Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 261 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, MAY 6, 1882.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 331,

For the Week ending May 6, 1882.

Price 10 cents. For sale by all newsdealers.

LIGHT, HEAT, AND POWER AT LITTLE COST.

Among the most interesting exhibits to be seen at the Electrical Exhibition now going on at the Crystal Palace, London, is the new secondary electrical battery of Sellon and Volkmar, the operation of which appears to mark the opening of a new era in electrical progress. If all that is said of the new invention be true, the storage of power by electrical means is now reduced to commercial practice, and, as results, we may soon expect to observe some curious changes in the arts, habits, and wants of the people.

For example, anybody who chooses to put a windmill upon his house or barn will be able, by means of the secondary battery, to light his dwelling at night, supply it with heat and hot water for washing and cooking, drive sewing machines, churns, washers, pumps, keep electrical carriages that will run anywhere about town without horses, do his plowing, draw mowers, reapers, seeders, propel boats, and perform almost any sort of work that may be required. The rotation of the windmill, running day or night steadily or intermittently, costing nothing except repairs, will have its power stored up and held in the secondary battery, and by the touch of a button to be instantly delivered and put to use when wanted in the form of light, heat, or power. The battery forms in effect a reservoir of force, which when connected with an electrical lamp yields light, or with an electric machine yields heat or motive power. Furthermore, the battery is quite portable, and may be placed in an ordinary carriage, giving motion thereto, like a locomotive. But there is no boiler to explode, and no fuel or water to be supplied. Women and children may safely use it. Every class of society, from highest to lowest, every art and industry in the civilized world, will benefit by its adoption. These, we say, are only some of the indicated uses and advantages of the new invention, if all that is claimed for it be true.

A trial and exhibition of the new battery was lately given at the Crystal Palace, before a large number of distinguished guests, among whom were Mr. Warren de la Rue, Professor Crookes, Professor Hughes, Professor Dewar, Dr. Huggins, Alexander Siemens, Professor Thompson, Professor Adams. Mr. Sellon, the principal originator of the invention, was called on for a speech and gave the following particulars. He stated that the capital stock of the new company, "The Electrical Power Storage Company," was $4,000,000, that it was all subscribed within a few hours, and that he could have obtained ten times the amount had he desired. The distinctive peculiarity of the Sellon-Volkmar battery is that the plates composing the cells are made of perforated plates, the oxides used being held by and within the perforations. Heretofore, as, for example, in the Faure battery, it has been necessary to hold the oxides in contact with the plates by means of packings or wrappings of cloth or other fibrous substances, the use of which was always attended with expense and difficulty, and has prevented the actual success of the instrument. The action of the acids soon destroyed the wraps.

In this new form of battery all the clumsy wrappings are removed, and simple perforated plates are used, the result being the production of durable and more powerful cells than heretofore. Mr. Sellon said that he looked forward to the time when huge plates of half a ton or a ton each will be used, and thousands of lamps supplied from one battery or reservoir. He further said:

"Of the sizes now made, one standard size of the dimensions of forty-three one hundredths of a cubic foot, and containing of metallic composition about 62 pounds, will yield when properly charged an aggregate amount of current equivalent to fully one horse power of electrical energy for one hour, giving off from 350 to 400 amperes at any required rate up to 40 amperes per hour. The next standard size contains of metallic composition rather less than 300 pounds, and can yield five horse power of electrical energy for an hour—giving up its 1,800 to 2,000 amperes at any rate up to 200 or 250 if required. One set of 39 such cells will be seen working 200 Lane-Fox lamps in the Alhambra Courts. The plates have no supports, and are simply in appearance solid pieces of metal separated by slips of wood, and immersed in acidulated water. In reality they are full of interstices or holes, which contain the packed material. This is applied in such a form that it makes a solid alloy (if I may use the term) with the plates themselves."

