of the utmost value. It is hoped that the railway companies, at least in the metropolis, will take advantage of this enterprise on the part of the Postmaster-General. The borough councils have in the past not been very sympathetic, but perhaps, now that the matter will be arranged for them by the Post Office at such a trifling cost, they will adopt a more progressive attitude.

The explosives committee has considered the question of the available sources of nitrates, and the possibility of obtaining them during war; also the feasibility of manufacturing nitrates on a large commercial scale in this country. The committee considers that it is of the utmost importance that nitrates should be manufactured in Great Britain, even if the manufacture is not profitable; it is, however, of opinion that a commercially successful scheme is possible.

In the report of the Canadian committee reference is made to the conservation of natural resources of Canada. A source of great loss to the country is the prevalence of forest fires, and last year the Government spent the sum of 312,500*l.* in protection against this source of loss. The protection of native birds is also referred to. Much useful work has recently been done by the Canadian Waterways Commission, and in connection with this Dr. H. T. Barnes, the hon. secretary of the Canadian committee of the guild, has continued his valuable researches on ice formation in the St. Lawrence. Other subjects dealt with are radium standards, university settlement, prevention of tuberculosis, and free ice for the poor.

Appended to the report are the reports of committees dealing with the Milk and Dairies Bill, the work of the Canadian branch, and on a national system of education. Prof. R. A. Gregory contributes an appendix in which benefactions exceeding 10,000*l.* for the purposes of science and higher education are recorded, and a comparison is made between the incomes of universities and colleges in the United States and that of State-aided universities in Great Britain. From this article it appears that the total receipts of universities in the United States in the year 1910–11 amounted to nearly nineteen million pounds, and the benefactions to four and a half millions. In the same year, the total receipts of those universities and university colleges in Great Britain which participate in the Treasury grant were little more than 600,000*l.* The receipts from fees in England amounted to rather less than 32 per cent. of the total income. The amount received from endowment was about 15 per cent.; the receipts from local authorities 15·6 per cent. The total receipts of all kinds from the Exchequer amounted to 28·5 per cent. of the income.

As regards numbers of students in universities and technological institutions of university standard, comparison is made with Germany. There are twenty-one universities in the German Empire and eleven technical high schools or technical universities having the power to grant degrees. Taking the universities and technical high schools together, the statistics show that in the year 1910–11 they had about 71,000 matriculated students. The total number of full-time day students in the universities and university colleges of England and Wales (including those of Oxford and Cambridge) in 1910–11 was about 17,000, and in Scotland about 7600, in comparison with 55,000 in German universities. In the technical institutions of the United Kingdom, the number of day students in attendance was about 2000, in comparison with 16,000 in the technical high schools of Germany. From other tables given in the article it appears that more than 90 per cent. of the pupils in the State-aided secondary schools of England and Wales are under sixteen years of age, and one-quarter of the pupils are under twelve years of age. More than four-fifths of the pupils have not passed an examination of university matriculation standard when they leave school. Two per cent. of the pupils proceed to universities, and 7 per cent. to technical schools and institutions, medical schools, training colleges for secondary-school teachers, and like places providing special training for professions, trades, or commercial occupations.

RECENT WORK IN ECONOMIC ENTOMOLOGY.

VALUABLE memoirs published by the Entomological Division of the United States Department of Agriculture are constantly reaching us. Of these, Bulletin 110, on "The Spring Grain-Aphis, or Green-bug," by F. M. Webster and W. J. Phillips, is of more than passing interest. The species described—*Toxoptera graminum*, Rondani—has been noticed as seriously destructive to wheat and other cereals in North America—especially in the Middle Western States—during several seasons from 1890. In the eastern hemisphere it has been recorded only from a few localities—Italy, Hungary, Belgium, India, South and East Africa. The bulletin, extended to 150 pages, gives a full account of the insect, its embryology, post-natal development, habits, and natural enemies. An interesting bionomical observation is that south of the 35th parallel the species reproduces itself only by successive generations of virgin females, and even further to the north the sexual generation may be omitted from the life-cycle in mild winters.

Another bulletin which contains welcome original contributions to our knowledge of the life-history of Hemiptera is No. 108, on "Leafhoppers affecting Cereals, Grasses, and Forage Crops," by Prof. Herbert Osborn. H. M. Russell's contribution (No. 118) on the bean thrips (*Heliothrips fasciatus*) is also noteworthy. It is needless to add that these bulletins all deal with practical means for the extermination or control of the pests.

As a contribution to animal parasitology, Bulletin 106, "The Life-history and Bionomics of some North American Ticks," by W. A. Hooker, F. C. Bishopp, and H. P. Wood, is worthy of mention. It forms an excellent introduction to the ticks of pathological importance, giving diagnostic characters of genera and species, and furnishing in each case details of the early stages in the life-history.

From the Canadian Department of Agriculture we have received Dr. C. Gordon Hewitt's Bulletin, No. 10, on the large larch sawfly (*Nematus Erichsonii*). This paper gives, in a handy form, particulars of the prevalence of the insect as a larch-destroyer in Europe and North America. British entomologists are familiar with Dr. Hewitt's work in connection with this insect in the Cumbrian lake district. He finds it still more injurious across the Atlantic, where, he believes, it must be regarded as an introduced species. Naturally he is endeavouring to acclimatise in Canada the ichneumon-fly (*Mesoleius tenthredinis*), which reduced so considerably the sawfly population on the shores of Thirlmere.

Dr. Hewitt has found time also to contribute to *Parasitology* (vol. v., No. 3, 1912), a short account of the larvæ and bionomics of *Fannia canicularis* and *F. scalaris* (better known to most naturalists under the generic name of Homalomyia). These curious spinose maggots have an unpleasant interest as occasional inhabitants of the human intestinal and urinary tracts.

