THE ROYAL SOCIETY CONVERSAZIONE.

FEW conversaziones of the Royal Society have exceeded in interest the one held on Wednesday of last week. Many of the exhibits were very striking, while all of them presented novel features. Physical science predominated, and Röntgen photography attracted a large share of attention throughout the evening. Mr. A. A. C. Swinton had an elaborate exhibit to illustrate experimentally the production of Röntgen rays, and the visible and photographic effects produced by them. By means of several binocular cryptoscopes, all who so desired were able to see shadow pictures of the bones in the living body, and of objects enclosed in opaque boxes, while Röntgen photographs of the hands of many persons were taken during the evening.

Mr. Herbert Jackson's demonstration of the use of phosphorescent materials in rendering Röntgen rays visible, brought out the supremacy of potassium platino-cyanide as the salt for phosphorescent screens. The tube used to produce the rays was a slight modification (described in the *Proceedings* of the Chemical Society) of a tube originally introduced by Mr. Crookes to illustrate the heating effect of kathode rays. These are brought to a focus at the centre of curvature of the concave kathode, whence they proceed in nearly a straight line to a platinum plate, from the surface of which they are apparently scattered in all directions. The rays penetrating the glass were caused to fall upon phosphorescent bodies and were rendered visible, thus showing the different intensities of response of these bodies to such rays. By means of a large phosphorescent screen covered with platino-cyanide of potassium, all the effects seen individually with a cryptoscope were viewed by a number of people at the same time.

Mr. Sydney Rowland exhibited a series of "skiagrams" illustrating the applications of the "new photography" to medical and surgical diagnosis. The following analysis, based on a record of some fifty cases, is useful as showing the branches of surgery in which the new process will probably be found of most use. About 20 per cent. of these include the discovery and location of foreign bodies, needles, bullets, &c., lodged in soft tissues, and in one case a coin lodged in the intestine, which caused troublesome symptoms. In one of these cases two previous operations had been fruitlessly performed. 15 per cent. of the cases were instances of pathological conditions of the elbow-joint of more or less obscurity, on which new and unexpected light was thrown by the diagnosis thus obtained. In 10 per cent. of the cases the object in view was the determination of the extent and distribution of tuberculous lesions in bone. Various ankyloses and deformities of the bones and joints of the extremities have made up the remainder of the cases.

A self-testing resistance box and bridge were exhibited by Mr. E. H. Griffiths, F.R.S. This apparatus presented many novel features, the chief advantages being as follows:—(1) The observer can (without use of standards, &c.) ascertain accurately, and quickly, the comparative errors of all the coils, including those in the ratio-arms. (2) An exact calibration of the bridge wire can be made by means of the box itself. (3) The temperature of the coils can be accurately determined. (4) The resistance of leads to any object is self-eliminated. (5) Resistances from 0·00001 ohm to 105 ohms can be directly read by a null method, without observation of galvanometer swings. (6) All coils after adjustment have been heated to a red heat, and are thus very free from strain, &c. (7) There are special arrangements for securing constancy of all plug contacts, &c.

A resistance box, standard coils, and wire bridge were exhibited by Mr. F. W. Burstall. The resistance box was of the dial pattern, wound in bare platinum silver wire on strips of mica, the wire being immersed in pure mineral oil; there were five dials, ranging from $\frac{1}{10}$ ohm to 1000 ohms, and four pairs of proportional arms. The four standard coils were of similar forms, but were intended to be used with mercury cups. In conjunction with Mr. H. R. J. Burstall, the same exhibitor showed bare wire resistance thermometers for use in vessels under high pressure. The measuring wire was wound on mica plates carried by slender columns from a metallic plug which was screwed into the vessel. The change of resistance was measured by comparing the drop of E.M.F. over the measuring wire, with the drop over a standard coil put in series with it and a battery. A thermometer was exhibited which had been in a steam superheater for more than a week continuously, at a pressure of 160 lb. per square inch. Both these exhibits should prove of great assistance in electrical and thermometric measurements.

