Correspondence.

The Albert Hall Organ.

To the Editor of the Scientific American:

There appears in your issue of Dec. 29, 1888, an extract from *La Science en Famille*, in which the total number of registers in the Albert Hall organ is given as 100, and the Riga organ as 125. The former really contains 132 registers, of which 116 are speaking stops, but of the 125 allotted to the Riga organ, there are only 105 speaking stops.

NORMAN H. SCHNEIDER,
late organist, London, Eng.

Flatbush, N. Y., January, 1889.

Capacity of the Simple Plunge Battery.

To the Editor of the Scientific American:

Will you permit me to say, through your columns, in answer to numerous inquiries I observe in your paper, that, in my opinion, you overestimate the number of cells of "simple plunge battery" necessary to run motor illustrated and described in SUPPLEMENT No. 641. The writer has constructed a motor of the size mentioned, and on the same general principle, and has run a sewing machine with it, sewing through twenty-four thicknesses of heavy drilling, and using only six cells of simple plunge battery, with double carbons and single zincs, each 6"×1½"×¼", size of jars one pint. He has also driven a fan, 16½ inch diameter, six blades, at a speed of 900 revolutions per minute for over half an hour, using the same battery and same motor, speed taken by regular speed counter every fifteen minutes. The fan ran for over an hour before battery was exhausted, running at from 500 to 300 revolutions per minute during the last fifteen minutes.

The motor ran the sewing machine for over half an hour before it began to slow up. Speed not taken, but running as fast as one would wish for sewing comfortably.

The only objection to use of such small battery appears to be the rapidity with which the solution is exhausted, owing to its small quantity. The plates appear to be large enough to give the number of amperes necessary, and the number of jars give the volts.

Cost of six pints of solution about 25 cents.

C. D. PARKHURST,
Lieut., Fourth Artillery.

Fort Snelling, Minn.

[It is a great object always to allow for enough battery power. Your experience shows this, as the battery under the work you give it to do so quickly ran down. The voltage of a single fluid battery rapidly decreases, and this diminution of force has to be allowed for.—ED.]

Electro-Physiology.

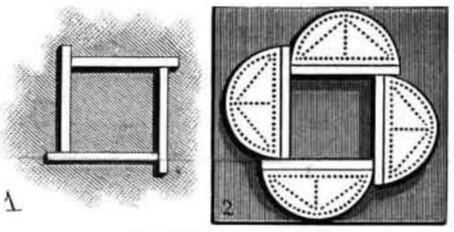
At Owens College, Manchester, Professor Stirling lately delivered a lecture on the electrical properties of the tissues, but especially of those composing the nervous system. There are about fifty species of fishes which are known to have specially modified organs for the generation and discharge of electricity. These organs when at rest do not discharge their electricity; but if the animal be irritated, electrical shocks are discharged, which in some fishes are very powerful indeed. By means of electrical discharges these animals not only stun their prey, but they ward off the attacks of their enemies. The animal may discharge its batteries voluntarily, but after having done so for a considerable number of times the electrical organs become fatigued, just as muscles after severe exercise are fatigued. At first sight it might seem remarkable that certain animals are provided with structures which evolve powerful discharges of electricity. This, however, is not by any means the most remarkable fact. When we know that the whole of the body of the animal is traversed by the electrical current at the moment it is discharged, it does seem far more wonderful that the tissues of the animal itself are not thereby affected; not even a muscle is caused to contract, although the discharge must necessarily traverse the nervous system as well as the muscles. The animals, therefore, have an immunity from the effects of their own shocks. Darwin admitted that the presence of these organs in a limited number of fishes was a fact not easily explained on the evolution hypothesis. Recent researches, however, have shown that the electrical organs are really modified muscular organs, or the terminations of nervous structures in muscles. This fact greatly simplifies the problem. Muscles and nerve, however, evolve electricity in the living condition; and a variation of the electrical conditions of a muscle, a nerve, or even of protoplasm generally is one of the best signs of the vital activity of these structures. With Galvani's experiments on the twitchings of the limbs of frogs, there commenced the investigation of electrical phenomena, which have led to such splendid results, not only in physiology, but to the development of new means of producing electricity and its numerous applications in the arts. The lecturer demonstrated the classical experiments of Galvani, Volta, Noboli, Du Bois Reymond, and others, showing historically on what lines our present knowledge of animal electricity had been reached.

