Gardner will deal with the same subject as regards the Cretaceo-Tertiary Floras.

Other papers are:—G. F. Matthews, on the Geological Age of the Acadian Fauna, and on the Primitive Conocoryphean; E. Wethered, the Structure of English and American Coals.

After the Azoic and Palæozoic rocks of Canada, the Drift Deposits are of great interest. The following papers bear on this subject:—Mr. A. R. Selwyn, on a Theory of Ice Action in the Formation of Lake Basins and in the Distribution of Boulders in Northern Latitudes; the Rev. E. Hill, on Theories of Glaciation; F. Drew, on the Thickness of Ice in the Himalayan Valleys during the Glacial Period.

Amongst other papers of interest are:—Prof. Hull, on the Geology of Palestine, giving an account of his recent explorations; Prof. T. R. Jones, on the Geology of South Africa; W. Whitaker, on the Economic Value of Geological Maps, with especial reference to water-supply, illustrated by the Survey Maps of the Chalk area in England.

Papers are also promised by Mr. Arch. Geikie, Dr. G. M. Dawson, Prof. V. Ball, Prof. W. Boyd Dawkins, Dr. C. Le Neve Foster, W. Carruthers, H. Bauerman, E. Gilpin of Halifax, N.S., and others.

Other papers will be sent by American and Canadian geologists, particulars of which have not yet been received. Prof. James D. Dana and Dr. James Hall, if not present in person, will probably send one or more communications.

Several Reports will be submitted by Committees, or by persons appointed for this purpose at the last meeting of the Association (the name mentioned is that of the Secretary to the Committee, or the Reporter):—Prof. J. Milne, Earthquakes in Japan; W. Cash, Fossil Plants of Halifax; G. R. Vine, British Fossil Polyzoa; Dr. H. W. Crosskey, Erratic Blocks of England, Wales, and Ireland; Prof. T. R. Jones, Fossil Phyllopoda of the Palæozoic Rocks; C. E. De Rance, Underground Waters; J. W. Davis, Raygill Fissure, Yorkshire; C. E. De Rance and W. Topley, Erosion of Sea-Coasts of England and Wales; F. Drew and Prof. A. H. Green, the Present State of Knowledge respecting the Interior of the Earth; W. Whitaker, Geological Record; W. Topley, National Geological Surveys; and Progress of the International Geological Map of Europe.

With several sections of the Association the work is mainly confined to the meeting room. Geologists are more fortunate, their most pleasant memories of these meetings are with the hills, rocks, and streams of the district. At and near Montreal there is much to be seen. Mount Royal rises steeply behind the city, a mass of cruptive rock intruded through the Silurian beds. From the summit a grand view is obtained over the Laurentian Mountain on the north, and over the hills and rolling plains of Silurian rocks on the south and east. From amongst these latter rise the more sharply defined trap hills of Montarville, Beloil, and Rougemont. The excursions are of especial geological interest. Niagara is only a short run of 300 miles away; the Rocky Mountains will be reached by a special train over the Canadian and Pacific Railway.

The Local Committee at Montreal is preparing a guide-book to the city and neighbourhood, which will contain a geological map. A general Geological Guide to the Dominion will be prepared by the Geological Survey of Canada.

PRIMARY EDUCATION AT THE HEALTH EXHIBITION

THE recent opening of the City and Guilds of London Institute by the Prince of Wales, and the simultaneous issue of a special catalogue of the educational exhibits at the Health Exhibition, which are for the most part housed in that Institute, has been the means of drawing much public attention to this most interesting and valuable collection, and renders some account of it opportune. It is probably not too much to say that no such elaborate and extensive collection of educational appliances, methods, and results, has ever been brought together before, notwithstanding the fact that, the primary object of the whole Exhibition being to elucidate the conditions of health, it was considered expedient to attach to the principal display mainly such objects and appliances as had a special relation to healthful school life. This limitation, however, has been interpreted somewhat liberally, and the result is a collection in which can be studied and compared the educational systems in primary, general, and technical education as practised in the British Islands, France, and Belgium, and to a less extent in Germany, Sweden, Switzerland, the United States, and Canada. It is earnestly to be hoped that such an opportunity for comparing their own systems, practice, and results with those of others, whether English or foreign, will not be allowed to pass by our schoolmasters and schoolmistresses, as well as by members of School Boards, and indeed by all interested in this vast subject. We hear with pleasure that it is intended to organise visits there by parties of London masters and mistresses, and we hope that arrangements will be made enabling provincial educationalists to avail themselves of the advantages offered by this temporary display at South Kensington, which will not be prolonged beyond the middle of October.

