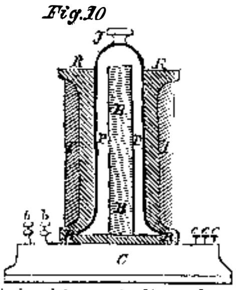
ELECTRICITY AND SOME OF ITS PRACTICAL APPLICATIONS.

ARTICLE VI.

Having stated the principles upon which most machines for the induction of electric currents are constructed, we shall proceed to a description of the "Ruhmkorff Coil."

The cut represents a section of the coil. B B is a bar of soft iron; immediately overlying it is a coil of thick copper wire, P P, and outside of this electro-magnet is a heavy bell jar, J. The induction coil, I I, is wound upon the reel, R R R R, and this is fitted nicely to the bell glass. The battery wires are attached to the binding screws, *b b*, and the current, before passing through the electro-magnet, is carried through the condensers, which are contained in a shallow chest, C, and are regulated by the screws, *c c c*. The condensers, which form a distinctive feature of the apparatus, are analogous in their action to an electroscope condenser, and their object is to secure a sudden rush of the current through the primary coil. The best current for working this machine is one of considerable quantity and of moderate intensity.

Fig. 10



The original machine of Ruhmkorff has been greatly improved by Mr. E. S. Richie, of Boston, and he now manufactures three sizes of the coil, the smallest of which throws a spark four inches long, and the largest nearly twelve. The chief characteristic of the current or wave produced by this machine is its extremely high tension, which is greater, if possible, than that of ordinary machine electricity. The greater part of the wave induced by this machine passes, if at all, between the two extremities of the induction wire, and, in this respect, it differs from the ordinary machine current, which passes from the prime conductor to the earth or any other negative body. Advantage has been taken of this fact, and a device for lighting gas by the induced current has been recently patented, and it is in use for lighting the gas in the large hall of the Cooper Institute, in this city. We have been informed that in this way all the burners, 170 in number, have been lighted twenty-six times in a minute!

The spark produced by a discharge of the Ruhmkorff coil through the air appears to be about one-fourth of an inch in width, and pursues a very crooked path, throwing out forked branches, and presenting all the appearance of a small flash of lightning, which, in fact, it is. Some idea may be formed of the power of the machine, from the fact that by it a Leyden jar of large size may be charged and discharged *several hundred times in a minute!* When this charging and discharging of a jar is carried on with rapidity in a dark room, the deafening *crack, crack* of the discharge, together with the fitful and lurid glare which lights up the apartment, and the ghostly appearance of the bystanders, creates a mingled feeling of wonder and awe in the spectator, which is not removed until, the lights being turned on and the motion of the crank stopped, he sees before him only a modest looking velvet covered cylinder. By a touch of the finger, there is developed within it a mysterious current, which, traversing its many miles of wire, flashes out in an instant with a force which tells that there is within an unseen but tremendous power, waiting only to be called into action. There are many beautiful experiments which may be performed with this apparatus, but the want of space forbids our describing them, and we shall proceed to the description of magneto-induction machines.

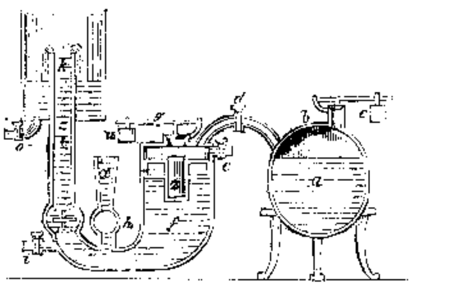
A great number of such machines have been invented, one of the first of which was that of Mr. Saxton. This was brought forward soon after Faraday made known his discovery of magneto-electric induction, and continues in use to the present time. It consists of a powerful horseshoe magnet, across the poles of which a U-shaped armature revolves; upon this are wound several hundred feet of fine insulated wire. When the armature is revolved, twice in the course of each revolution its poles must come opposite those of the magnet, when it will become temporarily magnetic, and a current induced in the fine wire coil; this current is conveyed by means of springs, which press upon the shaft of the armature, to two binding screws, and thence through any conductor desired. When the armature is revolved with sufficient rapidity, the induced currents succeed each other with such rapidity that they are, for all practical purposes, merged in one continuous stream.

ROMANCE OF THE STEAM ENGINE.

ARTICLE IX.

THE HESSIAN STEAM ENGINE.

The accompanying figure represents a section of a peculiar steam ram invented by Denys Papin and his great patron, the Elector of Hesse: *a* is the boiler, having a pipe, *b*, closed with a lever valve, through which it is supplied with water; the pipe, *d*, connects it with the cylinder, *f*; a heated iron bolt, *z*, is placed in the cavity of a hollow float piston; an orifice made in the top is closed with a valve, *g*, which is kept in



position by the weight, *u*, hung on the end of the lever; *x* is a funnel through which water is introduced; it is closed by a cock, *h*; the pipe, *k*, is a continuation of the forcing vessel, *f*; and is inserted in the reservoir; *o* is a pipe for conveying the water which has been forced into the cistern.

