For the Scientific American.

The Voltaic Battery.

NUMBER III.

We have already seen what it required to form a battery in general; we will now inspect the different kinds of batteries, and examine their different parts and attend somewhat to the chemical operations going on in the instrument. By this course we may arrive at a clear conception of what it is that makes the difference between the inventions of Grove, Daniell and Smee.

Let us again recur to our primary experiment:—we saw that the battery must contain a compound fluid, one element of which must combine with the zinc. For the sake of illustration we supposed this fluid to be muriatic acid. But this is not the only compound fluid capable of giving up one element to the zinc; water, which consists of oxygen and hydrogen, will readily give up its oxygen to the zinc; but if we use water to excite the battery, we shall find the action extremely feeble at first, and soon to cease altogether. If we now inspect the zinc we shall find it covered with a hard and insoluble white crust,—hence it is evident what caused the deficient action: the oxide of zinc formed by the oxygen of the water and the zinc, has excluded the water from contact with the zinc, for as it formed on the surface of the zinc it remained there—the oxide of zinc being as insoluble as a flint stone.

But if we can render the oxide of zinc soluble, so as to remove it from the zinc as soon as formed, it is obvious that we may employ water for the battery. Sulphuric acid will combine with oxide of zinc and form sulphate of zinc, which is very soluble; now we will add some sulphuric acid to the battery containing only water, and whose action has ceased, and we see immediately a copious stream of hydrogen bubbles from the silver plate.

It must be borne in mind that it is not the acid that excites the battery, but the water; the acid serving merely to form with the oxide of zinc a soluble substance, which, being dissolved by the water, allows the zinc to be continually in contact with the water, and thus oxide to be continually forming.

Here it is manifest that the water performs two offices; first, to form oxide, and afterwards to dissolve this oxide when combined with sulphuric acid. Now, as a given quantity of water will dissolve only a certain quantity of sulphate of zinc, it will be useless to add more acid than will make sufficient of the sulphate to saturate the water, for if the acid exceeds one-fifth the weight of the water, more sulphate will be made than the water can dissolve, and so the battery action will cease. Practically, the acid should never exceed one-fourth the bulk of the water.

We have now made one change in our experimental battery by substituting, in the place of muriatic acid, water and sulphuric acid—this acid being cheaper than the other, not poisonous, and free from any unpleasant smell.

But the zinc we supposed to be chemically pure, and as such is very expensive; let us try a piece of ordinary zinc in its place: now we see there is constantly a torrent of gas from the zinc, whether the wires are joined or not, and in a short time the zinc is all gone. This shows rather a poor prospect for the use of ordinary zinc. But Mr. Kemp, of England, made the important discovery, that by smearing the zinc with quicksilver it would act precisely like pure zinc, thus suffering no loss except when the battery is in action. To amalgamate a zinc plate, it is only necessary to immerse it for a few moments in dilute acid, and pour a little mercury on it, and spread it over the whole surface with a rag.

Let us now attend to the difference between pure and common zinc:—ordinary zinc is contaminated with about five per cent. of charcoal and iron; if we rub a piece of pure zinc with iron filings or coal dust, and then immerse it in the acid, we find that it behaves precisely as the impure—each particle of zinc giving off a stream of gas; hence it is evident that the iron or coal performs an office to the zinc precisely similar to that of the silver of the battery, only the voltaic influence is not conducted by the wires but confined exclusively to the vicinity of the impurities. This is what is termed "local action;" and it is a great trouble and loss in large electro-metallurgical operations. As the zinc is dissolved away by the proper battery action, the impurities are brought to the surface, and combining with the mercury, deprive the zinc of its protecting influence: local action will then commence and rapidly eat up the zinc plate. In general, one amalgamation will last for the depth of one-tenth of an inch on each side of the plate, and a plate of one fourth of an inch thick will require several times to be amalgamated. But local action may begin at any time, and the prudent operator will amalgamate every day, for much zinc will be thus saved, and in the end no more mercury for the spongy compound formed on the surface of the plate should be saved, and the mercury obtained by distillation. In this way the ultimate cost of amalgamation will not exceed two cents per pound.

In forming our primary battery, it was supposed that we used any convenient silver plate —say a dollar hammered out to extend the surface. Let us now take this rude plate and polish it until it is as bright and smooth as a mirror. On restoring it to the battery we find it no longer performs its office of throwing off the hydrogen, but the gas adheres to it in large bubbles. We now find that taking away the roughness of the plate injured it, and if we again roughen it by well rubbing it with fine sand-paper, we find it to perform even better than at first.