Two foreign Governments, those of France and Belgium, have organised elaborate collective exhibitions, showing the methods and results both of primary and secondary education in those countries, and the catalogue of the French exhibit is prefaced by ten closely printed pages containing an admirable summary of the present position of education in France, which has of late made most rapid advances. The money which neither the Liberals of the Restoration, nor those of the Monarchy of July, nor the *Corps Législatif* of the Second Empire, had been able or willing to find for popular education, the Parliament of the Third Republic, definitely consolidated in 1877, has not feared to demand of the State, notwithstanding the pressure of taxes resulting from the foreign

and civil war of 1870. In 1882-83 there were 5,432,151 pupils, and 129,657 public teachers (of whom only 21,781 were uncertificated) in the elementary primary schools of France, and the general outlay of the State for primary education amounted in the same year to 94,881, 942 francs, or about 3,825,000*l*.

While cordially recognising the very great trouble that the Ministers of Public Instruction in France and Belgium have taken to illustrate their respective systems, we must not forget that our Education Department occupies a different and wholly unique position, and hence that the English Government, as a Government, is unable to make a similar display. Our Education Department scrupulously abstains from enforcing particular methods and processes, simply requiring that by some local means, voluntary or otherwise, efficient schools shall be provided, and it then confines itself to the estimation of results and to the distribution of funds provided by Parliament in aid of the local efforts; in a word, its control is indirect rather than authoritative. The intelligent foreigner therefore has to search through the collective exhibits of the great voluntary societies which have so long and so largely influenced English primary education, and also of several of the municipal bodies called into existence by the Education Act of 1870, in order to become conversant with the methods and results of English schools. In the special catalogue for education, each of these bodies which exhibits has taken the opportunity to place on record an account of its aims and history, and of the scope and character of its present work. Such additions to this catalogue, occupying many closely printed pages, render it a very admirable hand-book to the whole subject of education, and add immensely to its value. Among the most interesting and valuable statements of this kind are those issued by (to use the shorter titles) the National Society, the British and Foreign School Society, the Wesleyan Education Committee, the Sunday School and the Ragged School Unions, and the School Boards of London, Birmingham, Glasgow, and Edinburgh.

There is one Society, however, which merits more than a passing notice, since its collective exhibit is not merely one of the most remarkable and interesting in the whole Educational Exhibition, but is also one from which a great deal is to be learnt. It is cosmopolitan in its aims, and exhibits the results of its schools in Belgium, France, England, the United States, Canada, Egypt, and India, although its head-quarters are in Paris. The Institute of the Brothers of the Christian Schools was founded in 1680 by the Venerable Dr. J. B. De La Salle, who was the first to establish primary education in France, and also training colleges for teachers. At present the Institute has nearly 12,000 Brothers, distributed over thirteen countries, directing 1200 schools, with an attendance of about 330,000 pupils, who, we regret to say, are all boys, the Brothers not concerning themselves in any way with the education of girls. The Brothers everywhere follow the same general methods of teaching, while they modify the details according to the custom of the country in which they are, varying their programmes also to meet local requirements and the wants of the times; for example, in their United States schools, where all the boys stay till about sixteen, every boy in the first class learns (1) shorthand writing, (2) the use of the type-writer, (3) the Morse alphabet, since without these acquirements the Brothers are unable to get situations for their pupils. The rooms in the Technical Institute, as well as the space in the Belgian and French Courts devoted to the results of their work, will well repay very careful examination, since only their most leading features can be here indicated. Foremost among these, and bearing distinctly upon a subject recently discussed both in this journal and in the *Spectator*, is their system of models, maps, and atlases for the scientific teaching of geography, which are exhibited by Brother Alexis. These maps were the first hypsometrical maps published in French, and, we believe the first of the kind published anywhere for school use, and are intended to give, by a suitable arrangement of colours, clear notions of the real configuration of the earth's surface. An introduction to their study is afforded by a glass tank, with a very uneven bottom, upon which contour lines are marked; when this is filled to various depths with water, the effects of changes in the relative level of land and sea are clearly and effectively demonstrated. This demonstrative or objective method is the keynote to the system of instruction adopted by the Brothers, and its effect is seen in many instances, notably in the splendid school museums of Annecy (Savoy), Beauvais, Rome, and Marseilles, in which the specimens are all collected by the pupils, and classified by the masters; in the apparatus employed in scientific and handiwork teaching; and in their system of teaching drawing, the results of which, as illustrated by an enormous series of designs, entirely the work of pupils, are almost incredible. The lithographed notes of science lessons distributed to the pupils, and the extensive series of science and other text-books, written in various languages by the Brothers, all deserve close inspection.

