platinum plates partly immersed in dilute acid, and partly in the respective gases will yield a current if connected by a wire, and will continue to do so, so long as the gases exist in such proportions as to form water by combining. Further, if the terminals of the gas battery are connected to an ordinary galvanic cell capable of decomposing the dilute sulphuric acid, or practically of liberating hydrogen and oxygen, the reservoirs of the gas battery become replenished. It is not unlikely that, before long, a useful secondary battery, working on the principle of the Grove gas-battery will be invented ; but the latter is practically of little use as a reservoir of electricity and just at present more encouraging results in the direction of storing electricity have been obtained with modifications of the devices which Ritter was the first to employ. About 20 years ago, M. Gaston Planté took up the study of the subject where Ritter had left it, and after experimenting with a number of metals, he found that electrodes of lead immersed in dilute sulphuric acid gave the best results. He, in fact, invented the first real accumulator of electricity—a cell which, charged by a weak source, would yield a powerful current for a short time. The Planté cell consists of two sheets of lead, cut so as to leave a long tongue projecting at right angles at the end of each ; these are separated by two sheets of canvas, and are rolled up loosely, so as to fit into a battery-jar containing dilute sulphuric acid. The canvas is merely to keep the two sheets of lead from touching ; bands of rubber and other materials have also been used, felt, for instance, being employed in the Faure battery. The lead plates being connected with an ordinary battery, oxygen and hydrogen are liberated, the former attacking the surface of its plate and forming peroxide of lead, while the hydrogen is probably to a large extent occluded by the other plate, the surface of which assumes a peculiar spongy texture. When the plates are brought to this state the secondary battery is in its best condition to receive a charge, and in the shape of chemical work done will store up a considerable amount of energy which it will give up again in the form of electric current, less a certain percentage. The current furnished by the secondary battery is, as a rule, far more intense than that employed to charge the accumulator ; for instance, a battery of half a dozen Planté cells, about 6in. high, can be charged by a couple of Bunsens, and when, so to speak, saturated, will yield a current capable of melting a knitting-needle, or of producing a brilliant electric arc for a time counted by seconds rather than by minutes. A reference to the indices of our back volumes will show that other forms of secondary battery have been devised, but practically, M. Planté is the most successful, with the exception (perhaps) of its most recent modification by MM. Reynier and Faure. Instead of charging and recharging, including reversing the action, in order to get the lead plates into the proper condition, for receiving the charge, M. Camille Faure coated the plates at once with a film of minium or red-lead, the ordinary composition of which is represented by the formula, $2\ PbO, PbO_2$, whereas the peroxide formed by the charging and recharging of the Planté battery is PbO_2. The plates separated by strips of felt or rubber are rolled up just as are those employed in the Planté batteries, and according to the accounts published in Paris, the results are surprising. There seems to be no doubt that the use of the red-lead or minium is a decided advantage,—to what extent is not at present known, and that therefore the Faure modification of the Planté accumulator is more likely to be useful than its predecessor. It must be clearly remembered that the Faure battery creates nothing ; it is a receptacle for electric energy, which it stores in the shape of chemical work, and gives out again in the shape of electric current, with more or less of loss—how much remains to be seen.