New apparatus for measuring the magnetic permeability of iron or steel was shown by Prof. Ewing, F.R.S. The apparatus allows measurements of permeability to be made with samples in the form of short rods, and greatly simplifies the process. It acts by making a magnetic comparison between the rod to be tested and a standard rod, the magnetic qualities of which have been determined beforehand. The magnetic detector, which shows when the two rods have the same induction, consists of a compass needle placed in a gap in an iron bar joining the two yokes. From its analogy to the Wheatstone Bridge, the author proposes to call the instrument a Permeability Bridge. It forms a companion instrument to the hysteresis tester exhibited last year.

A flint glass prism of nine inches aperture and 45° refracting angle was exhibited by Mr. J. Norman Lockyer, C.B., F.R.S. The prism has been constructed by the Brothers Henry, of the Paris Observatory, and will be used as an objective prism for photographing the spectra of stars. Mr. Lockyer also showed the following:—Photograph showing positions of coronal spectrum rings in the total eclipse of the sun, April 16, 1893. The original negative was taken by Mr. Fowler, at Fundium, West Africa, with the 6-inch prismatic camera near the middle of totality, with an exposure of forty seconds. In addition to the images of a number of prominences, there were portions of rings representing the radiation spectrum of the corona. The brightest of the rings corresponds to the well-known corona line 1474 K, but the others have not been previously photographed. All the rings are most intense in the brightest coronal regions, near the sun's equator.—Photographic spectra of α Cygni, γ Cygni, and Arcturus. The photographs were taken at South Kensington with a 6-inch objective prism of 45°, and illustrated the difference between stars of increasing and stars of decreasing temperature. Arcturus is a cooling star, almost identical with the sun, while α Cygni differs very widely from the sun and is getting hotter. The spectrum of γ Cygni, like that of Arcturus, consists of a very large number of lines, but as many of the more prominent lines agree with those of α Cygni, and are absent from the solar spectrum, this star must be classed with those of increasing temperature.—Photographs showing the spectra of helium and gas X in relation to the spectra of Orion stars. The lines of the two gases were arranged in the series deduced by Messrs. Runge and Paschen, and their distributions in the spectra of Bellatrix, Rigel, δ Orionis, and Spica were shown. —Photographic map of the spectra of metals of the iron group. The map extended from wave-length 3900 to 5900, and included the spectra of iron, manganese, cobalt, nickel, chromium, and uranium, as shown at the temperature of the electric arc. Rowland's map of the solar spectrum formed the term of comparison, so that the wave-lengths of the lines could be read off directly from the map.

Mr. F. McClean, F.R.S., exhibited photographs of the spectra of twenty-three characteristic helium stars. These stars correspond to Class I.*a* of Lockyer (*Phil. Trans.*, December, 1892), who further attributed their spectrum to helium (*Proc. Roy. Soc.*, May 9, 1895). The hydrogen and helium were indicated below the scale of wave-lengths. The enlargement was 8½ times the original negatives. Mr. McClean also showed photographs of the spectra of six stars of the third magnitude, illustrating the transitions from type to type.

Another spectroscopic exhibit was by Prof. Hartley, F.R.S., whose subject was, however, terrestrial. He showed a series of photographed spectra illustrating an investigation of the Bessemer flame, as seen at the North Eastern Steel Co.'s Works, at Middlesbrough-on-Tees, in which the presence of the rare element gallium was recognised by a single line in its spectrum, and separated from both the metal and the ore of the district.

A remarkable exhibit, by Mr. Joseph Goold, consisted of steel tuning-bars and synchronising sound-generators. The new synchronising sound-generator was a vibrating rubber having the pitch or vibration-period of the note to be elicited. The separate partial-tones were thus developed singly with remarkable power and sweetness. These appliances have already led to the further discovery of *vibration-axes and -vortices*, examples of which were exhibited.

The rapid photographic printing machines, exhibited by Mr.