Results of Good Patents.

W. P. Proctor, vice-president of the Singer Sewing Machine Company, lives at the Fifth Avenue Hotel, and has the best horses and carriages in the city, but never rides. His own exercise is walking, and the carriages are for his family. He was a mechanic when he first met Singer. They went into partnership to make rock drills on Cherry Street. The drills worked with a hand ratchet. Their factory blew up, and Singer walked all the way to Boston in the hope of interesting Boston people to start a factory there. While in Boston he was asked to go around the corner to see a wonder—it was a sewing machine. He came back to New York and said he could make a better sewing machine than the one he saw. They raked together $50, and the machine was made, and in thirty-five years this $50 of capital grew to be $30,000,000. Proctor married Singer's daughter, and is probably worth $25,000,000. He owns a third of the stock of the Singer company. It is amusing to hear him tell at times how, in the early days of his sewing machine experience, he and Singer used to dream of the time when they could make 2,000 machines a year, which they were certain would yield them a fortune. To-day they make 2,000 a day.—*Daily Paper.*

A BOY'S INVENTION.

Dr. L. K. Klemm, of the Technical School, of Cincinnati, Ohio, tells, in the *Journal of Education*, of a rather interesting instance of the inventive genius of a boy which had been stimulated and developed by technical education. At a tile manufactory near that city, it was the practice to have different sized steel forms for each size of tile. Whenever it was necessary to make a new size of tile, a new form was necessary, the cost of which was $18.50. In the course of a year, this item became quite a heavy expense. A boy, whose name it is unnecessary to mention, was passing through the works one day with his father, and his attention was called to this fact, whereupon he said he had a suggestion he would like to make. Upon being given paper and pencil, he made the accompanying diagram after a few minutes' thought, stating that the steel bars could be arranged to form either squares or rectangular tiles. It was then explained to him by the manager that it would be necessary to provide some means of retaining the bars in position, as the moulds had to be subjected to a heavy hydraulic pressure, which would separate them, unless they were fastened securely in place. He then suggested backing the bars with plates as shown, which should be provided with holes, enabling them to be screwed firmly to the table, which should be provided with corresponding holes. In this way a solid form was provided, which could be used as a universal mould for tiles of various sizes and shapes. The idea was a good one, and reflects much credit for originality upon its youthful inventor.



A BOY'S INVENTION.

Luminosity of Colored Surfaces.

At the last meeting of the Physical Society, Captain Abney read a paper "On the Measurement of the Luminosity of Colored Surfaces," which was illustrated by experiments. In a communication to the Royal Society, General Festing and the author have described a method of comparing the intensity of the light of different parts of the spectrum, reflected by various pigments, with that reflected from white; and luminosity curves have been constructed, the areas of which give comparative measures of the total luminosities. This method of comparison is accurate, but requires considerable time, and the author has devised a more rapid process. The colored surface whose luminosity is to be compared with white is placed beside a white patch within a dark box. A direct beam of light passes through an aperture in the box, and a black rod casts a shadow on the colored patch; another beam from the same source is reflected at an angle, and forms a shadow of the same rod on the white patch, the junction of the two shadows connecting with that of the two surfaces to be compared. In the path of the direct beam is placed a rotating disk with angular openings, adjustable while rotating by a single lever, and by this means the white patch can be made to appear too light and too dark in rapid succession. By gradually diminishing the range of oscillation of the lever, a position of equal luminosities can be found. The colored surface is now replaced by a white one, and the adjustment again made, and from the angular apertures required in the two cases the relative luminosities are determined. Comparisons made in this way—the numbers relating to which are given in the paper—with emerald green, vermilion, French ultramarine, etc., gave results in close agreement with those deduced from the luminosity curves obtained by the spectrum method.