Referring now to the famous letter that appeared in the *Times*, and taking the statements there given by an enthusiast—a box containing four of the new batteries each about 5in. in diameter by 10in. high, weighing some 75lb., and holding nearly one million foot-pounds of "power," conveyed to Glasgow in 72 hours—we may well ask what is the feat that has caused so much ink and paper to be wasted? The new battery enables us to "store electricity" in such a form that we can use it just when we want it ; it enables us, therefore, to use electricity where before the invention of the accumulator we could not conveniently or comfortably employ its agency ; but as a source of power, from an economical point of view, the secondary battery is practically nowhere. To utilize it as power we must have a dynamo-machine, and that costs rather more than a gas-engine, while at the same time rather more than a million foot-pounds could be put into a box having a capacity of a cubic foot, in the shape of the common, well-understood, and cheap coal-gas. It is pointed out that the wonderful box contained no more energy than exists in an ounce and a half of coal ; but then, unfortunately, we have never been able to utilize more than about one-tenth of the energy of the coal, whereas, from the experiments of Sir W. Thomson it seems probable that we may fairly count upon recovering some 90 per cent of the energy put into a Faure's battery, and it obviously has many applications where lumps of coal would be simply useless. But the Faure battery weighs 80 times as much as its actual mechanical equivalent in coal, or 800 times as much as the theoretical equivalent. Suppose, then, we find some means of utilizing the energy of coal in a more economical manner, so as to approach the theoretical value ; where then is the wonderful battery which, according to financial speculators and newspaper scribblers, is to revolutionize the industrial world ? As the matter stands, to obtain the energy practically available in one ton of coals, we must have 80 tons of lead plates and battery jars, and shall then have to determine whether it is more convenient to use an electric current, or employ the more familiar appliances of steam or gas-engines. The Faure accumulator is more useful than, say, a Daniell's battery, because it enables us to employ the current generated by the latter under more serviceable conditions—under conditions in which the Daniell's battery would be useless : in fact, it presents energy to us under another form than that in which it exists in coal. It may be urged that Faure batteries can be charged by means of currents derived from machines worked by water or wind-power ; but if so, it will be necessary to store the batteries near the source of power, and the cost of their carriage to and fro will be heavy ; the alternative is to keep the battery where it is to be used and conduct the current to it. With the exception of wind and water-power, the cheapest source of energy is coal ; but if anyone can so decompose coal as to employ its energy directly in the form of a battery, then we may regard steam-engines and their boilers as old-fashioned and costly incumbrances. Sir W. Thomson has experimented with the "wonderful box," and has found that one weighing 165lb. will store and give out 2,000,000 foot-pounds, or one horse-power during an hour, and if the conditions of work are adapted to insure economy it will do that with a loss of only 10 per cent. of the energy imparted to it. Accumulators weighing three-quarters of a ton (15 cwt.) will work for six hours on one charge at the uniform rate of one horse-power, giving a high economy, probably fully 90 per cent. of the energy put into them ; but if applied to driving tramcars, where it is necessary to reduce the weight, Sir W. Thomson thinks that accumulators weighing 7½ cwt., and working through a dynamo machine, would drive a tramcar more economically than horses, so far as power is concerned ; but that is a question that cannot easily be settled, for on the one side we have the cost of horses, their keep, care, and stabling, and on the other the cost and care of dynamo-machines and Faure accumulators. We are inclined to think that at present rates horses are cheaper and simpler, and that if ever tramcars are propelled by electricity it will be by currents received direct from a dynamo-machine, not by secondary batteries which will add materially to the non-paying load. The Faure battery has a field before it which it can occupy. It may be utilised for electric lighting for short periods ; it will furnish a supply of electricity where it would be impracticable to convey dynamo-machines and inconvenient to take batteries—it may even be found of use as a precautionary reservoir in electric-lighting circuits to supply current when the motor is temporarily disabled, -but as a substitute for mechanical power, we may safely say its day has not arrived. As a step towards a satisfactory method of storing electricity it will receive a full share of attention ; but so far as is know at present it can really do little more, from a commercial point of view, than the Planté battery.—*English Mechanic.*

APPLICATIONS OF ELECTRIC POWER.

Mr. G. Trouvè has just constructed an electric motor specially adapted to be used in a row boat or canoe. He made his first experiment on the 26th of May, in Paris, on the Seine, in the presence of MM. Berger, Commissioner-General of the Exposition Universelle d'Électricité, Antoine Breguet, editor of the *Revue Scientifique*, and numerous other spectators, who were greatly astonished to see the boat moving against the current without oars or the smoke generally inseparable from the steam engine.

This electric motor is furnished with a Siemens armature connected by an endless chain with a screw having three paddles, and placed in the middle of an iron rudder. The motor is placed on the upper part of the rudder, so that both the motor and propeller follow the movements of the rudder.