The Ministry of Public Instruction in Brussels illustrates most fully the Belgian educational methods, and here again one of the most prominent points is the teaching of geography, which is most completely systematised and thoroughly scientific; the minutely detailed maps of the War Department form the basis of much of this, dealing thoroughly with the physical and geological conditions of the country, which are gradually shown, one thing at a time, in a progressive series of maps. The technological and other school museums (notably that at Verviers) collected by the pupils, deserve special notice, as does the whole apparatus for handicraft teaching, such, for example, as the pasteboard models made by the pupils for the demonstration of problems in solid geometry, and of algebraical formulæ treated geometrically. The city of Antwerp furnishes a very interesting collective exhibit, further illustrating these points, and in this connection may also be mentioned the single exhibitors, D. Windels, whose zoological models of animals to scale are admirable, and J. B. Gochet, who shows a complete course of geography.

In the French Section the method and good gradation of all the school work and the way in which these points are illustrated in the exhibit are very remarkable. Here again we find great prominence given to the objective method of teaching in almost every subject; the results of the handicraft teaching of children from ten to thirteen in the Département du Nord are almost incredibly good, while the method of it in the Prevot Orphanage is excellent. The excellent choice of books for school libraries, the system of instruction in rhetoric and in the duties of citizenship, the results of the École Normale de Travail Manuel, and the programme of instruction for 1882, are particularly noticeable.

Of the English system, as illustrated by the Societies and the School Boards, the exigencies of space allow us to say but little. The publications of several of those enumerated above are well known, as are also their school appliances. For the methods and results of school work, the exhibits of the School Boards must be consulted. Here we are at once struck with the comparative absence of the apparatus for, and the results of, that objective system of teaching which stands out so prominently in the Continental systems. A praiseworthy exception to this, however, is to be found in the room devoted to the Birmingham School Board, where Mr. Jerome Harrison exhibits the apparatus and results of the itinerant system of teaching science to every child above Standard IV. in the Board schools of that town. The systematic arrangement of every subject of instruction, and especially of the needle-work, is particularly notice-

able here. More space is occupied by the London School Board, whose lending libraries for schools and reference libraries for pupil teachers are well selected. The geographical teaching cannot, of course, be compared with that on the Continent, though some of the district maps are good. Fair provision is made for teaching science to pupil teachers, but there is a lamentable deficiency in the apparatus for this and for the whole system of object-lessons, when the needs of the scholars themselves are considered. The School Boards of Edinburgh and Glasgow show some excellent models, photographs, and plans of school buildings of the newest type, and some remarkable specimens of drawing. The Wesleyan Education Committee show some excellent results of the scientific and handicraft training of boys, and some very simple yet remarkably effective appliances for elementary geographical instruction.

Although these collective displays by public bodies are the most interesting feature of this portion of the Exhibition, there is much that will repay examination in the various objects shown by many single exhibitors of the great variety of school desks and furniture; some of the desks of G. M. Hammer, G. E. Hawes, and H. Simon and Co., deserve more than a passing notice, as do also the revolving partitions of Hodkinson and Clarke. Among maps and charts the collection of Mr. E. Stanford stands out prominently, and is specially noticeable for the five series of physical and orographical maps, some of which in frames are on continuous sheets and rollers. Mr. Bacon's maps are singularly clear and good for school use, and his picture-lessons in geography are a step in the right direction. The apparatus for teaching music, exhibited by J. Curwen and Sons, is perhaps not approached by any similar exhibit. The science charts and diagrams produced by M. Emile Deyrolle are of an extremely high degree of excellence, and deserve to be made widely known. The educational publications of such firms as Messrs. Cassell and Co., Messrs. Gill and Sons, the Messrs. Johnston, Messrs. Griffith and Farran, Messrs. Bemrose and Sons, and Messrs. William Collins, Sons, and Co., who are all well represented, are too well known to need more than a reference.