Glucose.

The process of making glucose will be best understood by following the corn from the time it enters the factory until it runs out at a spigot, a clear, odorless liquid. The shell corn is first soaked for several days in water to soften the hull and prepare it for the cracking process. The softened corn is conveyed by elevators to one of the highest stories of the factory and shoveled into large hoppers, from which it passes into mills that merely crack the grains without reducing them at once to a fine meal. The cracked grain is then conducted to a large tank filled with rinsing water. The hulls of the corn float at the top of the water, the germs sink to the bottom, and the portions of the grain containing the starch, becoming gradually reduced to flour by friction, are held in solution in the water.

By an ingenious process both the hulls and the germs are removed, and the flour part now held in solution contains nothing but starch and gluten. This liquid is then made to flow over a series of tables, representing several acres in area, and the difference in the specific gravity of the two substances causes the gluten and the starch to separate without the use of chemicals. The gluten is of a golden yellow color, and the starch snow white.

By the time gluten has been completely eliminated the starch assumes a plastic form and is collected from the separating tables by wheelbarrowfuls and taken to a drying room, where it is prepared as the starch of commerce or is placed in a chemical apparatus to be converted into glucose. The conversion is effected by submitting the starch to the action of a minute percentage of dilute sulphuric acid, which, without becoming a constituent part of the compound, produces by its presence merely a miraculous chemical change. This change from starch to glucose is a gradual process, and has four or five well defined stages. On the addition of the acid the first change results in the production of what is known to chemists as dextrine. If at this stage the acid is neutralized by the addition of lime water, the process is choked and dextrine is the permanent product.

If the process is allowed to go on, the acid, however, works a second change, and maltose is the result. Here the process can, if necessary, be interrupted by neutralizing the acid by means of lime water, and for some purposes in the art of brewing this is sometimes done. The third and important stage in the chemical change wrought by the action results in the production of glucose, and just here is where the greatest skill of the chemist is required.

The product must show by test that it responds to the chemical formula C_6,H_{12},O_6. By comparing this formula with that of starch, which is C_6,H_{10},O_5—that is, six parts of carbon to ten of hydrogen and five of oxygen—it will be seen that the sulphuric acid has not added to the starch, but has taken up two parts of hydrogen, and the only gain in the starch is one part of oxygen. The lime water introduced to neutralize the acid forms with it a product called gypsum, which can be removed from the glucose without leaving any appreciable trace.

The fourth stage in the chemical process results in crystallizing the liquid, and then the product is called grape sugar. There is a fifth stage, in which caramel, or burnt sugar, could be produced were it of any commercial value. The gypsum, or sulphate of lime, formed by the neutralizing lime water and sulphuric acid, sinks by gravitation to the bottom of the vessel and the supernatant saccharine liquid is drawn off from the top. This is almost pure chemical glucose, but it is still subject to a filtering process through bone black, and refined in the same way as cane sugar is refined. The bone black has anything but the appearance of a purifying agent, but possesses the peculiar property of attracting to itself all coloring matter.

The glucose, passing through a labyrinthine system of filtering, is drawn off through spigots in the lower part of the building, and is ready to be shipped away in barrels. To give the glucose the appearance of cane sirup, as well as to impart some of the characteristic taste, a small amount of that sirup is added to suit the fancy of buyers.

To make grape sugar the glucose is dried in rapidly revolving vessels, from which much of the moisture escapes by virtue of the centrifugal force. Neither the glucose nor the grape sugar is used for domestic purposes, although either one is about two-thirds as sweet as the sweetest cane sugar. Glucose is chiefly used for fermenting purposes, and of late years has become valuable to the brewer in making beer and pale ales. It is also largely used in mixtures with cane sirups and molasses, and esteemed more wholesome than the cane product which is, at best, only a side product or residue in the manufacture of sugar.—*Amer. Analyst.*