Scientific.

THE FAURE BATTERY—STORED-UP ELECTRICITY.

(FOR ILLUSTRATION SEE PAGE 241.)

The current number of *Le Journal Universal d'Electricité* contains, says *Engineering*, a very ably written article by M. Frank Géraldy upon the Faure secondary battery, to which we recently referred. From this article we find the space to make the following extracts: "The posters bearing the words "Power and Light" in enormous letters, are still visible on the walls; the noisy articles that have appeared in certain journals are not yet forgotten; however, the bills are beginning to disappear, the effect of the articles to decrease, excitement is on the wane, and the scientific press can at last be heard. It has, indeed, been difficult to discuss this matter sooner, for it was essentially necessary to have data and information as exact as possible, and these have not been obtained without trouble."

The author then refers briefly to the secondary battery of M. Reynier, and proceeds to describe the Planté battery, which he states to be almost identical with that of M. Faure M. Planté having, except in one point, long ago anticipated what M. Faure has recently brought forward, and which has been received with so much popular excitement. He then continues: "We will now proceed to the Faure secondary battery. It is protected by two patents dated October 20, 1880, and February 9, 1881, respectively. In these patents M. Faure describes principally those batteries composed of lead plates laid on frames covered with red lead, and protected by leather, attached by means of lead rivets, an arrangement similar to the rectangular batteries of M. Planté. The actual batteries are not so made, being constructed as follows: Two sheets of lead are taken 7·87 inches wide; one of these plates is 23·62 in. long, and 0 04 in. thick; the other is 15·75 inches long and 0·02 inch thick. Each plate is covered on both faces with a layer of red lead reduced to a paste by water, 1·76 lb. being spread over the larger plate, and 1·54 lb. over the smaller. On each face thus prepared a sheet of parchment paper is placed, and the whole is introduced into a sheath of thin leather. One plate is then put on top of the other and rolled up, strips of rubber being interposed obliquely, as shown in the sketch. The roll is then placed in a cylindrical lead cell, the outside of which is strengthened with copper bands, and the inside covered with red lead and leather, so as to increase the useful surface of the battery. The latter then presents the appearance shown in the sketch, and one of the projecting stems from the lead plates is bent over and soldered to the inclosing cylinder, which is ready for use when it has been filled with water with about 10 per cent. of sulphuric acid. The apparatus when charged weighs about 20 lb. It will be seen that this differs from the Planté secondary battery only in the employment of red lead. The material chiefly employed is the same, the mode of construction is precisely similar, the leather takes the part of the cloth previously used by M. Planté; it has no merit in itself; on the contrary, it is a cause of resistance, and is liable to deterioration, being useful only to keep the red lead in place. It is, in fact, this red lead which constitutes the new feature, and gives the special advantage to the apparatus.