In a second article we hope to deal in a similar way with the exhibits of apparatus and results of scientific and technical teaching carried to a higher degree than in mere primary schools, and also, briefly and by way of introduction, with that range of subjects which may be shortly described as comprising the technical education of children and girls. It may perhaps be permitted to the writer to say, as the result of a very close examination (extending over more than a week continuously) of the exhibits relating to primary education in various countries, that one important lesson to be learnt from the comparison of Continental methods with our own is the great advantage afforded by the objective system of teaching, and by the adoption of that systematic order and method in all subjects of instruction, literary or otherwise, to which the name scientific, in the highest and best sense of the term, is applicable.

WM. LANT CARPENTER

WORK-MEASURING MACHINES[1]

UNDER this title a little *brochure* has recently appeared from the pen of the Rev. F. J. Smith, B.A., of Taunton, in which work-measuring dynamometers, or *ergometers*, as the author terms them, of various forms are described. Amongst these machines there are many devised by the author himself, and some of these are of considerable interest and much originality. The transmission ergometers of the type originally invented by General Morin deserve notice in particular. The following is the general principle involved in transmission ergometers:—

Let it be supposed that a belt passes over from the driving wheel of a prime-mover such as a steam-engine to the pulley of a dynamo which is being driven. One half of the belt is subjected to a strong pull, the other is relatively slack. Then if we could introduce spring balances into the two parts of the belt, and if we could read the difference of the tensions T and T′, and if we multiplied this T − T′, expressed in pounds, by the velocity of the belt in feet per second, we should then have the "foot-pounds per second" spent in driving the dynamo. From this we can calculate the horse-power by dividing it by 550, since 550 foot-pounds per second is one horse-power. This we may write algebraically:—

$$\text{H.P.} = \frac{(T - T')}{550} v ;$$

where v denotes the velocity of the belt in feet per second.

Now since such an arrangement as this cannot be easily carried out, the usual method is to place between the engine and the dynamo some instrument capable of showing the tension of the belt in pounds, and the velocity of the belt, and in certain cases these instruments can even give a continuous record of the work done. The ergometer devised by Mr. Smith is an admirable instance of such a combination, and it undoubtedly possesses points of superiority over all transmission dynamometers hitherto invented. A view of the machine (see figure) shows how the ergometer is arranged. The central shaft, of Whitworth steel, which is tubular at each end and link-shaped between, carries two pulleys. One is keyed to the shaft and carries two bevel-wheels, these engage with another bevel-wheel which forms part of the second pulley, which is loose on the shaft.

To each of the two bevel-wheels, as shown in the diagram, there is fitted a cylindrical drum, on these either gut or steel tape is coiled over three-fourths of their faces, and the gut or tape is attached to a cross-head. The latter is in turn attached to a cylindrical steel spring placed within the link, and from the cross-head a rod of steel, passing through one end of the link, actuates the pointer of a dial, whereby the pull on the spring attached to the end of the link is shown. This instrument resembles therefore the earlier dynamometer of Morin in having two pulleys; the angular advance of one of them being regulated by a spring. But in Morin's form the spring was simply an extended piece of steel. In the more recent modification by Profs. Ayrton and Perry, coiled steel springs are also used; but in that instrument the springs are liable to fly out by centrifugal force, and the arrangement for observing the angular advance is an optical one, requiring an observation of a silvered bead by a reading-telescope. In Mr. Smith's ergometer there is no such tendency of the spring to fly, and the tension is read direct on a dial. The speed indicator is shown just below. If a continuous record of work is required, the steel rod is either attached to a recording drum or to an integrating apparatus.

The instrument having been placed between a prime-mover and a machine to be tested, the belt from the prime-mover drives the loose pulley, and another belt from the fixed pulley drives the machine to be tested. The tension on the driving side of the belt causes the spring to be extended by means of the bevel-wheels, and difference of the tensions is indicated by the pointer of the dial. The instrument is calibrated by hanging known weights from strong thin cords or catgut strings passing round the pulleys, and marking the dial in accordance with the weights.

The springs used by Mr. Smith are made by Messrs. Salter and Co., they are of four sizes, capable of being extended 2 inches by 50, 100, 150, and 200 lbs. respectively. They have been put to severe tests, but have come

[1] "Work-Measuring Machines." By Frederick J. Smith, B.A. 32 pp. 12mo. (London: E. and F. N. Spon, 1884.)