W. Friese Greene, turned out prints at a rate almost beyond belief. The machines are for the production of prints wholly or partly by photography, and their chief object is to effect a very rapid production of copies adapted for use as illustrated supplements, newspapers or magazines, or for other purposes where a large number of copies of the same picture, design, or other objects are required. A roll of rapid bromide paper was fed in at one end of each machine, and finished prints were turned out at the other end at the rate of two or three thousand an hour. Mr. Greene also showed a new type-setting machine dispensing with movable types.

Instantaneous photographs of splashes were shown by Prof. Worthington, F.R.S., and Mr. R. S. Cole. These photographs were taken each with an electric spark giving an exposure of less than 3-millionths of a second (see NATURE, vol. l. p. 222.) The spark could be so timed as to pick out any desired stage of the splash within limits of error not exceeding, as a rule, about 2-thousandths of a second. In this way the progress of a great variety of splashes has been followed in minute detail. Specially interesting were those which illustrated the formation of a bubble, and those which showed how the nature of the disturbance produced by the entry of a solid sphere depended on the condition of its surface.

By means of the colour patch apparatus exhibited by Captain Abney, C.B., F.R.S., it becomes possible to throw on a screen, or on a photographic plate, the image of a luminous object in monochromatic light. An image is first formed on the face of a prism or grating by means of a lens of proper focal length, placed close to the slit of the spectroscope. The spectrum is formed in the usual way, and the colour in which the image of the object is to be formed is allowed to pass through a slit placed in the spectrum. A second lens placed close to this slit forms the image in monochromatic light of the image on the prism or grating on a screen or photographic plate.

Prof. Roberts-Austen, C.B., F.R.S., showed his interesting modifications of an experiment of M. Charles Margot. A wire of aluminium was raised, by a current of 30 amperes, to a temperature far above the melting point of aluminium, but a film of oxide on its surface prevented the wire from breaking. The molten wire through which a current was passing, could then be attracted by a magnet.

On behalf of Mr. Carl Zeiss, new portable binocular field-glasses and stereo-telescopes were exhibited. The objects of the new types are (1) to obtain a considerably larger field than that possessed by a Galilean telescope of similar magnifying power: (2) to enhance the stereoscopic effect of the images formed, by placing the object-glasses further apart than the eye-pieces. These objects were attained by prisms and astronomical oculars. The rays passing from the object-glass to the eyepiece undergo four reflections at the surfaces of the prisms, and emerge from the last prism with undiminished intensity. The interposition of the prisms serves to erect the inverted image formed by the object-glass, and, at the same time, to displace the axis of the eyepiece with respect to that of the object-glass, the amount of this displacement being variable within wide limits.

Mr. F. E. Ives had on view his stereoscopic photo-chromoscope. The photo-chromoscope camera makes, at a single exposure on a commercial photographic sensitive plate, three pairs of images, which by differences in their light and shade constitute a record of everything that excites vision in the two eyes. The stereoscopic photo-chromoscope translates this record to the eyes, so that the object photographed appears to be seen through it.

The composite archer's bow, its structure and affinities, was the subject of an exhibit by Mr. Henry Balfour. Archers' bows of composite construction, of wood or horn, or both, overlaid with a "backing" or reinforcement of animal sinews, were shown. There were complete bows from North-west America, Japan, Corea, Manchuria, China, North India, &c., a composite cross-bow from Germany, and an unique specimen of composite bow from a tomb of the twenty-sixth dynasty, Thebes, Egypt. A map and diagram showing the distribution and affinities of the various types of composite bows were also exhibited.

A bifilar pendulum in action was exhibited by the Cambridge Scientific Instrument Company. This instrument was designed by Mr. Horace Darwin for observing and recording slow tilts and pulsations of the earth's crust, by whatever cause they may be produced, and is a modification of that used by the Messrs. Darwin in 1881, at the suggestion of Lord Kelvin. It is possible to observe with this pendulum a tilt of less than $\frac{1}{300}$ of a second, an angle less than that subtended by a line an inch long placed at a distance of a thousand miles, as was shown by the experiments made at Birmingham by Dr. Charles Davison.