The steam from the boiler, *a*, flowing through the pipe, *d*, presses the floating piston downward, when the water beneath it is forced up the pipe, *k*, into the reservoir. When the floating piston has reached the limit of its stroke, the cock, *d*, is turned to shut off the further flow of the steam, and the vapor is allowed to escape from the cylinder, *f*, by the cock, *e*. The valve, *h*, is turned at the same moment, and the water in *x* flows into *f*, and raises up its floating piston. The water in the pipe, *k*, is prevented from descending by the valve placed near its bottom. The opening in the lid of the cylinder, closed by the lever valve, *g*, was provided to insert the iron cylinder, *z*, a red-hot iron for the purpose of increasing the heat of the steam—to superheat it. There was no practical necessity for the reservoir at the end of pipe, *k*; it was simply designed as an air vessel and tank to allow the water a full and steady flow through the discharge pipe, *o*.

An engine of this description was built at Marpurg in 1708, and was placed in the court of the Hessian Academy of Arts and Sciences. It forced water into a cistern at a hight of 70 feet; thence it flowed down by a pipe and played from a fountain in the court.

This was a steam ram, somewhat similar in the principle of its operation to the hydraulic ram. Although steam was employed in this engine for forcing up water, it was applied in a very different manner from that of Savery's engine. In the Hesse motor the steam was made to act upon the water by pressing upon a floating piston, while in Savery's the pressure of the steam was applied direct to the surface of the water. English writers have given the highest praise to Savery's engine; we think it was inferior to this one, not in ingenuity but in one point of real practical utility. Much of the steam, in Savery's engine, was condensed when it was brought into contact with the water, and its elastic force was thereby destroyed; but with a floating piston intervening between the steam and the water to be forced up, the condensation of the steam was prevented. It will be understood that this was a high pressure steam engine, not dependent upon the production of a vacuum for its action. Savery's engine combined the features of raising water from considerable depths by vacuum, and a most ingenious mode of feeding the boiler—provisions not secured in this engine of Hesse.

In our next article, we shall enter upon a description of a new class of steam engines.

Burning glasses have been made by Sir David Brewster, Sir John Herschel, and others, by which the diamond and several metals were melted in a few seconds.

THE SCIENCE OF COMMON THINGS.

NUMBER VI.

SOME FACTS ABOUT METALS.

"Potash contains a very peculiar metal—potassium. It is so light that it will float upon water, being just about as heavy as ice. But its most remarkable property is its strong affinity for oxygen. This is so great that, when a piece of potassium is thrown upon water, it immediately begins to decompose the water, combining with the oxygen of the water and setting the hydrogen free. During this burning of the metal it swims about on the surface of the water in the most furious manner, throwing off light and heat. The water is also consumed at the same time, and thus we have a substance that can actually set the river on fire."

"Is the water really set on fire?"

"Scientifically and strictly speaking, it is not. It is consumed with all the appearance of burning, but as it does not combine with oxygen, it could not be said to burn. The metal potassium is set on fire by throwing it into the water. It combines with the oxygen that it takes from the water, forming an oxyd of potassium, which is called potassa. Now, if this potassa is combined chemically with carbonic acid it will form the carbonate of potassa, which is potash. The potash of commerce contains many impurities, and if it is calcined and these are removed, we have pearl-ash. A combination of a still further supply of carbonic acid gives us saleratus."

"Then saleratus contains that curious light metal which takes fire on being thrown into water."

"Yes; potash saleratus. There is another saleratus made from soda. Soda is the oxyd of a metal—sodium—which is very similar in its properties to potassium. It is lighter than water, and, on being thrown upon water, decomposes it very rapidly, but not with sufficient rapidity to produce flame as in the case of potassium. The overland emigrants to California tell of finding the ground covered in some places with saleratus. This, I suppose, is the sesquicarbonate of soda, as this salt occurs in Egypt and other places in similar position. The metal sodium combined with chlorine, forms common table salt."

"I had no idea that there was a metal in common salt."

"You will find metals in almost everything. Every brick in our buildings contains a portion of aluminum, a metal that is worth now about nine dollars per pound. Potassium, sodium and aluminum enter largely into the composition of granite and other rocks; all marbles and limestones are the carbonate of lime, and lime is the oxyd of the metal calcium. In short, with the exception of silex, nearly all of the rocks, clays and earths which form the crust of the globe are metallic oxyds, that is, consist of some metal in combination with oxygen. The degree of affinity which any metal has for oxygen determines many of the uses to which it is applicable in the arts. When a metal oxydizes so rapidly as to produce flame, the process is called burning, but when the process is very slow it is called rusting. A thin ribbon of iron, with a little fire at the end to kindle it, put into a jar of pure oxygen gas, burns with the most intense brilliancy and more rapidly than a piece of pine wood in the atmosphere. But if a ribbon of iron is placed in damp air it combines with oxygen very slowly, rusting as we say. The heat given off by any substance is just in proportion to the oxygen with which it combines, and it has been ascertained by delicate tests that the amount of this heat is the same whether the process be slow or short—the same in rusting as in burning. Potassium has the strongest affinity for oxygen of any of the metals, and at the other end of the scale are the precious metals, gold silver, platinum, &c. It is partly owing to their small affinity for oxygen that these metals are so precious; they do not rust—they are incorruptible."

CURING HAMS.—At a late Fair of the Maryland State Agricultural Society, the first premium was awarded to hams cured as follows: "To 150 pounds of ham, take 1½ lbs. saltpetre, 4 quarts of fine salt, with molasses enough to make it a paste; rub well on the flesh side; let it lie four weeks; make a pickle strong enough to bear an egg, let the hams lie in it four weeks; then hang and smoke. Two days before removing from the smoke-house, paint with black pepper and strong cider vinegar, after which bag them.