

leaving the latter task to the speakers in the discussion; of these there were no less than twenty-five. They included Sir W. H. White, Prof. Kennedy, Colonel Crompton, Captain Sankey, Profs. Ayrton, Burstall and Capper, the Hon. R. C. Parsons, and Messrs. D. Drummond, A. F. Yarrow, E. B. Ellington, Bertram Hopkinson and Mark Robinson. Most diverse opinions were expressed by the various speakers, but it may be said generally that some system in which a college course would alternate with practical experience, in periods of greater or less duration, received acceptance. Sir William White, in closing the discussion, gave a promise that the matter would be considered by the council of the Institution of Civil Engineers, which would take into consideration what had been said in the section, as well as the proceedings before the Institution of Mechanical Engineers and the Institution of Naval Architects, both of which had presented to them papers on this subject by Prof. W. E. Dalby, who recently made a tour in America and on the Continent to study this question.

MINING AND METALLURGY.

Seven papers were read in this section. The first taken was by Sir Thomas Wrightson, Bart., M.P., and Mr. John Morison, the subject being "Notes on Percussive Coal Cutters." Details of the machinery were given, the authors arriving at the conclusion that in America machine coal-cutting had been successful, but in this country, up to the present, almost the opposite experience had been the result of the adoption of machinery, the economy, except in special cases, being doubtful.

"Recent Improvements in Gold-mining Machinery on the Rand," by Mr. A. E. T. Lees, followed. He dealt with the labour difficulty and its effect on the introduction of labour-saving devices. Considerable progress has recently been made in surface works, as well as certain improvements in mining machinery generally.

Mr. J. H. Harrison read a paper on "Equalising the Temperature of the Blast for Blast-furnaces, and its Effect on the Melting Zone." He gave particulars of the practice followed in America for preventing "scaffolds."

"Notes on Steam-driven and Gas-driven Blowing Engines" were contributed by Mr. Tom Westgarth, who had no hesitation in saying that the gas engine generally was more suitable for blast-furnace work, provided always that the gas saved by the use of the gas engine could be readily employed.

The remaining three papers read in this section were:—"The Continuous Method of Open-hearth Steel-making," by Mr. B. Talbot; "Alloys of Iron, Nickel and Manganese," by Mr. R. A. Hadfield; and "The Dangerous Crystallisation of Mild Steel and Wrought Iron," by Prof. J. O. Arnold.

SHIPBUILDING.

Section v. had five papers before it. The first was by Mr. A. F. Yarrow on "The Comparative Merits of Drilling and Punching in Steel for Shipbuilding." The author gave particulars of the British Admiralty regulations, which require drilling in place of punching for light vessels. He had found by experience that this was a wise provision, although it had been objected to by some contractors. In the discussion which followed, it was allowed that a drilled hole was better than a punched hole for light vessels, such as torpedo craft. For merchant ships, however, the greater expense of the drilling might be objected to.

Mr. John List read a paper on "Screw Shafts," pointing out the severe effects set up in them by racing in light vessels. He referred to the growing use of nickel steel for propeller shafts.

Mr. A. E. Seaton also read a paper on "The Modern Express Steamer for Short Passages," whilst Prof. A. W. Rateau dealt with "Steam Turbines." Mr. H. H. West contributed a paper on "Harbour Dues and Charges."

WATER-WORKS, SEWERAGE AND GAS-WORKS.

Five papers also were read in this section. The first was by Mr. G. T. Beilby on "Smoke Abatement." The author looked forward to the spread of the internal combustion engine and electric transmission of power to produce a better state of the atmosphere in large towns.

He also considered that the firing of steam-boilers with washed gas would prove advantageous.

The next paper read was by Dr. S. Rideal, and was on "Coal-gas Standards." The subject is not one that lends itself to compression. The same may be said of Prof. Percy F. Frankland's paper on "The Bacterial Treatment of Water and Sewage." The other papers read in this section were:—"Steam Turbine-driven Centrifugal Pumps for High Lifts," by Mr. C. W. Darley; and "The Raising of Water by Compressed Air," by Mr. Percy Griffith.

APPLICATIONS OF ELECTRICITY.