The results of experiments on steel gas cylinders were shown by the Gas Cylinder Committee, lately nominated at the request of the Home Office. These showed (1) the danger of using hard or unannealed steel for gas cylinders; (2) the extraordinary amount of violent ill-treatment to which a good soft annealed cylinder may be subjected without destruction, even when charged to 120 atmospheres; (3) the effect of very great internal pressure steadily applied, in this case due to the expansion of liquefied ammonia gas which completely filled the cylinder when cold; (4) the violently destructive character of the explosion of mixed gases under pressure which no practicable cylinder can withstand.

Portable apparatus for gas-testing in electric culverts was shown by Prof. Clowes. A standard hydrogen flame, fed from a small steel cylinder of the compressed gas, is enclosed in a brass vessel provided with a transparent front. This apparatus is mounted on a camera tripod, and is observed by throwing a black cloth over the head. The air to be tested for inflammable gas is pumped over the flame by dropping the end of a flexible tube into the culvert, and compressing a rubber ball provided with suitable valves. A constant stream of the air is thus caused to pass over the hydrogen flame, and by the appearance and dimensions of the flame-cap produced, gas is detected and its percentage is accurately measured. The hydrogen flame can be adjusted to two standard heights, and thus percentages of gas from 0·2 to 5 can be detected and measured.

Geometric wall brackets were exhibited by the Rev. F. J. Smith, F.R.S., and Prof. C. V. Boys, F.R.S. The brackets have been designed with the object of providing wall supports with definite position for physical apparatus. After the apparatus and bracket have been adjusted, they may be removed, and at any time immediately restored to their original position. This is found to be convenient where a class or lecture room is used for some portion of a day only for physical demonstration. The construction is as follows:—Three small projections, A, B, C, are fixed to the wall, one of the two upper projections is furnished with a three-sided indentation, the other with a V-groove, the third is a flat surface; two hemispherically ended screws drop into the upper projections, and the third screw at the bottom of the bracket rests against the flat surface.

Geometric steady blocks were also exhibited. These have been designed so as to rest each on the one below it, upon six independent small surfaces, so as to be geometrically clamped. Thus any number of blocks may be piled to the desired height, and carry physical apparatus with perfect steadiness. Both square and triangular forms were shown.

M. Maurice d'Ocagne, Professor at the École des Ponts et Chaussées, exhibited a very complete series of "abaques" of his invention, intended to perform certain calculations, such as the solution of a cubic equation, or of Kepler's equation, and generally of any equation involving three or four variables. The interest was purely mathematical, appealing to a select few; but the applications of the principle are numerous and important.

Mr. W. Barlow exhibited models to show the nature of the repetition in space which characterises a homogeneous structure having cubic symmetry.

Specimens of ancient "astrolabes" and other instruments were exhibited by Mr. Lewis Evans.

Messrs. Read, Campbell, and Co. showed "aerators" for aerating water and other liquids. The aerator is used in combination with a soda-water bottle and patent stopper. It is made of sheet steel, and contains compressed carbonic acid gas; the soda-water bottle being filled with water or other liquid, the aerator is inserted in the stopper, and the closing of the latter liberates the gas, producing strongly aerated water or other liquid. The aerators may be charged with other gases and used for other purposes than aerating liquids.

There were exhibited by the Meteorological Council: (1) Current charts of the Indian Ocean for the months of January, April, July, and October. The currents shown on these charts had been generalised from a very large number of observations, the arrows and figures attached to them indicating the direction and maximum and minimum velocities of the current likely to be experienced at any particular spot. (2) Wind charts of the South Indian Ocean, between the Cape of Good Hope and New Zealand, for the months of January, April, July, and October.