He then proceeded to request that a scientific committee should be appointed to examine and verify his statements and test the battery. He then continued:

"Now as to the practical application of these batteries. To my mind their employment will be almost unlimited. I can conceive no installation of domestic electric lighting to be complete without them, whether as a supplying or as a regulating medium. For motive power I anticipate immense demand; and although the factory now nearly in course of construction is upon a scale somewhat commensurate with the business in hand, yet I feel confident that it will form but the nucleus of an immense and important industry.

"The application of the forces of nature, such as wind, running and tidal water power, will now, doubtless, receive more engineering attention than heretofore; and electrical energy, which upon its generation can now be stored and reserved for use as required, must become a much sought for and highly prized source of power. To regard the use of these batteries only as a small matter of personal convenience, take, for instance, my own case. Up to the introduction of these batteries it had been necessary for me to keep one of my gardeners every evening attending to the engine and dynamo machine up to whatever hour light might be required; for the future he need only set the charging of the batteries in action during the day, and my store will be ready for evening use without fluctuation or intermission. The durability of the incandescent lamps is also greatly increased, and the lights can be regulated to any required degree of intensity if you diminish your electromotive force by cutting off so many cells, and you thereby conserve so much of your electrical power."

The practical exhibition of the new battery is described as having been attended with great success. Many lights were shown, the brilliancy of which could be readily increased or diminished by switching on or off one or more cells of the battery.

THE PROTECTION OF SMALL INVENTIONS.

A characteristic feature of the American patent system, and one toward which the patent laws of other countries have been steadily approximating, is the encouragement which it offers to all men, poor as well as rich, to make inventions and publish them to the world under the protection of letters patent. The smallness of the official fees and the exceptionally thorough protection offered have been very fruitful in calling out and making public inventions which, like the Bessemer bronze powders (elsewhere commented, upon), are easily open to spoliation; hence the rapid and enormous multiplication here of individually small devices which have had in the aggregate such a shaping, helping, and enriching influence upon all our industries. Not unfrequently has it happened that seemingly minute and unimportant devices, inventions which could not have been patented elsewhere or which the inventors would have been unable to patent on account of the cost, have here brought liberal fortunes to their patentees, vastly greater profit to the public, and sometimes have furnished the beginnings of great industries.

Such results are possible only where the inventors' rights, easily secured, are rigorously guarded. One of the strongest safeguards to patents upon easily marketable inventions of general utility is the law which makes the buyer of infringing devices measurably responsible for the wrong done the rightful patentee, thereby spoiling the market for dishonest and unlawful products. This vital truth has repeatedly been recognized by past Congresses, and quite recently again by the Congress now sitting in Washington, in defeating projects calculated to sacrifice the rights of patentees of articles of small market value. The action of the Senate upon Senate bill No. 1238, a few days ago, may serve as an example. The first section of the bill provides that in suits for infringement, where the defendant's purchase was made "in good faith for his own use and not for sale, and not in any manufacturing process," the plaintiff must recover $20 or he cannot recover costs; while the second section requires the plaintiff to deposit "a reasonable sum not exceeding $50," as security for the defendant's costs and expenses.

The chairman of the Senate Patent Committee strenuously urged the passage of this bill; but the objections to it were so strong that it was withdrawn, it is to be hoped permanently. The provisions of the bill (as will be obvious to any one) would reach a very numerous class of patentees whose rights would be sacrificed entirely.

A still more reprehensible attempt to remove the legal safeguards of patentees is said to be favored by the Patent Committee of the House. According to the *Evening Post* of April 25, the committee that day directed a favorable report to be made to the House on a bill providing that no action for damages or proceeding in equity shall be sustained, nor the party held liable under sections 4919 or 4921 of the Revised Statutes, for the use of any patented article or device, "when it shall appear on the trial that the defendant in such action or proceeding purchased said article for a valuable consideration in the open market."