Sir WILLIAM THOMPSON has the following letter in this week's *Nature*:—I am continuing my experiments on the Faure accumulator with every-day increasing interest. I find M. Reynier's statement, that a Faure accumulator weighing 75 kilogrammes (165lb.) can store and give out again energy to the extent of an hour's work of one-horse power (2,000,000 foot-pounds) amply confirmed. I have not yet succeeded in making the complete measurements necessary to say exactly what proportion of the energy used in the charging is lost in the process of charging and discharging. If the processes are pushed on too fast, there is necessarily a great loss of energy, just as there is in driving a small steam engine so fast that energy is wasted by "wire-drawing" of the steam through the steam pipes and ports. If the processes are carried on too slowly there is inevitably some loss through local action, the spongy lead becoming oxydized, and the peroxide losing some of its oxygen viciously, that is to say, without doing the proper proportion of electric work in the circuit. I have seen enough, however, to make me feel very confident that in any mode of working the accumulator not uselessly slow, the loss from local action will be very small. I think it most probable that at rates of working which would be perfectly convenient for the ordinary use of fixed accumulators in connexion with electric lighting and electric transmission of power for driving machinery, large and small the loss of energy in charging the accumulator and taking out the charge again for use will be less than 10 per cent. of the whole that is spent in charging the accumulator: but to realize such dynamical economy as this, prime cost in lead must not be stinted. I have quite ascertained that accumulators amounting in weight to three-quarters of a ton will suffice to work for six hours from one charge, doing work during the six hours at the uniform rate of one-horsepower, and with very high economy. I think it probable that the economy will be so high that as much as 90 per cent. of the energy spent in the charge will be given out in the circuit external to the accumulator. When, as in the proposed application to driving tramcars, economy of weight is very important, much less perfect economy of energy must be looked for. Thus, though an eighth of a ton of accumulators would work very economically for six hours at one sixth of a horse-power, it would work much less economically for one hour at one horse-power, but not so economically as to be practically fatal to the proposed use. It seems indeed very probable that a tramcar arranged to take in, say 7½ cwt. of freshly charged accumulators, on leaving head-quarters for an hour's run, may be driven more economically by the electric energy operating through a dynamo-electric machine than by horses. The question of economy between accumulators caaried in the tramcar as in M. Faure's proposal, and electricity transmitted by an insulated conductor, as in the electric railway at present being tried at Berlin by the Messrs. Siemens, is one that can only be practically settled by experience. In circumstances in which the insulated conductor can be laid, Messrs. Siemens' plan will undoubtedly be the most economical, as it will save the carriage of the weight of the accumulators. But there are many cases in which the insulated conductor is impracticable, and in which M. Faure's plan may prove useful. Whether it be the electric railway or the lead-driven tramcar, there is one feature of peculiar scientific interest belonging to electro-dynamic propulsion of road carriages. Whatever work is done by gravity on the carriage going down hill, will be laid up in store ready to assist afterwards in drawing the carriage up the hill, provided electric accumulators be used, whether at a fixed driving station or in the carriage itself.

THE STORAGE OF ELECTRICITY.

The storage of electricity is a subject which naturally attracts great attention at the present time, which may without much exaggeration be described as the era of electric inventions, and thanks to the letters of Sir W. Thompson, the public has been led to believe that a great and wonderful discovery has been made, which is to give us light, power, and heat for next to nothing. The statement that a million foot-pounds of energy had been stored in a box and conveyed from Paris to Glasgow seems to have astonished the newspapers, especially the apparent magnitude of a "million foot-pounds." Those acquainted with the rudimentary data of mechanical science know that large as a "million foot-pounds" looks upon paper, it really represents very little in the shape of power—just about as much for instance as an Otto gas-engine would give out at the cost of one half-penny! The really important point is that MM. Reynier and Faure, experimenting on the lines laid down by M. Planté, have invented a secondary battery which enables us to store electricity in a fairly economical manner; what the practical value of that discovery amounts to remains to be seen. The discovery of the secondary battery, the effects of which are technically known as "polarisation of the electrodes," seems like other great inventions, to have been made gradually. Soon after Volta's pile made its appearance at the very beginning of the century, M. Gautherot, a French savant, observed that wires of certain metals after being used as electrodes for the decomposition of water, acquired the power of yielding a current for a short time after being detached from the pile; but Ritter, of Jena, was the first to devise what is termed a secondary battery. He made many experiments with many metals, including lead; but, as is often the case, he failed altogether with the very metal which is now known to yield the best results. Volta and Marianani, and after them Becquerel, gave the true explanation of the phenomenon by showing that the action arose from the accumulation or deposit of oxygen and hydrogen on the electrodes, the surface of which thus became changed chemically, and were consequently capable of acting towards one another as two metallic plates in an ordinary form of battery. In 1843, Mr. Justice Grove invented what is known as his gas-battery, in which two platinum plates are placed in bell-jars containing respectively, oxygen and hydrogen, the whole being partially immersed in a vessel containing dilute sulphuric acid. The