These charts showed, by a new form of wind rose, recently adopted by the Meteorological Council, not only the frequency of the winds, but their strength, over areas contained by 3° of latitude and 10° of longitude. Isobars were also drawn on the charts so that the relation of the winds to the barometrical pressure could be compared. In the corners of the wind areas the percentage of fog and the number of weather observations were given. A small inset chart showed the temperature of the air, which was represented by isothermal lines, and the limits of fog were also indicated. (3) Sea surface temperature charts of the South Indian Ocean, between the Cape of Good Hope and New Zealand, for each month of the year.

Coming now to natural science, Dr. Woodward, F.R.S., showed a part of the collections made by Dr. C. I. Forsyth Major in Madagascar, 1894–95; and Dr. J. W. Gregory exhibited a geological map of part of British East Africa, with sketches, sections and specimens. The map showed the main features in the structure of British East Africa. The region consists of a plateau of Archean rocks (gneiss and schist) sinking beneath strips of Carboniferous and Jurassic deposits in the coastlands, and buried by piles and sheets of volcanic rocks in the interior. Volcanic activity probably lasted from the Cretaceous to the present day. The lavas have been ejected by plateau eruptions and by crater eruptions. The former poured forth sheets first of trachytoid phonolite, and then of basalt. The country is traversed by the Rift Valley, on the floor of which are thick series of lacustrine deposits; on its walls are the terraces of extinct lakes. Dr. Gregory also showed specimens of Hemiptera (*Flata nigricincta*, Walk.), the colonies of which resemble inflorescences. Mr. H. W. Seton Karr, and Sir John Evans, K.C.B., Treas.R.S., exhibited (1) palæolithic implements from Somaliland; (2) palæolithic implements from Somaliland, ogether with European, Asiatic, and African specimens for comparison.

Gold nuggets showing internal crystalline structure, formed an exhibit by Prof. Liversidge, F.R.S. The specimens (Australian) had been sliced and polished, and then etched with chlorine water or other reagents, so as to show the internal crystalline structure and the presence of enclosures of quartz, iron oxide, &c.

Prof. McKenny Hughes, F.R.S., exhibited (1) specimens illustrating the amount and mode of shrinkage of bog oak; (2) mulberry, showing symmetry in the twigs and asymmetry in the leaves; (3) travertine lining a wooden pipe, and reproducing all the details of the surface on which it was thrown down.

Photographs of "cup and ring" markings naturally formed upon stucco, were exhibited by Mr. C. Carus-Wilson. The wall of a house, built about forty years ago, was covered with stucco. Alternations of temperature, to which the face of the wall had been subjected, had rearranged the particles composing the stucco, producing linear and annular ridges and depressions similar to those occasionally seen on rock-faces, and usually ascribed to the hand of prehistoric man.

Prof. Ray Lankester, F.R.S., showed a cast of enlarged model (eight times natural size) of the type specimen of *Amphitherium prevostii* (lower jaw, Stonesfield slate). Casts taken direct from these very small jaws are of little use. Drawings necessarily fail to show clearly the modelling of the teeth. Accordingly Prof. Lankester has obtained, through the skill of Mr. Pycraft (one of his assistants in the Department of Comparative Anatomy, Oxford), a careful wax model of each of the unique Oxford mammalian fossil jaws, eight times the natural size. A coloured cast of the wax model of one of these jaws, the type specimen of Amphitherium, was exhibited, and similar casts will be offered to the chief European and American museums.

The Marine Biological Association had on view a series of specimens illustrating the boring habits of certain marine animals, amongst them being a series of shells showing the gradual disintegration due to the action of boring sponges. Some rare or interesting marine organisms recently found at Plymouth were also shown by the Association.