If we look at the sand-papered plate with a magnifying glass, we see the bottom of each scratch smooth; now Mr. Smee, to take the utmost advantage of the roughening principle, after roughening with sand paper, attaches it to the zinc of a battery, and so uses the plate to decompose chloride of platinum; the metal is reduced on the silver in the form of a black powder. If we now look at this platinised plate with the magnifyer, it appears as a bed of points. A plate so prepared will evolve the gas in torrents.

We have now converted our experimental battery into a Smee's battery, and such an instrument, formed of a dollar hammered out and a piece of amalgamated zinc, both suspended in a tumbler of dilute acid, will be as good a battery as we can obtain: a better one cannot be purchased, though bigger ones may be had. Let this be borne in mind, that the mechanical form of the battery does not affect the battery action.

This adhesion of the hydrogen was a great obstacle to the battery action, and the different methods of overcoming it is what constitutes a Smee's, Daniell's or Grove's battery. By our first definition of a battery, it must consist of two bodies capable of eliminating the elements of the fluid the zinc eliminates one element in all three batteries. In the Daniell's battery the second element is eliminated by using sulphate of copper in the place of the silver of our battery; but as the sulphate of copper would commingle with the water and acid necessary for the zinc, it has to be confined in a bag or porous cup, for it is necessary for the second body of the battery to be in contact with the compound fluid. The hydrogen here is not evolved, but enters in combination with the oxygen of the oxide of copper and forms water, while the copper is precipitated on the conductor.

This battery is generally constructed of a leather or other porous cup, containing a cylinder of amalgamated zinc and acid, and the porous cup placed in a copper vessel, filled with a solution of sulphate of copper; crystals of the salt are added from time to time, and being first dissolved, and afterwards decomposed, their metal is precipitated on the copper, which at length becomes so thick as to unfit it for use. There is a great trouble from the blue salt leaking through the porous cup to the zinc, and also from the deposition of copper on the porous cup. But the operator need not trouble himself about these defects, for the battery costs more than one of Smee's of the same size, in the first place, and more than twice as much to maintain its action, and will do only one-fifth of the work.

This battery is called the "constant battery," and "sustaining battery." As the copper is abstracted from the sulphate the acid is set free, and this leaking through the porous cup supplies a small but steady stream of excitant to the zinc, but the amount of action obtainable in this way is very small, but it answers well for the kind of telegraph used in England, and also for some other purposes.

(To be Continued.)

For the Scientific American.

Steam and Water Power.

In compliance with a call in the columns of your journal, for information as to the comparative expense of water and steam power, a writer who signs himself B. A., appeared in the Scientific American of the 24th of last August, with the intention of clearing away all the knotty points of the question, to make the subject as clear and plain as the light of the mid-day sun, and thereby putting the controversy at rest forever. B. A. seems to know, or assumes to know, so much about the subject, that it may possibly be deemed presumptuous in me to question any of his statements, or try to shed any further light on the subject than has flowed from his pen; yet I must beg leave to do so, even at the hazard of being written down an ignoramus.

B. A. commences his statements with, "Steam power in cost is nearly uniform, and except as to location, a trifle in the cost of fuel, is much the same every where; but that of water has no fixed value, its cost depends on location and other local advantages." He then gives as "a comparatively extreme case," a water power "within five miles of the tide waters of the Hudson River," with a "natural rock dam," and "estimated constantly at 300 horse power in the driest time that water runs." This water power and natural rock dam, he puts down at a cost of one thousand dollars. B. A. says, "steam power in cost is nearly uniform," &c. Well, the location is something—indeed it is so much that we will agree to erect a steam mill, in an Atlantic city, that shall save all that he gains by his cheap water power, in the expense of transportation alone and heating the mill; and will also engage to furnish steam to run and warm the mill, in some locations I could name, at less cost than he can warm his with, on his cheap water power. He speaks also of the difference of a trifle in the cost of fuel. Well, he puts down coal at $5 per ton, or $6,260 per annum, to generate 300 horse steam power; but there are hundreds of sites for cotton mills in the United States, where both cotton and coal may be had in abundance at the very doors—the cotton at two cents per pound less than he can purchase it for at his cheap water power, and the coal at 60 cents per ton. The saving in the cost of cotton would be more than $30,000 per annum, and, in the cost of coal, above $4,000 more—an aggregate per annum quite as large as the profits he can make at his cheap water power; and this is not "comparatively an extreme case." He is fortunate enough to find a natural rock dam. So possibly might we at Niagara Falls, with as much water as we pleased, free of cost. But B. A. has not told us how much it has cost to erect flumes, race-ways, wheel pits, &c., and to construct foundations for his mill —probably quite as much in proportion to the power used, as the sum of $25,000 set down as the cost of the steam engine of 300 horse power. He also puts down the sum of $6,500 as the cost of water-wheel, bulk-head and race. We should very much like to see all this apparatus for 300 horse-power at that cost. Water-wheels, &c., must grow spontaneously in that country, and be endued with magic powers; they are probably accompaniments to natural rock dams,—nature must have formed that site for a cotton mill, and secured it by patent. The science of mechanics and improvements in mechanical labor, have not yet reached that point of excellence at Lowell and Lawrence. Our friend would do well to repair thither, and give them a few lectures on wheels, bulk-heads and races. Some of the wheels there cost $20,000 apiece, for 150 horse-power, and there are few, it is believed, which have not cost three, four or five times as much as he states, to say nothing of the other matters named.

