

such as contain antimony. What is called mechanical *Pattinage* is used at Stolberg, but the zinc method, employing steam and hand work, is now substituted for all kinds of ores, especially pyritous and blendes.

Another step in advance is the completion of the mechanical preparation works at Clausthal, commenced about eight years since. This immense establishment, more than 1,000 feet in length, is chiefly designed for silver leads, blendes, and the Hartz mountain deposits. It combines all of the latest improvements, and enables the government to economize all of the precious metals of that region, and serves for the education of a useful class of metallurgists.

Similar works have also been constructed at Ems, where the character of the ores is more in the yield of lead than of silver.

In the metallurgy of zinc, there has been a great improvement by the adoption of the regenerating furnace. At the extensive zinc works in Belgium, there is one furnace which runs 160 muffles, and the gas regenerating furnace has nearly everywhere superseded all other forms. In lower Silesia, they work ores of zinc which do not contain more than nine to ten per cent.

The economical use of iron slags has been pushed so far that Professor Egleston made the startling announcement that there are a good many furnaces on the Continent which actually sold their slags. The slags are either run directly into iron wagons or into water for granulation. They are worked up into cement and artificial building stones, are employed in chemical processes, especially the manufacture of alum, and are used to make crown glass where lime is required; and, in general, waste cinders are fast becoming a thing of the past.

The progress in steel manufacture has been very great, especially in the size of the pieces cast, and in mechanical contrivances for handling and working them. Twenty-five ton hammers are not uncommon. At Krupp's renowned establishment he was received with the utmost courtesy and shown everything. The great secret of the efficiency of these works is in the military discipline which prevails. The different gangs of men are marched up, deployed, and manoeuvred precisely like companies and regiments of soldiers; and there is no haste and no confusion, so that any number of crucibles of melted steel can be brought and poured out without any company coming in contact with another.

Krupp now proposes to construct a hundred ton hammer. By a new contrivance of reversing the rollers, heavy steam carriages are superseded, and the armor plates or rails go back and forth.

The ideas in reference to the construction of blast furnaces are much modified. They now build them without the massive outer coating, and sometimes exclusively of fire bricks, and much more open and accessible below.

In general, according to Professor Egleston, the progress of metallurgy in Europe has been very great within a few years, and he promised to present the chief points, for the information of the Society, during the course of the winter.

MASTER AND APPRENTICE.

The relation of masters to their apprentices may form a theme upon which a few hints may be profitably thrown out, although unfortunately, as we think, for the industrial interests of the country, these relations have changed very materially during the last fifty years. The old system of binding boys to a term of service, for which their reward should be largely in instruction imparted to them, has given way, in good measure, to the method of paying stipulated money reward for very limited terms of service, instructing the youths so employed only in some few details of a trade, and then getting as much as possible out of them for the money paid.

The result of this is that the proportion of really skilled workmen, when considered with reference to the aggregate number engaged in mechanical avocations, has greatly diminished; while many who are called machinists, boot-makers, or carpenters, are really only competent to run a lathe, to peg on a sole, or to shingle or clapboard a building.

There are, however, some shops which adhere more or less to the old apprentice system; and, whether they do or not, there still remain certain duties which masters owe to the youths employed by them, which, we fear, are often too much neglected.

While the full parental power of control, and the father's right to exact obedience, are, under the modern system of limited service, perhaps not to be considered as vested in employers, the duty to watch, with some care, the habits of boys, and to counsel and admonish them when likely to go wrong, is a duty devolving upon every master, and one which he ought not to shirk.

It is his duty, also, to judiciously praise and encourage all that he sees commendable, in their habits or handiwork, thus cultivating their self respect, and that regard for the opinions of others which forms in youth one of the most powerful stimulants to well doing, and one of the strongest safeguards to morals.

It is his duty to reprove when reproof is deserved, and to set such an example to others that his reproof will deserve and command respect. But his reproof should be so tempered with kindness, and an earnest desire for the good of the one reproved, that evil passions shall not be roused into violent opposition. It is his duty to instruct, not only in the elements of the calling upon which his apprentices are entering, but upon all matters of life experience, upon which his age and knowledge of the world have rendered him wiser than his young assistants.

How many masters throughout this great country are performing these obvious duties with fidelity? How many of

them can point to this or that young man who is going to the bad, and say, "My conscience is guiltless of neglect toward him?"

The dictates of common humanity, not to say Christianity, should prompt every master to watch, counsel, admonish, reprove and instruct, as seems necessary for the good of the young minds and hearts over which he has some measure of authority. The man who refuses or neglects to do this is neither humane nor Christian.

