THE THIRD LECTURE OF PROFESSOR DOREMUS'S COURSE.

The third and last lecture of Professor Doremus's course on "Views of Life through the Medium of of Natural Science," was delivered in the evening of Saturday, April 21, before the same large audience that had listened with so much interest to the other lectures of the course. The subject of the first lecture was heat, of the second light, and of the third electricity and magnetism, with a glance at the relation of the imponderable forces to each other.

ELECTRON.

The speaker commenced by taking up a large and fine specimen of amber, which he rubbed upon the sleeve of his coat, and showed that it would then pick up light pieces of paper from the table. He stated that this mysterious property of amber was discovered by Thales, of Miletus, six hundred years before the Christian era; as the Greek name of amber is electron, the attractive force received the name of electricity. The nature of this force is as mysterious and wonderful to us as it was to the ancients who first discovered it, but we have accumulated a vast mass of facts in relation to its operation. We now know that instead of being confined to the friction of a single substance, it is developed in every change of form of every substance in nature.

HYDRO-ELECTRICITY.

When water is condensed from the gaseous state of steam, electricity is developed in enormous quantities. With galvanic electricity, we consider it extraordinary to obtain a spark ten or twelve inches in length, but with a suitable apparatus hydro-electricity has been collected of such intensity that it would leap a chasm, from one electrode to another, of nine feet!

THE VOLTAIC BATTERY.

The voltaic circuit was described in a previous lecture. The speaker exhibited several modifications of that, and finally one of two fluids—dilute sulphuric acid, and a solution of bicromate of potash—in which for the platinum plate was substitued carbon powerfully compressed and cemented in a mass by paraffine. At the back of the stage were seen several hundred of these cups, forming the most powerful battery ever collected on this continent. Two ribbons of copper, an inch and a half in width, were employed to connect the opposite poles of this battery, and whenever, in moving them about the stage they accidentally touched each other, the copper instantly flashed into a bright green flame. When the zinc of one cup is connected by a metallic conductor with the carbon of the adjacent cup, and so on through the battery, though the quantity of electricity is not increased, its intensity is augmented; it will overcome greater resistance, but will not decompose a larger quantity of any compound. By connecting the several zinc plates with each other, and the several carbon plates with each other, and then joining the two combinations, the quantity is augmented without any increase in the intensity. With the large number of cups in this battery, they may be so grouped as to give any desired quantity, or intensity, or both combined.

ELECTROLYSIS.

The two copper ribbons of the battery were connected with two wires, which had been fixed in the bottom of a jar of water, and so soon as the connection was made, bubbles of gas began to rise so rapidly as to give the liquid a white turbid appearance. The speaker explained that these bubbles were oxygen and hydrogen gases, the two elements that compose water being separated by the electric current. The decomposition of any compound by the electric current is called electrolysis. The neatest of all modes of decomposing water is by electrolysis. If one electrode is introduced into the mouth of one bell glass or inverted jar, and the other into the mouth of another jar—both being in one vessel—the hydrogen gas is all collected in one jar, and the oxygen in the other. The hydrogen always is of just twice the volume of the oxygen, though the oxygen weighs eight times more than the hydrogen—showing that water is composed of eight parts by weight of oxygen to one of hydrogen, and that the specific gravity of oxygen gas is sixteen times that of hydrogen.

AMMONIUM AMALGAM.

So far as we know, all metals are simple substances—none of them having ever been decomposed; but some doubt has been thrown on this view of the simple constitution of the metals by the fact that we have one compound substance which exhibits many of the properties of metals. This substance is ammonium, and it is composed of hydrogen and nitrogen in the proportion of one atom of nitrogen to four of hydrogen—the composition of ammonia being one atom of nitrogen to three of hydrogen. Among the properties which ammonium has in common with metals is that of forming an amalgam with mercury.

A tall beaker glass was exhibited containing a solution of chloride of ammonium, and into this was dropped a few pellets of the amalgam of mercury and sodium. Instantly the most violent action took place; the chlorine entered into combination with the sodium to form common halt, and the ammonium formed an amalgam with the mercury, increasing its volume enormously.

MAGNETISM.

Long before the commencement of authentic history, it was known that a certain natural mineral, if delicately suspended, would point one part toward the north and the other toward the south. This mineral was called by the Greeks magnet, from Magnesia, the place where they found it. We now know that it is a certain oxide of iron which occurs in various parts of the earth. If this mineral is rubbed upon a piece of steel, it imparts its peculiar property to the steel; and thus is constructed the mariner's compass—that wonderful little instrument upon which all distant navigation depends.

PARAMAGNETISM AND DIAMAGNETISM.

It was long supposed that iron was the only substance which was affected by this mysterious force, but it was found that nickel and some other metals were slightly attracted by magnets, and the researches of Faraday have demonstrated that all substances are affected in one way or another by the power of magnetism. A needle of iron, if suspended near a magnet, assumes a position parallel with the magnet, while a needle of copper arranges itself in a position diametrically across the magnet, and Faraday found all substances acting in one of these two ways. Those that become parallel with the magnet he called paramagnetic, and those which swing diametrically across the magnet he called diamagnetic. Not only are simple elements found to belong to one of these classes, but compound substances also—even organic compounds—a piece of bread or an apple—and the various gases.

