appendage of the variable star R Coronæ Australis. Some results obtained since 1911 are described in a preliminary note (Bulletin No. 16). It is found that the nebula is bright when R Coronæ Australis is bright, and selectively variable areas have also been noted.

BRITISH RAINFALL IN 1915.

A DIGEST of the rainfall returns over the British Isles for the year 1915 is given in the *Times* of January 18 by Dr. H. R. Mill, director of the British Rainfall Organisation. For the purpose of the discussion 130 stations, scattered over the British Isles, have been selected from a total of 3000.

A table shows for each of the 130 stations the rainfall for 1915 with the average fall for thirty-five years, and the difference of 1915 from the average, also the percentage of 1915 fall on the average. The heaviest rainfall at the 130 stations was 103·52 in. at Seathwaite, and the least 24·56 in. at Bury St. Edmunds. Other records as yet to hand give 138·99 in. at Llyn Llydaw, in Snowdonia, and 138·97 in. on the Stye, overlooking Borrowdale, in Cumberland, whilst at Huntingdon the fall was only 23·99 in., and at Cambridge 23·00 in.

The percentage of the average rainfall for the year over the British Isles is given on a map which shows at a glance that the most excessive rainfall occurred in the south-east of England, south of the Thames, where the fall was 130 per cent. of the average. From the Bristol Channel to Mid-Norfolk there is a belt with practically normal rainfall, whilst to the north of this in the Midlands the rainfall was relatively higher. The east coast, as far north as the Moray Firth, had a rainfall in excess of the average. The whole of the west of Scotland and the north-west of England had a rainfall below the average; the deficiency was greatest in the West Highlands. The lack of rainfall in the north-west of Great Britain is said to have been a feature of the year's weather as striking as the excess in the south. In Ireland the distribution of rainfall during 1915 was not very different from the normal. For the British Isles as a whole there was practically an average rainfall with a tendency to excess rather than deficiency.

A table is given showing the general rainfall for the several months. The winter months—January, February, and December—had the greatest excess of rain in England and Wales, whilst the heavy summer rains in July were slightly the heaviest in Ireland.

The rainfall in London for 1915 was 28 per cent. above the average, the year being the wettest in fifty-nine years, with five exceptions—in 1903, 1879, 1878, 1872, and 1860; whilst the number of days with rain was 7 per cent. below the average. Rain fell for 568·9 hours, which is 136·1 hours above the average, and the highest in thirty-four years, except in 1903 and 1909.

SCIENCE AT EDUCATIONAL CONFERENCES.

II.

A PREVIOUS article (January 13) summarised the papers and discussions at conferences of teachers with reference to the national aspect of early training in science. The number and variety of the meetings was so great that many other points of general scientific interest deserve notice. First may be placed the exhibition of scientific apparatus at the meeting of the Public School Science Masters' Association, as it marks a new era. Formerly a large proportion of the laboratory ware and appliances were of German or Austrian origin; this year, with the exception of a few balances from Rotterdam, all the exhibits were British. Naturally, the size of the display was reduced, but there was no falling off in quality. So far as visual and handling tests can be trusted, the goods shown were of a high grade of material and workmanship. There was a large selection of electrical apparatus, mostly measuring instruments, suitable to all grades of teaching, from the most elementary forms of magnetometers or electroscopes to the elaborate potentiometer sets. Messrs. Philip Harris, F. E. Becker and Co., Gallenkamp and Co., and Gambrell Bros. all contributed to this section. Messrs. Baird and Tatlock (London) made a special feature of laboratory glassware, and a number of science masters paid a visit to their works at Walthamstow. Messrs. Philip Harris exhibited lamp-blown glass apparatus suitable for volumetric and research work, also moderately-priced strong instruments suitable for field-work in physical geography and meteorology. Balances were also a strong feature in the exhibits of the above-mentioned firms, and of Messrs. Townson and Mercer, the last-mentioned providing a good variety of glass apparatus. It was satisfactory to observe that those essentials, best quality porcelain and filter papers, have not been neglected. There is evidence that the efforts of the British Science Guild have stimulated the manufacturers; without doubt the guild, by bringing before the Government the fundamental importance of the supply of scientific apparatus, has done a great service to science teaching. It is inevitable that prices should be advanced, and doubtless there will be some shortage in the supplies here and there; but it is a matter for congratulation that the main requirements are being so well met by British firms under conditions of exceptional difficulty.

Exhibitions of books were held at the University of London, and also at the Science Masters' and the Assistant-Masters' meetings. New scientific books are being steadily issued, and the general state of the book-trade, so far as leading publishers of educational works are concerned, appears to be far more normal than could have been anticipated. This implies that instruction is proceeding with but little disturbance.

The inventiveness of the Science Masters shows no diminution. The Rev. W. R. Burton (Sandwich) showed several of those simple and cheap devices which combine the merits of economy with pedagogic effectiveness. An instance was an electroscope costing one shilling, the main insulator being a piece of candle deprived of its wick. Mr. D. R. Pye (Winchester) showed a most effective wave-motion model; even more educative was his model illustrating diffraction at a straight edge, of light from a point source. From Rugby came an admirable exhibit of chemical preparations made during the summer holidays, under the direction of Mr. E. R. Thomas. The Rugby exhibit included useful devices in the fitting of apparatus, and stereochemical models made almost instantaneously by the use of plasticine—a useful lecture "tip." To the present writer it seems a pity that these exhibitions should not be accessible to a larger number; if they could be transferred to South Kensington as soon as the P.S.S.M.A. meeting was concluded, their sphere of stimulating usefulness would be widened.

