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.

One of the best known automatic plants of this type is the "Lister-Bruston." This plant has been specially designed with the view of avoiding the expense of the large batteries of accumulators ordinarily demanded by country-house lighting. The plant consists of a dynamo driven by an internal-combustion engine, but only a small set of accumulators is needed. These accumulators are sufficient to supply three or four lamps without running the plant. When, however, more lights are switched on, the current demanded by the lamps causes a relay, or automatic switch, to make contact, and the current from the battery then passes to the dynamo, which rotates for a few seconds as an electric motor, this starting the engine. From this point onwards the load is taken up by the engine and the dynamo, the battery, however, being in parallel. By this means the battery is kept charged, and has a steadying influence upon the electric pressure. In the same way, when

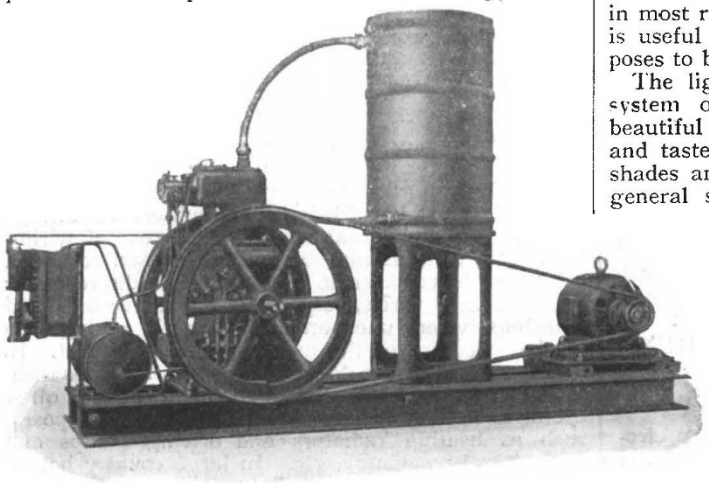

FIG. 1.—The Lister-Bruston electric generating plant. A petrol-driven engine drives a small dynamo, supplemented by a battery of small accumulators. By means of a special relay switch (shown on the left) the battery starts up the engine when more than a few lamps are put on. Similarly the switch is automatically released and the engine stops, when the load falls below a certain value. The plant is thus automatic in action and only a small battery is needed.

the lights are sufficiently reduced, the relay breaks the circuit to the dynamo and the engine stops, the few remaining lights being again run by the accumulators.

The plant is thus automatic in action, and is not run when the load is very small. In the event of the engine failing, the load will be taken up by the battery for several hours while the defect is put right. One advantage of the system is that the charging of the battery is automatically attended to, and the danger of permanent damage owing to the cells being allowed to remain uncharged for a long period is avoided. The success of such an automatic system demands an exceptionally robust type of cell, but it is claimed that these cells can be left to themselves for a long time without deteriorating. The firm also undertakes to keep plant and battery in order for a small annual sum.

While this system is mainly intended for lighting for country houses, it has also been applied to the lighting of small villages. In this case, the usual arrangement is to have several engines of varying capacity, which are automatically switched into circuit as the load increases and disconnected when the demand is small. This ensures that the plant is always working at full output and maximum efficiency.

Finally, a few words may be said on the illumination of country houses in general. It is most essential that the arrangement of the lights in the house should be carefully studied. Cases are sometimes encountered where a large, and even an unnecessarily large, plant has been installed, and yet the electricity available is not used to the best advantage. It is necessary to consider the purpose of the lamps in each room, and their positions should be selected with care. Bare metal filaments are inconveniently bright, and appropriate shades, softening the light and distributing it where it is chiefly needed, should be provided. By attending to these points it is often possible to manage with a much smaller plant than would otherwise be necessary. When electric light is used, the consumer should be cautioned against undue economy in the matter of switches and plugs. It is best to arrange for full control of the lights, so as to avoid the waste of burning an unnecessary number; in most rooms a series of plug outlets round the walls is useful in enabling portable lamps for special purposes to be employed.

The light should also be regarded as part of the system of decoration of the room. An otherwise beautiful interior may be marred by an incongruous and tasteless fitting; on the other hand, appropriate shades and fixtures harmonising with the colour and general style of decoration of the room add to its effect.

In converting old mansions to modern illuminants, considerable skill and artistic perception are often needed. Moreover, the lighting of each particular room, hall, dining-room, drawing-room, kitchen, bedroom, etc., presents a different problem. On the care with which this problem is studied the whole utility of the generating plant depends.

Petrol-Air Gas for Heating.

IN the article entitled "Modern Systems of Independent Lighting and Heating" in NATURE of January 6, p. 522, the section dealing with heating was necessarily curtailed, and Mr. W. Willett directs our attention to one point relating to his petrol-air gas system on which further explanation is needful. It should be explained that either a rich or a poor mixture of petrol and air can be obtained, the richer mixture being preferred for heating. For example, as stated, with the Willett plant a mixture of 2 per cent. of petrol is recommended for lighting; but the plant can be worked at either a 2 per cent. or a 6 per cent. mixture, according to the use for which it is intended. In country laboratories a richer mixture than 2 per cent. would be employed. Those selecting a plant would naturally turn to the makers for fuller particulars on this point.

THE BONAPARTE FUND FOR 1915.

THE committee appointed by the Paris Academy of Sciences to examine the requests for grants from the Bonaparte Fund make the following proposals, which have been confirmed by the academy:—

3000 francs to Auguste Lameere, professor at the University of Brussels, to enable him to continue his researches at the Roscoff Zoological Station.

4000 francs to Charles Le Morvan, assistant astronomer at the Paris Observatory, for the publication of a systematic and photographic map of the moon.

2000 francs to Paul Vayssière, for the continuation