Mr. Walter Garstang demonstrated certain adaptations, subservient to respiration, in sand-burrowing Annelids and Crustacea. In aquatic animals which burrow in fine sand, the activity of the gills would be impaired by the accumulation of sand around the gills, or in the course of the respiratory currents. To prevent this, the water before passing to the gills is sieved in the Annelid *Aphrodite* by a felted mass of fine hairs, and in Decapod Crustacea by the hairs bordering the branchiostegite. In the crabs *Atelecyclus* and *Corystes* the normal respiratory current is reversed, and the water passes to the gills through a sieve-tube formed by the interlocking of rows of special hairs on the apposed antennæ. In *Atelecyclus*, which burrows to a shallow depth, the reversal of the current takes place only when the crab is imbedded; in *Corystes*, which burrows deeply, the antennal tube is elongated, and the reversal of the current is all but constant.

A wax model of a single electrical nerve cell from the spinal cord of *Malapterurus electricus* (River Senegal), and microscopic serial sections, was exhibited by Dr. Gustave Mann. The model was made from camera lucida drawings of a complete series of sections through the cell. It showed one axis cylinder process, and an enormous number of dendritic processes which in many cases are joined by their ends to form loops. The model was 500 times the natural size of the nerve cell.

A selection of the dried plants collected in Tibet by Mr. St. George R. Littledale, was exhibited by the Director, Royal Gardens, Kew. The plants were collected in the Gooring Valley, between Tengri Noor and Lhassa, in lat. 30° 12′ N., and long. 90° 25′ E., at an altitude of about 16,500 feet; they represented the general character of the vegetation.

Nuclear division in the spores of *Fegatella conica* was shown by Prof. J. B. Farmer. The spindle in these spores is of a very unusual form at first, but becomes normal subsequently. The primary cell wall remains free in the cytoplasm, and during the two second divisions of the nuclei it becomes rotated through an angle of 90°, and the spore is thus divided into four cells. The ultimate position taken up by the walls corresponds with that of a system of soap films, introduced into a box similar in shape to that of the Fegatella spore, when the cavity of the box is to become divided into four chambers by such films.

Mr. A. Francis Dixon showed a model to illustrate the method of reconstruction from serial microscopical sections by the use of glass plates. This exhibit illustrated a method of reconstruction which is especially useful in tracing the crossing and branching of fine structures, such as nerves and vessels in the embryo. The model was composed of a number of glass plates covered with a transparent varnish. On each plate was traced the outline of a portion of a section belonging to a series, multiplied in the case shown fifty diameters. The thickness of each glass plate was fifty times that of the section drawn on it. When the different plates were placed one over the other in order, a transparent model of the whole structure results, multiplied fifty times. The model shown illustrated parts of the distribution of the trifacial nerve in a rat embryo of the fifteenth day.

During the evening two lectures, with demonstrations by means of the electric lantern, took place. At one of these Prof. Meldola described the exhibits, by M. le Prof. Lippmann, of colour photographs by the interferential method. The photographs, which were projected upon a screen, represented stained glass windows, landscapes and flowers taken from nature, vases, and a portrait from life.

Experiments with liquid air were described by Prof. Dewar, F.R.S., at the second of the two demonstrations.

THE IRON AND STEEL INSTITUTE.

THE annual general meeting of the Iron and Steel Institute was held last week in London, commencing on Thursday, the 7th inst., and continuing over the following day. From the Report of the Council it would appear that the Institute is in a flourishing state. The membership is increasing, and naturally with it the income, whilst the expenditure shows a very remarkable diminution during the last two years. Those who are acquainted with this society know that this lessening cost of management has not been accompanied by any diminution of efficiency.

On the members assembling on Thursday morning, Sir Lowthian Bell occupied the chair in the absence of the President, Sir David Gale, who was prevented from being present by indisposition. The first business of the meeting was the presentation of the Bessemer medal, which had been awarded to Dr. Hermann Wedding, Professor at the Berlin School of Mines, in recognition of the services he has rendered to the iron and steel industries by his valuable contributions to metallurgical literature. An interesting feature in this ceremony was the presence of Sir Henry Bessemer, the venerable founder of the modern steel industry, who made a speech congratulating Dr. Wedding on being selected by the Council as the recipient of the medal.