It is incredible that the House can lend itself to the furtherance of a measure so palpably intended to lay the property rights of patentees open to general invasion. Still less possible is it that both Houses can agree to such an unjustifiable reversion of the spirit which has thus far ruled in American patent legislation. There must be some mistake in our contemporary's report of the committee proceedings. The country is too deeply indebted to the ingenuity of our inventors, and has too much to hope for from the future working of their genius, to abandon the profitable practice of dealing justly with and by them.

BESSEMER'S BRONZE POWDER.—HOW THE PUBLIC GAINS BY GRANTING PATENTS FOR INVENTION.

About forty years ago Mr., now Sir Henry Bessemer, had occasion to buy some bronze powder, for which he was charged seven shillings (about $1.75) an ounce. On examination he found that the metal of the powder was worth less than a penny an ounce. So large a margin for profit set him to thinking, and his thinking resulted in a machine for making bronze powders rapidly and cheaply.

Having small faith in the adequacy of the protection rendered by the patent laws of England as administered at that time, Mr. Bessemer determined to keep his invention secret. He made working drawings of the machinery, and had the various parts constructed by different machinists in Liverpool, Manchester, Birmingham, and London, so that no one should be able to guess what the entire machine was intended to be. With two trusted assistants he put his machinery together, and thereafter only himself and those two ever entered his factory. At first he charged eighty shillings ($20) a pound. The same machines, under the super-

intendence of the same men, are now producing precisely the same article, which sells for two shillings and six pence a pound, less than one-thirtieth the former price.

Had Mr. Bessemer been sure of protection under a patent he would gladly have made public his invention at once, and would have surrendered the control of it at the end of the period of protection—fourteen years. Being fortunate in his choice of confidential assistants, he was able to guard his secret many years longer, and the public had to pay for his caution and success in a vastly augmented price. In the meantime the public lost the incalculable advantage of the new knowledge which the invention contained, and which, without infringement upon Mr. Bessemer's rights in the manufacture of bronze powder, might have been widely employed in the advancement of related arts.

The inadequate protection of new inventions thus works public injury and loss, not only by discouraging invention, but still more by smothering new knowledge. Discoveries which might work economic revolutions in many arts are kept secret, to be applied cautiously to some narrow use in a single art; or the discoverer, having no means of applying his discovery, and being unable to invite assistance without risk of losing his secret, keeps his knowledge to himself in the hope of eventually turning it to profit. The time for the utilization of the discovery passes, or the holder of the secret dies, and the world loses the good it might have had were its treatment of inventors juster. This was the experience of the world everywhere down to very recent times; and the same unprofitable practice still keeps in industrial immobility a large part of humanity. The growing judgment of the world is that the best way to advance the arts is to multiply inventions; and that the cheapest way to encourage inventions is to protect the property rights of patentees. This would be public policy even were it reasonable to suppose that without patent laws the same inventions would be made and developed as trade secrets as are now publicly developed under letters patent. Every important discovery or invention sets a multitude of other thinkers at work, and is the parent of many more inventions, provided it promptly enters into the world's stock of new knowledge; and the incidental advantages thus accruing more than recompense the public for any inconvenience and loss arising from occasionally mismanaged patent rights.

In the case of Mr. Bessemer's bronze powders the high market value of the product, and the comparative ease with which his invention might be infringed, together with the uncertainty of protection under the existing patent laws, practically drove him to secrecy. Since then the protection of inventors' rights under English patents has been greatly improved, and Mr. Bessemer has freely taken advantage of them, greatly to the advantage of England and the entire industrial world.

Canals on the Planet Mars.