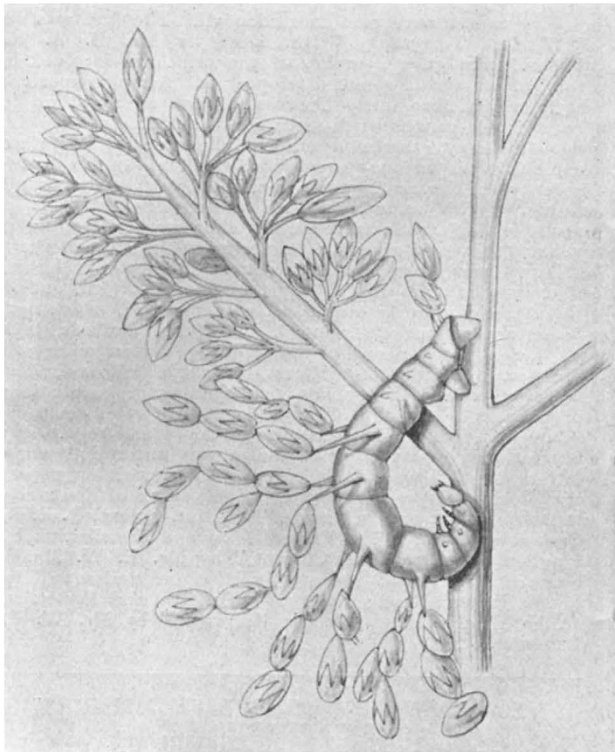
Five papers were read in section vii. The first was on "Wireless Telegraphy," introduced by Mr. E. A. N. Pochin, who gave a review of the principles involved in this subject and of recent developments. Among important facts which have lately been established are:—(1) up to considerable ranges earth-curvature is not a fatal obstacle, but hills may exercise a serious influence; (2) the ether exhibits what we may provisionally call a variable transparency to Hertzian waves, sunlight being an important factor. With regard to both these phenomena, it is probable that certain wave-lengths offer special advantages, whilst the second affords a faint clue to the relative share of earth and ether in transmission. Amongst problems, that of isolation is undoubtedly the most important, and in this direction two methods have been employed, which may be termed respectively syntonic and optical methods, both of which were described as regards performance and promise. During the discussion which followed, Mr. Gavey expressed the opinion that syntony in installations of wireless telegraphy of from 60 to 100 miles could be established, and maintained with certainty and regularity; but for long distances transmission was uncertain, owing to causes which were not apparent. The remaining papers read in this section were on the "Applications of Electricity to Driving Carriages in Towns," by Lieut.-Colonel R. E. B. Crompton, C.B.; "The Transmission and Distribution by Single-phase Alternating Current," by Mr. E. W. Monkhouse; "High-speed Electric Traction on Railways," by J. W. Jacob-Hood; and "The Position and Protection of the Third Rail on Electric Railways," by Mr. W. E. Langdon.

NEW CASE OF PROTECTIVE MIMICRY IN A CATERPILLAR.

IT is well known that the larvæ of many insects, such as those of the case moths, clothes moths, caddis flies, tortoise beetles, and the masked bug, construct for themselves cases or artificial coverings either for protection or concealment, and a new and somewhat remarkable instance is described by Mr. R. Shelford, the curator of the Sarawak Museum, in the *Zoologist* for May. We are indebted to the publishers for the accompanying illustration of the caterpillar described.

On May 16, 1900, a native collector brought in a quantity of a *Spiræa*-like plant, intended for the food of butterfly-caterpillars. It bore numerous pale green cymose inflorescences which were still in bud, and presently one of the branchlets was noticed to be moving. This proved to be due to the presence of a small Geometer caterpillar (only 9 millimetres in length) covered with buds from the inflorescence on which it was feeding. This "bore the following spine-like processes, a dorsal pair on the 4th segment, a dorso-lateral pair on segments 5, 6 and 7, a lateral pair on the 8th segment, and a short dorsal pair on the 11th; there were also some small tubercles in the positions shown in the accompanying sketch." To these spines strings of buds, connected by silk, were fastened in a similar manner, and when the green buds faded, or were removed, they were immediately replaced by fresh ones. "A bud would be shorn off with the mandibles, then held in the two front pairs of legs, and covered all over with silk issuing from the mouth of the larva; the larva then twisted round the anterior part of the body, and attached with silk the bud to one of the spinous processes, and another bud would then be attached to this, and so on, until a sufficiently long string (generally three or four buds) was made, when operations on another spine would be com-

menced." The larva fed on the buds of the inflorescence, scooping out the interior, and (when not hurried) using the empty shells in preference to whole buds for its covering. "When irritated, the larva curled up in the attitude represented in the sketch, and it remained in this position for fifteen or twenty minutes." At other times it would sway about, looking like a branchlet blown by the breeze. The larva spun up on May 28, forming a silk cocoon covered with green buds, but it was, unfortunately, destroyed by ants, and as no other specimen could be discovered, it is



supposed that, as is well known to be frequently the case with specially protected insects, the species must be very rare. The perfect insect is, of course, at present unknown.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Harkness geological scholarship has been awarded to Mr. R. H. Rastall, Christ's, and the Wiltshire prize in palæontology to A. Blackie, Peterhouse, and H. H. Hodgson, Trinity, equal.