From the Imperial Indian Government's Agricultural Research Station at Pusa has been issued Bulletin No. 28 on "The Cultivation of Lac in the Plains of India," by C. S. Misra, a well-illustrated account of the insect (*Tachardia lacca*), the trees on which it thrives, their culture, the collection of the product, the manufacture of shellac, and its economic uses. The most dangerous enemies of the lac insect appear to be the predaceous caterpillars of four species of moth.

FORESTS AND CLIMATE.

THE very general belief in the influence of forests upon climate, and especially upon rainfall, is discussed by Prof. R. de Courcy Ward in an interesting article in the April number of *The Popular Science Monthly*. The subject is very complicated, and the author points out that we must be careful not to put the cart before the horse; in other words, the forests are the result of the rainfall, and not *vice versâ*.

The various questions involved are discussed in detail, the following being among the points dealt with:—(1) The historical method; (2) why forests should influence climate; (3) influence upon (*a*) temperature, (*b*) humidity and evaporation; (4) the cases frequently cited as showing an influence upon rainfall; (5) recent European studies. Among the authorities quoted, Hellmann has shown that the increase in the rainfall over a forest is accompanied by a lessened fall to leeward—simply a slight difference in distribution. Both Voeikof (Russia) and Hann (the leading authority on climate) believe that the vast tropical forests may increase the amount of rainfall. But as regards our own latitudes the author considers that there is at present no conclusive evidence that forests have a significant effect upon the amount of rain-*fall*, as distinguished from the amount of the rain-*catch* in the gauge.

There is comparatively little popular interest in the possible influence of forests upon temperature; the forest is a little cooler than the open in summer, and possibly very slightly warmer in winter. Supan sums up the case as follows:—"No one will care to maintain that the system of isotherms would be radically altered if Europe and Asia were one great forest from ocean to ocean." With regard to moisture, the author thinks that the local supply from forests cannot play any considerable part in the great rain-producing processes.

SYSTEMS OF LONG-DISTANCE WIRELESS TELEGRAPHY.

THE Advisory Committee appointed by the Postmaster-General to consider and report on the merits of existing systems of long-distance wireless telegraphy has made its report. The Committee heard evidence in private from representatives of the Marconi, the Telefunken, the Poulsen, the Goldschmidt, and the Galetti interests, and of the Admiralty, and the members visited a number of stations.

The report is strictly limited to practical considerations, and deals with matters of engineering rather than of scientific interest. From the point of view of the building of stations for immediate operation in the Imperial wireless chain, the report is overwhelmingly in favour of the Marconi Company, not only on account of its plant, but also on account of its experience; though the Committee points out that it would be possible for the Government to get together a highly trained staff and erect the stations, using any desirable patents under the provisions of section 29 of the Patents and Designs Act, 1907. The Marconi spark plant was tested by the Committee as to duplex working, and as to automatic transmission at the rate of sixty words per minute, across the Atlantic, a distance of 2300 miles. The Committee found Transatlantic communication practically continuous, though there are periods when the signals become very weak; and there are occasional periods when no signals at all can get through. These weak periods are due to natural causes, and can probably only be overcome by the use of high powers.

The Committee received no evidence supporting the reported transmission from San Francisco to Honolulu (2100 miles) by the Poulsen arc, but witnessed transmission over a relatively short distance at seventy words per minute. The members also saw the Goldschmidt alternator transmit at the rate of sixty words per minute. It is interesting to note that the Marconi Company and the Telefunken Company are both experimenting with generators of continuous waves. The Marconi machine consists essentially of a rapidly rotating contact-maker in a direct-current circuit with special dispositions of other circuits to give continuous oscillations in the antenna. The Telefunken machine is an alternator constructed to give as high a fundamental frequency as may be convenient in the first instance, the frequency being doubled or quadrupled by a polarised transformer method. The Marconi machine was witnessed working across the Atlantic.

SOME FURTHER APPLICATIONS OF THE METHOD OF POSITIVE RAYS.[1]

THE method to which I shall refer this evening is the one I described in a lecture I gave here two years ago. The nature of the method may be understood from the diagram given in Fig. 1. A is a vessel containing the gases at a very low pressure; an electric discharge is sent through these gases, passing from the anode to the kathode C. The positively electrified particles move with great velocity towards the kathode; some of them pass through a small hole in the centre, and emerge on the other side as a fine pencil of positively electrified particles.

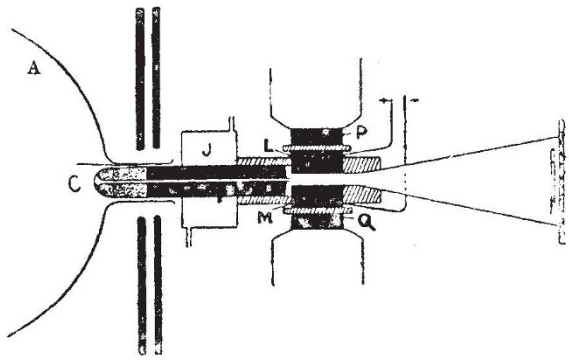

FIG. 1.

This pencil is acted on by electric forces when it passes between the plates L and M, which are connected with the terminals of a battery of storage cells, and by a magnetic force when it passes between P and Q, which are the poles of an electromagnet. In the pencil before it passed under the influence of these forces there might be many kinds of atoms or molecules, some heavy, others light, some moving quickly, others comparatively slowly, but these would all be mixed up together. When they are acted on by the electric and magnetic forces, however, they get sorted out, and instead of travelling along the

[1] Discourse delivered at the Royal Institution on Friday, January 17, by Sir J. J. Thomson, O.M., F.R.S.