FAIR OF THE AMERICAN INSTITUTE.

ELECTRICITY.

Electricity, in one form or another, plays a prominent part at the exhibition this year.

RHUMKORFF'S INDUCTION COIL.

This wonderful instrument is exhibited by the Stevens Institute of Hoboken. Its length is 40 inches, high 18½ inches, and it weighs 166½ pounds. The primary wire is 200 feet long, while the secondary wire is 234,100 feet, or about 44½ miles. The battery employed to charge it consists of three glass jars, 10 inches diameter and 12 inches high, into which are lowered, by a windlass, fifteen plates of zinc and fifteen of carbon, each 6×9 inches. The exciting liquid is the usual mixture of bichromate of potash and sulphuric acid. With the above battery freshly charged and immersed 1 inch, the coil freely gives sparks 21 inches long in air, and white Leyden jar sparks 14 inches long; and the spark can be made to penetrate glass 3 inches thick. This performance has never been exceeded by an induction coil, and it is satisfactory to know that it was constructed by our countryman, Mr. E. S. Ritchie, of Boston. A few years since, the coil belonging to Columbia College, also made by Mr. Ritchie, was carried to Paris by Professor McCullough, and shown to Ruhmkorff, who was so much astonished at its superiority over anything that he had ever constructed, that he begged permission to dissect it. This permission was granted, and he found that Ritchie's insulation and manner of winding the wires was superior to his own, and he adopted the American form.

It is generally admitted by physicists that Ritchie's contributions to our coils have been of great value, and that he has built several instruments superior to any of European manufacture. The performances of the monster coil are highly suggestive of a severe thunder storm, especially when the Leyden jar is filled and discharged in rapid succession. The effect of these discharges is to fill the air with the odor of ozone, and it is a question whether the instrument could not be used, as a convenient generator of this form of oxygen, on a sufficiently large scale to be employed as a bleaching agent in the arts.

BURGLAR ALARM.

There is the usual ringing of bells and perpetual din made by the opening and shutting of doors, to which the wires are attached, while the efficacy of this system of security against unwelcome visitors is set forth by the inventor or his agent. The plan of having the bells continue to ring until the connection is broken by some one in the house, is a capital one; and, if a bell on the street could be rung at the same time to attract the notice of the police, the rogues would be apt to vacate such premises, as being too uncomfortable for quiet work.

ELECTRO-PROPULSION MOTOR.

This is the name given to an invention for working sewing machines by magnetism. To the end of a long lever are attached two iron armatures, and, by an ingenious pole changer, the magnetic force is made to operate first on one side and then on the other; and, as the lever oscillates, it turns the crank of the wheel which is to do the work. The inventor uses four large cells of a Bunsen bichromate and carbon battery, to charge the magnets. The novelty of the adaptation consists in the manner of applying the pole changer, in the cup shape of the armature, and perhaps in the peculiar form of lever.

The circular which was handed to us, says: "This apparatus can be applied for propelling sewing machines, as now on exhibition; also other machinery and street cars—as any power desired can be obtained by *magnates*." There is considerable truth in the latter part of the claim, as the magnets of our city can testify; as to the power of magnets to propel "street cars and other machinery," there appears to be some difficulty, as it has never been successfully accomplished. There is a small locomotive, driven by magnetism in another part of the building, but this moves in such a weak timid way, as to suggest a break down the moment a load is attached to it.

Of the Electro-Propulsion Motor, the circular further says: "It dispenses with the use of the feet, which, in the opinion of the medical faculty is so injurious." We agree with the medical faculty that it is injurious to dispense with the use of the feet, and are decidedly in favor of plenty of exercise. If it is true "that the apparatus can be *pre-fixed* to any kind of machine," we are likely to see much of it. It will be necessary, however, for the inventor to employ a more economical and convenient form of battery, before he can expect to induce many private individuals to try the new motor.

PHOTOGRAPHS OF MAGNETIC FORCE.

A beautiful application of photography, to the illustration of physical phenomena, is shown by Professor Mayer, of the Stevens Institute, who exhibits plates of the diagrams, formed by magnetic force, very much resembling the sound pictures, so long familiar to the students of philosophy.

Professor Rood made photographs of the electric spark in a manner somewhat similar to this, an account of which was published in *Silliman's Journal*.

Putting electricity and magnetism on paper is one of the best ways in which to study these phenomena, and is a feature in modern research.

ELECTRICITY APPLIED TO MEDICINE.