The Museum of Zoology has received an important addition through the bequest of the late Mr. T. E. Buckley, of Trinity College. The collections include some 440 volumes of books, and about 400 birds.

In the natural sciences tripos, part i., thirty men and one woman gain first classes. In part ii. thirteen men and one woman appear in the first class.

The Raymond Horton-Smith prize for the best M.D. thesis of the year is awarded to the Hon. G. H. Scott, Trinity.

At St. John's College the Hockin prize for experimental physics is gained by Mr. J. H. Field, late Lieut. R.E. The Adams memorial prize in astronomy is awarded to Messrs. Gold and Phillips, equal. The Hutchinson studentship for research in botany goes to Mr. R. P. Gregory, University demonstrator.

DR. A. F. DIXON, professor of anatomy in University College, Cardiff, has been appointed to the chair of anatomy

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in Dublin University, lately held by Prof. Daniel Cunningham.

MR. J. STUART THOMSON, lecturer on biology at the Municipal Technical School, Plymouth, has been appointed to the post of assistant to the Government Marine Biologist at the Cape of Good Hope.

DR. K. J. P. ORTON, demonstrator in practical chemistry at St. Bartholomew's Hospital Medical School, has been appointed professor of chemistry at the University College of North Wales, Bangor, in succession to Dr. Dobbie.

THE Massachusetts Institute of Technology has established a laboratory of physical chemistry to be opened in September, which is to be devoted exclusively to research work. The laboratory is to be under the directorship of Prof. A. A. Noyes, with whom will be associated Profs. H. M. Goodwin and Willis R. Whitney. The researches will be carried on in large part by a staff of research assistants and associates working under their direction. Every facility will also be offered to advanced students who wish to carry on investigations in this branch of science.

AN appeal for funds to extend the department of experimental and applied science and natural sciences is being issued by the University of Dublin. It is pointed out that the University of Dublin must either obtain external aid to build and equip laboratories and lecture rooms for physical science, electrical and mechanical engineering, botany and zoology, or teach these subjects under grave disadvantage. A full report, drawn up by a committee appointed by the board of Trinity College to consider the present scientific requirements of the college, shows that a sum of 100,000*l.* is needed to provide for the requirements of the scientific schools of the University. Owing to the generosity of Lord Iveagh, however, the appeal is reduced to a request for an increased income of 27,000*l.* The entire capital outlay, 34,000*l.*, is undertaken by Lord Iveagh if the necessary income for upkeep is forthcoming within the next three years.

FOR a long time past the Merchant Venturers' Technical College, Bristol, though a large building, has been inadequate to meet the demands of the increasingly large number of adult day and evening students. Negotiations have, however, just been concluded by which an additional building will become available for the purposes of the college in September next. It is hoped to make provision in this new building for an extensive boot and shoe shop, and for new shops for printers, painters, bookbinders, and plumbers. In order that the new workshops may be fitted up with the latest improvements, the teachers of the college are to visit workshops of the same kinds in other towns. It is hoped also that the local manufacturers interested in the trades in question will be willing to contribute funds or apparatus. The total floor space in the new building will be close upon 12,000 square feet. The space available for the mechanical and the electrical engineering laboratories will be more than doubled. The present small hydraulic laboratory will be replaced by one many times larger, and a new large physical laboratory will be provided. Arrangements are being made to provide as early as the manufacturers can make them a large experimental steam engine, with two additional dynamos and all necessary measuring apparatus, at a cost of about 2000*l.*

THREE months ago, on March 26 (vol. lxxvii. p. 500), a note was given of the gifts to science and higher education announced in *Science* for the preceding quarter. Since then the following benefactions have been published in our contemporary:—Harvard University has received two anonymous gifts, respectively 2000*l.* and 10,000*l.*, for Emerson Hall, to be erected for the department of philosophy, for which the necessary 30,000*l.* required has now been obtained; a fund of 2100*l.* has been subscribed to establish a lectureship in memory of Edwin L. Godkin; 2000*l.* for the establishment of a scholarship and 1000*l.* for the Semitic Museum by the will of Jacob A. Hecht; Mrs. John Markoe has given 1000*l.* to establish a scholarship in memory of her son; and the Harvard Club of Chicago has given 1000*l.* to found a scholarship in memory of Dunlop Smith. Mrs. Anderson has given 200,000*l.* to Barnard