Mr. M. D. Hill (Eton) opened a discussion on "School Museums," the general outcome of which was the importance of frequent change in the objects shown, and the relatively great value of living objects, aquaria, etc. The curator must regard the function of the museum as dynamic rather than static. It was so much easier to follow the arguments of the speakers whenever the hearer knew the buildings in which the work was done, that it is here suggested that the British Association committee which is dealing with the subject should obtain a collection of photographs and lantern-slides of school museums.

The meeting of the Science Teachers' Association was largely attended by science mistresses, the proportion of men present being small. Miss Durham gave a lucid account of Mendelian laws, and described successful researches on the heredity of mice, canaries, and primroses. The association has recently formed small committees with the object of making it easier for teachers in schools to follow the growth of various branches of investigation. During the past year some papers have been read and circulated among members, of which we may instance "Development in Chemistry during the War," by Miss S. T. Widdows. Membership of the association is open to science masters, and it is hoped that those who realise the value to the nation of science in the schools and desire to promote efficiency by combined effort will communicate with the honorary secretary, North London Collegiate School, Sandall Road, N.W., with a view to membership.

These notes may finish with a quotation from the address on "The Teaching of Imperial History," by Sir Charles Lucas, to the Historical Society :—"What differentiated modern from ancient and medieval history was science and scientific invention. Scientific teaching has never been treated as the central and omnipotent force in the life of the nation, but democracy is the direct result of scientific invention and not of Acts of Parliament. The history of the past fifty years has been a record of the manner in which scientific invention has helped us by federating the different groups of Dominions." G. F. DANIELL.

MODERN SYSTEMS OF INDEPENDENT LIGHTING AND HEATING.[1]

III. *Lighting by Electricity.*

THE problems of lighting country houses by electricity vary greatly according to the size of the installation. The owner of a large country house has the advantage of being able to afford a competent engineer, and, since he generates on a large scale, he may obtain electricity at a relatively cheap rate, in some cases even at a lower rate than that ordinarily allowed by the local supply company. On the other hand, many country mansions are but little used by their owners during a great part of the year. This intermittent demand for electricity is a drawback, as it does not conduce to economy, and makes it difficult to maintain the plant in a state of continued efficiency. It is naturally inefficient to have a large engine and dynamo running to supply only a few lamps.

In small houses, on the other hand, the demand, though comparatively small, is more constant. It is probable that in such cases, taking due account of the running cost of generation, the interest of the original cost of the plant, and the repairs to the plant and batteries, the cost of generation will probably not be less, and may be more, than 4*d*.–6*d*. a unit; however, with some of the most recent automatic types of plant, generation at a rate of 2*d*. per unit is said to be practicable.

In a large country house the source of power may be a steam engine or an engine run by suction gas or oil gas. When water-power is available a water-turbine would probably prove the most economical and convenient source of energy. It is also necessary to instal a battery of accumulators in order to provide a steady voltage, and the usual arrangements for the control of the supply, including the switchboard, measuring instruments, resistances, etc., must be provided. It is generally agreed that the current of accumulators alone gives the most steady source of supply, and accordingly the battery may be used for the lighting during the evening and charged during the day. Special arrangements may also be made to run the lights from the battery and dynamo in parallel. One advantage of a large battery, as well as a dynamo capable of supplying the entire load, is that one has an emergency supply in case of the engine breaking down. The maintenance of the battery in good order is one of the chief difficulties in those installations where little current is used during the summer. Accumulators ought to be charged and discharged at regular intervals. There are even cases in which it is necessary occasionally to discharge the battery through a resistance as an "artificial load" during the summer, thus wasting current in order to keep the cells in good order.

It is very difficult to quote definite figures of the cost of country lighting installations; generally speaking, the cost for a fairly large installation, including the plant, battery, and switchboard of mains to the house, might work out as follows :—

No. of lights (16 c.p.)	Initial cost of plant, etc. £
25–30	100
40–50	130–150
80–100	150–170
200	200–220

To this must be added the expenditure on fittings and the cost of internal wiring. The cost of wiring in country districts may be as high as 25*s*. to 35*s*. a point. It is remarkable how the expenditure under this heading varies, especially in converting old mansions, where unexpected obstacles in wiring, due to the structure of the building, are often met. In many cases it is also desirable to allow a fair margin in estimating as to the size of the plant, as it is often useful to have electricity available for other purposes, such as heating radiators and driving pumps and agricultural machinery, etc. In large country houses with a big plant, electric radiators are frequently used for heating rooms. The small consumer, however, will scarcely go to this length, but may make good use of small heating accessories, such as electric kettles, irons, etc.

The possibilities of electricity for lighting a country house have been much simplified by the introduction of the metal filament lamp, the improved efficiency of which as compared with carbon filaments makes it possible to light a house of a certain size with a much smaller plant. It is usual to work at a pressure of 50 volts for lighting, as this enables metal filament lamps to be used under the most efficient and economical conditions. Small candle-power lamps having stout filaments and exceptional durability are available for 50 volts. On the other hand, if power is to be transmitted a considerable distance the cost of mains becomes an important item, and it may be desirable to raise the pressure to 110 volts in such cases, so that the current to be carried by the cables may be diminished.

To the small householder, the care of the plant is naturally an important item, and he may have to rely to a great extent on his personal efforts in this direction. It is therefore essential that a plant for small users should be as simple and easy to operate as possible. For small installations, the usual practice is to employ a dynamo driven by a small petrol engine. During the last few years there have been great improvements in the simplification of such plants, which have reduced the attention necessary to a minimum. In particular, devices have been adopted to enable the plant to run automatically, ceasing to generate when all the lamps are turned off, in the same way as a petrol-air gas plant.

[1] Continued from p. 553.