A curious discovery, made by Signor Schiaparelli, Director of the Royal Observatory at Milan, seems to start again that old and unanswerable question, "Are the planets inhabited?" This Italian astronomer is one of the most assiduous watchers of the planet Mars. It was he who, in 1877–8, first detected the many dusky bands which traverse and subdivide the ruddy portions of the martial orb. Again, in 1879–80, when the position of the planet was favorable, he reidentified these strange lines; but during last January and February he has been able to observe and map out in more than twenty instances duplications of the dark streaks "covering the equatorial region of Mars with a mysterious network, to which there is nothing remotely analogous on the earth." The Italian astronomer has styled them "canals," for they bear the appearance of long seaways, dug through the martial continents, as if a mania for short cuts had seized the inhabitants of the planet, and everybody residing there had become an active M. de Les seps.—*London Telegraph.*

Further Consolidation of Electric Light Companies.

About a year ago the Gramme Electrical Company was formed by a combination of the leading companies owning patents for arc lights and machinery for generating electricity for such use. Recently the combination has been strengthened by union with the Edison Company, thus giving the Gramme Company control of all the leading systems of electric lighting. The combination now comprises the American Electric Company, the Brush Electric Company, the Edison Electric Light Company, the Fuller Electrical Company, the Jablochkoff Electric Lighting Company, the United States Electric Lighting Company, and the Weston Electric Lighting Company, in addition to the original company owning the Gramme patents. Before the last consolidation the Gramme Company controlled all the patents for working arc lights, and now it practically monopolizes incandescent lighting also. The combination would appear to have been made chiefly to prevent litigation between the combining companies and to facilitate the suppression of organizations not in the ring by litigation, or competition, purchase, or otherwise.

Mr. Darwin Buried in Westminster Abbey.

The funeral of the eminent scientist, Charles Darwin, took place in Westminster Abbey, April 26. The pallbearers were United States Minister Lowell, the Duke of Argyll, Lord Derby, Professor Huxley, Sir Joseph Hooker, Sir John Lubbock, Alfred Russel Wallace, and William Spottiswoode. The procession was merely within the precincts of the Abbey. Lord Salisbury, Lord Aberdare, Sir Charles Dilke, Sir Rutherford Alcock, Mr. Mundella, Right Hon. Edward Gibson, Mr. Thomas Burt, Professor Tyndall, Mr. John Morley, Mr. Herbert Spencer, Vice Chancellor Evans, and Professor Jowett, the last two being members of a deputation representing the University of Oxford, were present at the funeral service, besides numerous members of Mr. Darwin's family and deputations from learned societies.

Who would have dared to predict, twenty years ago, that the authorities of conservative England would so soon and so conspicuously recognize the merit of the author of the "Origin of Species through Natural Selection?" Or in what other age of the world could so radical a revolution in men's interpretation of the facts of life and nature have been wrought during the lifetime of one man?

How a Scientific Man Detects Arsenic.

Recently during the trial of the Malley brothers for murder, at New Haven, Conn., Prof. R. H. Chittenden, a young man, instructor in physiological chemistry, Yale College, testified as follows:

"I made a chemical examination in a room in the college to which no one had access but myself. The doors were doubly locked, and, in my absence, sealed. On the 16th of August I opened the jar labeled 'Stomach and œsophagus.' I poured the contents into a clear porcelain dish. They weighed 603 grammes, or 1 pound 5 ounces and 118 19-100 grains avoirdupois. The fluid contents had the odor of alcohol, and were distinctly acid in reaction. The stomach had already been opened. Nothing abnormal was observed in its lining. I then sampled the mixture preparatory to analysis. I cut the stomach into small shreds, transferred them to a mortar and ground them into a liquid mass. I next weighed off from this mixture 266 grammes, equal to 9 ounces and 167 2-5 grains. I subjected this to evaporation or distillation at a gentle heat. In the distillate I could detect only alcohol. I examined the residue for organic or alkaloid poisons. All the residue retained failed to give any reaction to chemical reagents, or when given to animals. I found no trace of organic or alkaloid poisons. Sometimes they can be obtained by physiological tests when chemical tests fail. Eighty-eight grammes, or 3 ounces 45½ grains, of this stomach mixture were then weighed out, and tests were applied for mineral poisons. They revealed traces of a substance bearing a resemblance to arsenic. It was got in the form of a dark metallic body."

