ELECTRICITY AS POWER.

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In the early history of electrical science, many forms of engines were made, by which the power of electricity could be shown. Each was as wonderful as the other to the unthinking observer; for, without apparent combustion of fuel, work was done. We find, among the largest of these engines, one used in St. Petersburg, to drive a small boat, and one in this country to propel a train.

The United States Congress voted a sum of money to Prof. Page to carry on his experiments and he built a very efficient motor. After many experiments, though it was found that any amount of power could be obtained, yet the expense was so great as to make it of no practical value. In a small machine, the consumption of zinc might not be noticed, while in a large machine it would be found to burn exactly as the work was taken. Now that the doctrine of energy is clearly understood, the folly of the attempt can easily be seen. In a battery the fires are fed with an expensive metal. The energy developed by the zinc, thus used, was given to it artificially when it was reduced from the ore. In order to obtain a convenient fuel, both the coal and zinc ore must be mined, and the latter reduced, absorbing in the reduction a very small per cent. of the energy of the coal used in the process. Thus batteries for furnishing power consume a fuel at least fifty times more expensive than coal.

Besides the cost of fuel, the atmosphere, so to speak, in which the zinc burns, must be furnished to it artificially in the shape of acids or solutions. Though this has nothing to do with the theoretical cost, yet in practice, it is found to be the largest item of expense. It resembles furnishing a boiler with air made by a chemical process, so far as the economy of combustion is concerned. Yet the convenience and reliability of a battery to burn zinc has, where very small amounts of power are required, allowed of its use commercially, since steam is extremely difficult to manage in fractions of a horse power.

To-day the practice has been entirely reversed from what the first experimenters expected to realize. For electricity is now entirely made by means of steam engines to drive large motors. The last few years have brought the means of generating and using electrical currents to such a high state of perfection that power may be with economy transferred by them.

The loss in transferring is double; if a machine converts fifty per cent. of the power it receives from a staem engine, only fifty per cent. of that can be utilized, that is, twenty-five per cent of the original; thus wasting seventy-five parts out of each hundred of energy. A sixty per cent. machine can render effective thirty-six per cent.; an eighty per cent. machine can turn into useful work sixty-four per cent., and so on. This wasting of power in the transmission is more than counterbalanced in a great many cases by its delivery at the point where needed; for example, from a waterfall to a field for ploughing and threshing, as has been done in France; or from the shore to the water for the purpose of driving a torpedo boat, as has been done in this country.

Lately experiments have been made to show the application of electricity to railroads. Mr. Siemens, in Berlin, and Mr. Edison, at Menlo Park, are experimenting with electrical railroads. Mr. Edison uses the rails as conductors of electricity, the current going in one and returning in the other. The wheels are insulated, so that, by means of brushes on them, the electricity may be brought to the moter, which is on a carriage. The moter is simply one of Mr. Edison's generating machines, laid on its side, and connected by suitable mechanism to the axle of the driving wheels. On an experimental track of one-half mile length, a speed of twenty to thirty miles an hour has easily been reached, in spite of heavy grades and sharp curves.

For elevated and underground railroads, this method has many advantages; it does away with all the smoke and noise from the puffing of the locomotive, and substitutes for the many locomotives a few stationary engines scattered along the route. Mr. Edison feels very confident of success, since his troubles so far have all been in transferring the power from the armature to the driving wheels. He thinks that if the armature is only reliable, experiment will lead to proper mechanical devices for transferring the power from the quick-running armature to the slower driving wheels.

The road will be very useful in mountainous regions, since the engine is quite light and can be carried by trestle work and light earth work, over any country. The engine and boilers are not in this case put on wheels and required to push themselves over grades and around curves, but are placed in the valley below. Perhaps in many cases they may be done away with and water used to drive the generators.

For beach roads, in grand exhibitions, as feeders to main lines, and in many ways it is easy to see that use may be made of a properly constructed road. The gentle fluid, which has so quietly, for many years been the swift messenger of man, is now showing that it is also able to be a strong and lusty servant, and carry any load that it may be asked to take.

ELECTRICAL INSECTS.—It is not generally known that there are insects which possess the peculiar electrical properties of the Raia Torpedo and Gymnotus Electricus. Kirby and Spence, in their entomology, describe the *Reduvius Serratus*, commonly known in the West Indies by the name of the *wheel bug*, as an insect which can communicate an electric shock to the person whose flesh it touches. The late Major-General Davis of the Royal Artillery, well-known as a most accurate observer of nature, and an indefatigable collector of her treasures, as well as a most admirable painter of them, once informed me, that, when abroad, having taken up this animal and placed it upon his hand, it gave him a considerable shock, with its legs, as if from an electric jar, which he felt as high as his shoulder, and dropping the creature, he observed six marks upon his hand where the six feet had stood. Two similar instances of effects upon the human system resembling electric shocks, produced by insects, have been communicated to the Entomological Society by Mr. Yarrell; one mentioned in a letter from Lady de Grey, of Groby, in which the shock was caused by a beetle, one of the common *Elateridae*, and extended from the hand to the elbow on suddenly touching the insect; the other caused by a large hairy lepidopterous caterpiller, picked up in South America by Capt. Blakeney, R. N., who felt on touching it a sensation extending up his arm, similar to an electric shock, of such force that he lost the use of his arm for a time, and his life was even considered in danger by his medical attendant.