The number of pieces of apparatus for the use of the medical practitioner, shown in the Fair, is unusually large, and indicates greater attention to this branch of therapeutics than formerly. Some of the contrivances would be highly prized by teachers in our schools, if they were better known, and could be had of dealers in philosophical instruments. We have to note particularly cauterizing instruments, an improvement on Stoehrer's induction apparatus, a universal platina zinc battery (which would be an admirable thing for professors of physics, if they knew about it), and a battery for galvanocaustic, exhibited by Curt W. Meyer; to this list, must be added the electro-medical generator of Professor Steele, and the portable machines of the Galvano-Faradic Company. The electromagnetic machine of the latter company is highly commended by some of the best physicians in New York, and, from the cursory examination we were able to make of it, we are disposed to cordially unite in calling attention to its efficiency, convenience, ingenious adaptation to a variety of uses; portability, endurance, and simplicity. While it is specially constructed for the use of the medical profession, it has many points to command the attention of all persons who may have occasion to employ induced currents for any purpose whatsoever.

GALVANIC FLUID.

There are so many fluids that can be employed in galvanic batteries, that it is difficult to see how any one of them can be patented; and, after they are patented, we should suppose that most persons would prefer to know what they were using, rather than to blindly follow a prescription. This reminds us that we found one exhibitor who bought his bichromate of potash, at a high price, already in solution, under the head of a "yellow liquid," without knowing what it was. We suggested a saving of fifty per cent, by using the dry salt and Croton water.

OTHER APPLICATIONS.

We do not refer to the telegraph, as that has become an old story. Nickel plating, which a short time since, was uncertain, now comes out brighter and more durable than silver. Aluminum plating is yet to come, but can hardly rival the pure white of nickel. Galvanoplastic is represented in a few groups, and indirectly in ornamental decorations of machinery. It would have been instructive to the public to have had the whole process of electrotype deposit illustrated and explained.

Electric clocks, with self feeding battery, and bank alarms, were on exhibition, and there may have been other pieces, of apparatus in which electricity played a part, which escaped our notice. We should have been glad to see a good thermo-electric pile, a cheap ozone generator, a large Ladd's magneto-electric machine, a meteorograph, alarm thermometers, electric pianos, engraving by electricity, electric car brake, Caselli's telegraph for sending autograph messages, electric lights, electric safety lamps, and a suite of galvanic batteries, such as we have seen at exhibitions in other countries. Much more has been done in the line of the application of electricity to the arts than is commonly supposed, and it would be of great use to the community could all of the contrivances be collected into one exhibition for comparison and study.

BULKLEY'S PYROMETER.

In our recent notice of this invention, we gave the address of Mr. H. W. Bulkley as 10 Barclay street; it should have been 98 Liberty street, New York city.

A REMARKABLE HISTORY--A TRUE STORY THAT IS STRANGER THAN ROMANCE--HOW MISFORTUNE WAS CROWNED BY SUCCESS.

In 1858, Mr. Thomas Sheehan, now as well as then of Dunkirk, New York, foreman in the blacksmith department of the Erie Railway shops at that place, patented, through the SCIENTIFIC AMERICAN PATENT AGENCY, a submarine grapple, which, though an ingenious invention, proved to be one for which there was little demand.

This was his first invention; and the cost of its completion, together with one year's struggle to manufacture and introduce it, completely exhausted Mr. Sheehan's means, and reduced him to the extremest poverty. Now Mr. Sheehan, though not fortunate in inventing, making, and selling submarine grapples, had, in conjunction with his good spouse, been eminently successful in increasing his family, which comprised eight children at the close of the year of struggle above mentioned.

Eight children, and an empty larder, are rather stern facts when a father is called upon to meet them; and in this case our inventor's troubles were increased by the not unnatural complaints of his wife, who accused him of having left a good situation to pursue a chimera, thus reducing his family to pauperism. In fact, the good woman was decidedly bitter, and her acerbity, added to the really desperate condition of Mr. Sheehan's finances, produced in him a mental state under which some men would have permanently gone to the bad.

Not so our inventor. He kept a stiff upper lip, and sought long and anxiously to provide support for the hungry mouths that appealed to him for food.

It did not subtract from the trouble of this critical period in Mr. Sheehan's life, to discover that his failure had been due, in great measure, to the derelictions of a partner whom he had taken in with him to aid in conducting the grapple business, and who he found had taken undue advantage of his position, selling wares for which no returns were ever made to the firm, and otherwise misconducting himself.