The Professor stooped down and raised a mahogany case filled with little glass vials, all numbered. It was similar to the one used in the Hayden trial. He laid it on the Judge's bench. It was afterward transferred to the table in front of the jurors. Glass bulbs and tubes, a Marsh apparatus, an alcohol lamp, a porcelain bowl, vials filled with acids, and other chemical paraphernalia were placed on the District Attorney's table. A white rubber tube connected it with the gas bracket over the witness box.

"In addition to the substance bearing a resemblance to arsenic, I got seven milligrammes of oxide of iron," he said. "I calculate that the stomach and contents contained 739-1,000ths of a grain of this oxide. I dissolved it in hydrochloric acid, making it chloride of iron. It is the fifth exhibit [pointing to a vial in the mahogany case]. I next identified the arsenic, and ascertained the amount. I weighed out another 100 grammes of the stomach mixture, 3 ounces 230 3-5 grains. I weighed it in a porcelain bowl. 223 centimeters of nitric acid were added to the mixture. I placed the bowl in an air bath, heated at 150 degrees, nearly 380° Fahrenheit. In this way all the tissue was dissolved and converted into liquid. The arsenic present was converted into arsenic acid. This heating on the air bath was continued for nearly two hours. The liquid then took on an orange color. I am particular in detailing this operation because in this work I have repeated it nearly sixty times. When the orange color appears, three cubic centimeters of pure sulphuric acid is added to the mixture. This produces a very violent oxidation or combustion.

"The organic matter of the tissue is converted into carbonization like charcoal. The arsenic acid still remains. While still heated, eight cubic centimeters of pure concentrated nitric acid, were drop by drop, added to the mixture. The mass was then heated fifteen or twenty minutes longer. The destruction of the organic matter was then complete. A dish containing the carbonaceous matter was then filled with distilled water. It was allowed to soak twenty-four hours. In this way the arsenic, as arsenic acid, is dissolved out of the water, and the carbonaceous matter left undissolved. The clear solution containing arsenic, with a little coloring matter, is then evaporated to dryness, being heated by steam. The residue contains all the arsenic originally in the tissue. This residue is then dissolved in very dilute sulphuric acid. This solution is then gradually introduced into the Marsh apparatus. In this apparatus [holding up a bulbular glass instrument], thirty grammes of pure zinc, alloyed with a little platinum, is placed. Then a small quantity of sulphuric acid is poured in, which, acting on the zinc, generates hydrogen gas. This gas issues from a tube like this [attaching a glass tube like the spout of a pump to the Marsh apparatus]. It then passes through this tube [exhibiting another tube], called the chloride of calcium tube. This dries the gas, and frees it from moisture. The gas then passes through a longer and smaller glass tube [showing it], and finally issues in a jet, which when lighted gives a colorless flame. When the apparatus is filled with hydrogen gas, the substance under examination for arsenic is poured into the upper bulb of the Marsh machine [showing the bulb]. A glass stop cock [illustrating] is then turned, and the fluid flows, drop by drop, into this lower bulb, into which the hydrogen is being constantly evolved. In this manner the solution containing the arsenic is brought into contact with the hydrogen. The arsenic combines with the hydrogen, forming a gaseous compound, called arseniureted hydrogen. The arseniureted hydrogen ultimately passes through this narrow glass tube [showing tube]. This tube is placed over a small glass furnace [exhibiting a furnace]. By the action of these three lights [showing lights in furnace] six inches of the tube are heated to a red heat. As the arseniureted hydrogen passes through this six inches of tube, it is decomposed into metallic arsenic and free hydrogen. The hydrogen passes off, and the metallic arsenic is deposited at the cold end of the tube. The apparatus is allowed to run until the zinc is completely dissolved. This usually takes from three to four hours. It depends upon the rapidity with which the gas is evolved. As the first portion of the acid flows into the bulb a second portion of stronger sulphuric acid is added, and allowed to flow under the zinc. Lastly, a third portion of still stronger sulphuric acid is added. These serve to completely change the arsenic into arseniureted hydrogen, and the entire amount of metallic arsenic is deposited on the inner surface of the glass tube. The apparatus is then taken apart, and the portion of the tube containing the metal is cut out with a file. [The Professor illustrated by cutting a tube with a file.] Thus a piece of glass is secured which contains all the metallic arsenic. The tube, plus the arsenic, is then carefully weighed. Then the incrustation of arsenic is dissolved by nitric acid. The tube is rinsed with water, and finally dried. It is weighed. The difference between the first and second weighing is the weight of the metallic arsenic. My hundred gramme sample of the stomach mixture, treated in this manner, gave a metallic deposit, which weighed 1 3-10 milligrammes.