A copper wheel was exhibited suspended between the poles of an electromagnet, and the lecturer stated that if the wheel was made to rotate when the current was not passing around the core of the magnet, the wheel would run without apparent resistance, but so soon as the current was formed, a strange resistance was experienced, as if the wheel was pressing between two pieces of cheese. If, overcoming this resistance, the wheel was made to rotate, it would grow rapidly warm, and eventually red hot.

THE MOST DELICATE THERMOMETER.

If two bars of metal of different kinds, for instance, a bar of bismuth and a bar of antimony, be soldered together at one end, the opposite ends being connected by an electric conductor, then if the soldered end of the bars be heated an electric current will pass through them.

By collecting a number of these pairs the electricity is increased, and such a combination is called a thermo-electric pile. By passing the current thus generated around a bar of soft iron, we, of course, produce an electro-magnet, in which both the electricity and magnetism are generated by heat. By having the magnet act upon the short arm of a long index, we have an instrument which will indicate more minute changes of temperature than any other.

The lecturer held up a brass box about a cubic inch in dimensions, and stated that that contained a series of several small bars arranged as a thermo-electric pile. When it was properly shielded from lateral rays, if the human hand was presented to its face at a distance of forty feet, the index instantly moved!

THE GEISLER TUBES.

If two wires are placed parallel and near each other, at the instant a current of electricity is passed through one wire, an induced current passes for a moment through the second wire, but in the opposite direction from the first. The induced current instantly ceases, but if the primary current is broken, a second induced current passes momentarily through the adjacent wire, but in the opposite direction from the first induced current. By winding the wire for the primary current in a coil or helix, and coiling around it a finer wire for the induced current, with suitable mechanism for automatic breaking and closing the primary circuit, we may obtain a rapid succession of induced currents. Such an arrangement is called a Ruhmkorff coil.

A very large Ruhmkorff coil was exhibited, and the old gentleman who made it, Mr. Ritche, of Boston, was introduced to the audience. The lecturer stated that the outer wire for the induced current was twenty-five miles in length, and the instrument was of such power that Mr. Ruhmkorff had declined to attempt its construction.

The lights were now turned down, and Mr. Ritchie proceeded to exhibit the passage of electricity from his large coil through the tubes of attenuated gases, that have been named after Mr. Geisler. The delicate flash and play of these yellow, violet and rosy lights no pen can describe; many who witnessed them considered the exhibition worth the high cost of the whole course of lectures.

A SCIENTIFIC MIRACLE.

Among the various matters introduced for illustration in the course of the lecture was a description of the constitution of gun-cotton. It was stated, that by treating cotton, linen, or any other vegetable fiber composed principally of cellulose, with nitric acid, the acid lost one equivalent of oxygen, becoming NO_4 and this was substituted for a portion of the hydrogen of the cellulose. This change introduced a large quantity of oxygen into the compound, thus making it more inflammable. This change is as readily wrought in linen as in cotton, so we may have gun-linen, as well as gun-cotton.

The lecturer said that he treated a linen handkerchief with nitric acid, making it into gun-linen, and threw it into the wash with his other clothes. His servant girl washed and dried it, of course without perceiving any difference in its character. She then laid it upon the table to iron it, but at the first touch of the hot iron, the handkerchief vanished with a light flash, leaving no trace behind.

THE CLOSE.

With an eloquent tribute to the enlightened enterprise of the Mercantile Library Association, and with a cordial acknowledgment of the zeal and efficiency of his assistants, Professor Doremus took a graceful farewell of his large audience.

American Riflemen's League.

The various rifle clubs and associations of the United States have formed a general organization with the purpose of stimulating a friendly intercourse among members of rifle practicing societies, in cultivating the art of rifle shooting, and in diffusing a knowledge of the use of fire-arms generally among the nation, similar to the organization of Germany and Switzerland, at the annual gatherings of which tens of thousands of the best marksmen of the world congregate for the purpose designated. The second annual convocation of the League of the United States will be held at Chicago this year, commencing on the 13th of June, and continuing for five days. Preparations upon the most extensive scale, and at an enormous outlay, are in contemplation to accommodate the riflemen from all parts of the Union.

Safety Apparatus for Steam Boilers.

The invention of Mr. J. M. Courtauld, of Brocking, consists in the employment of a copper or other suitable metal tube, carried through the upper part of the boiler, and descending below the proper working level therein, and in connecting to the upper part of the tube carried to a greater or lesser hight from the top of the boiler a rod, which, by the expansion of the tube, acts upon a safety valve, when the water falls below the proper level, and allows steam to escape from the boiler.—*Mining Journal.*

[This gage is an American invention and has been in use in this country for some time. It is owned by Messrs. Carpenter & Van Riper. It works very satisfactorily. —Eds.