MANUFACTURER.

Scientific Memoranda.

STAITE'S ELECTRIC LIGHT.

We had thought that Mr. Staite or his "electric light, was dead, but it seems that he is as lively as a kitten, and has been recently illuminating some of the cities of old England. At Sunderland he exhibited his electric light from the Light House,—thousands thronged the quays and piers; and many took trips to sea to witness the effect of the light several miles from the land. The apparatus was erected upon a temporary platform, raised a few feet above the light-house, on the South pier—the galvanic battery being placed in a shed below. We learn by the Sunderland Herald that at ten o'clock exactly the anxious spectators were gratified by the first glimpse of light, which was shown by a parabolic reflector.

At Ryhope, three miles off, a lady was enabled to read a letter which she had never opened; and at Whitburn, two miles distant, in an opposite direction, the Herald was read on the sands by several individuals, when the reflector was in such a position as to cast a beam of light in that direction. The iron bridge which crosses the river Wear, three-quarters of a mile from the pier, was crowded; and indeed, almost everywhere that it was known the light was to be exhibited, parties were eager to obtain a glimps of it. At half-past ten o'clock the commissioners proceeded out to sea, a distance of seven miles, in the Sea Horse steamer, at which distance the pier light was invisible; while the electric light shone clear, bright and effulgent as ever; and a captain might have brought his chart on deck and consulted it with ease.

EXTRAORDINARY SUBSTANCE FOUND IN THE STOMACH OF A HORSE.

A short time since a horse belonging to a Mr. Moates, of Spalding, Eng., died and was opened, when a stone about the size of a man's head, or rather in shape and appearance exactly resembling the wig-block used by barbers, was found in the stomach. It weighed eight pounds, and seemed as a flint-stone, and extremely polished and beautiful. Another stone, of the shape and size of a horse's foot, was found in the stomach. These wonderful formations are produced in the stomach, no doubt much in the same way as stone in the bladder, a nucleus being first formed. The polish would be caused by the motion of the stomach in the course of digestion, or perhaps by the friction of one stone against the other. How any animal could live and work with such productions within its stomach is most astonishing. A very large sum is offered for the productions.

MONTGOMERY PRIZE HAM.

Mr. Nathan White, of Montgomery county, Maryland, gives the following as the recipe by which the prize ham at the late Fair was cured:

"The pork should be perfectly cold before being cut up. The hams should be salted with bloom salt, with a portion of red pepper, and about a gill of molasses to each ham. Let them remain in salt five weeks; then hang them up, and smoke with hickory wood for five or six weeks. About the first of April take them down, and wet them with cold water, and let them be well rubbed with unleached ashes. Let them remain in bulk for several days, and then hang them in the loft again for use."

MAMMOTH CYLINDER.

The largest cylinder in the world was cast on Saturday, the 21st ultimo, at the West Point Foundry, Cold Spring. Its outside diameter is 17 feet and its depth 11 feet; the bore is to be 14 feet diameter. This cylinder is for a rotary engine, the invention of Henry G. Thompson, Esq., of this city, and is intended to work, it is said, with low pressure steam, and expansively at the same time. It is intended for a new steamboat, 340 feet long, to run on the Hudson. We shall see what this rotary will do; if it be like its predecessors, it will be an entire failure.