"I calculate from my analysis of the 100 grammes of stomach mixture," Professor Chittenden continued, "that the whole 603 grammes contained 79-500ths of a grain of arsenic. I next verified the result already obtained. I dissolved the metallic arsenic in nitric acid, and evaporated the solution to dryness. It left a white residue. This residue dissolved completely in a drop of water. I then added a little solution of nitrate of silver, which gave a heavy brick-dust red precipitate of arsenate of silver, soluble in ammonia and soluble in nitric acid. I identified the substance as the white oxide of arsenic beyond the shadow of a doubt. It is the same as that sold at stores under the name of arsenic."

The Professor said that he next weighed out 106 grammes, or 3 ounces 323¼ grains of the sample stomach mixture, and treated it in the same manner as he had treated the preceding portion. He got from it 1 7-25 of a milligramme of metallic arsenic. This demonstration proved to his mind that the arsenic was evenly distributed. There still remained 43 grammes of this sample stomach mixture. He oxidized this in the same manner, and obtained from it metallic arsenic. He proved it by a different process from the first. He used various processes in proving his demonstrations, with the same result. The arsenic was always there. The liver, kidney, heart, lungs and spleen, brain, trachea, diaphragm, and intestines were similarly examined. The total amount of arsenic obtained from these organs was 1 grain and 847-5000ths of a grain.

The Brainerd Sumner.—A Steam Schooner.

A vessel of a novel type recently arrived at this harbor from Rockland, Me. It is called the Brainerd Sumner, and in general appearance closely resembles the ordinary large three-masted schooner. A closer inspection shows that the mizzenmast is painted black, while the foremast and mainmast are slushed and scraped down in the ordinary way. It is necessary to board this queer craft to ascertain that the third mast is really a tall smokestack of iron, similar in shape to the two other masts. It has a topmast like the others, and a fore and aft sail like them, with the ordinary gaff and boom, which have jaws working on the smokestack as on any other mast. A small steam whistle is alongside the mizzenmast. The engine and boiler are in the extreme after part of the vessel. The furnace and boiler are athwartships, and the engine is an upright propeller of the ordinary type. The steam power is intended as an auxiliary, but she has made seven knots an hour under steam alone She was built in Rockland a short time ago, and is the first vessel of the kind ever constructed. She is about 600 or 700 tons Custom House measurement.

Fast Railway Speeds.

We have received from Mr. J. J. Burleigh, chief operator, West Jersey Railway, his certified copy from the register of trains of the performance of the special passenger train, on the above road, on Saturday, April 22d last. Conductor, Mayhew; engineman, Reinhart; engine No. 22 (class C, anthracite), burning bituminous coal; combined car No. 375, passenger cars Nos. 369 and 600; number of passengers on train, 124. The following time was made: Between Glassboro and Vineland, 16½ miles, 14 minutes; between Woodbury and Court House, 61 1/10 miles, 60 minutes; between Westville and Cape May, 76 1/10 miles, 76 minutes. This is certainly very fast running.