For the Scientific American.

Poisonous Metals.—Test of Arsenic.

When the poison is obtained in the state of arsenious acid, it may be reduced to the metallic condition by igniting it in a small glass tube with some reducing agent, such as a soda flux made by grinding crystals of soda with one eighth of their weight of charcoal, and then heating the mixture gradually to redness, so as to drive off all the water. A more convenient flux, is the residue of the tartrate of soda incinerated in a covered platinum crucible. Cyanide of potassium is not so good as this mixture although it answers very well. In reducing the arsenious acid, two or three parts of the flux should be employed to one of the acid, the tube should be of the hardest and best glass for this purpose, about 3 inches long and one eighth of an inch in diameter.—When the heat is applied by a spirit lamp, the metal sublimes and forms a ring of an iron gray color on the cool part of the tube, an odor like that of garlic is given out at the same time. The physical properties of the metallic crust are very perceptible, sufficient to distinguish the arsenic. The surface next the glass has a brilliant polished appearance a little darker than bright steel, and has a fracture of cast iron when examined with a lens. On applying the flame of a spirit lamp to the crust, it disappears settling on the cooler portions of the tube. Dr. Christisson remarks, " that the characters of the arsenical crust are distinct when weighing only the 300th part of a grain, and that a crust of this weight a tenth of an inch broad and four times as long, may show characteristically all the physical peculiarities of an arsenical sublimate a hundred times larger."

If there arise a doubt as to the mistaking a deposit of charcoal for that of arsenic, this can be removed by submitting it to the action of the spirit flame. Charcoal too, has a brown deposit without lustre, not so with arsenic Preparations of antimony and zinc yield sublimates, it is said, resembling the arsenical crust, but " no preparations of these metals," says Dr. Turner, " can be reduced to a metallic state either by charcoal or black flux with the fullest red blast of the blow pipe." The oxide of cadmium may be reduced and sublimed but it gives out no odor, and its lustre is like that of tin with a brown margin of reproduced oxide, but in no case need there be suspicions of mistaking arsenic for this rare metal. It must be observed that the glass for the foregoing experiment must contain no lead, or the action of the flux may stain the lead glass with a crust somewhat similar to the arsenical crust, but the arsenical crust is volatile, the lead glass stain fixed. There are some kinds of glass made with a portion of arsenic flux, but this all volatises during the burning and in a number of experiments made by the Paris Academy of Medicine in analysing clear glass, no poison could be detected. In cases when the quantity of arsenious acid is very minute, it should be dropped into a dry and warm tube of about one eighth of an inch in diameter, and well dried charcoal in the proportion of about three or four times its bulk dropped upon it. The upper part of the charcoal should be brought to a high temperature before the arsenious acid is heated. In this way, says Mr. Taylor, distinct arsenical sublimates may be procured, less than the 100th part of a grain.

There are not a few liquid tests for this poison, a few of which we will enumerate.

Metallic copper when boiled with an acidified mixture containing arsenious acid becomes covered with a steel gray crust of metallic arsenic. This is a very delicate test, and will detect arsenic when present in no more than a millionth part of the liquid. But the crust thus formed has to be submitted to a careful examination. Mr. Taylor instead of using copper foil employs fine copper gauze of woven wire which presents a great surface to the arsenical liquid, and after the deposit has taken place, he dries it first by pressure between the folds of blotting paper, and then above the flame of a lamp. He then rolls it into a small compass and introduces it into a reduction tube already described, when it is heated slowly and octrahedral crystals of arsenious acid are thus obtained. In this way he detected the 144th part of a grain of arsenious acid in two fluid drachms of gruel and other organic fluids in many experiments. In this manner it has also been easily separated from wine, brandy and the liquid contents of a person's stomach poisoned by arsenic. Mr. Taylor recommends this method as a test when examining organic liquids supposed to contain the poison, for which purpose, the liquid, after being filtered through muslin, or paper, should be strongly acidulated with hydrochloric acid and boiled with a slip of bright copper. Should the brightness of the metal remain unimpaired at the expiration of half an hour, no arsenic, or an extremely minute quantity, can be present, should the copper be covered with a gray deposit, it must be dried and heated in a reduction tube, with the view of procuring from it crystals of arsenious acid. Dr. Christisson speaking of this process, says: " It is the best yet proposed for the detection of arsenic in solution." He says that the fluid to be boiled should be mixed with one-tenth of its volume of hydrochloric acid and to be heated to boiling before the copper is introduced, otherwise the metal may become tarnished though no arsenic be present. In the weakest solutions, it is ten or fifteen minutes before the arsenic is visibly deposited and forty minutes at least should be allowed for complete deposition.

We will adduce some more tests in our next.

For the Scientific American.

Mezzotinto Engraving.

This is kind of engraving very different from common engraving upon steel. The common or line engraving, as it is called, is done by the graver, the lines made by that instrument producing the figures by shade. Mezzotinto on the other hand produces the shades as it were by minute dots and the light by scraping away dotted parts of the steel plate. The first operation is to trace out with chalk the space for the picture on a smooth steel plate. The grounding tool is then employed to go over the whole face of the plate for the picture. This tool is formed with a curved face serrated like the finest rasp. It is held steadily in the hand pressed with a moderate force rocking it from end to end till it has completely hacked all the face of the plate. The other lines are then drawn across the plate at right angles to these and the rocking operation repeated. These diagonal operations have to be repeated a number of times until the part of the plate for the picture, produces a very dark ground. The design is then traced on the plate, some artists employing one way and some another, and the picture is finished by scraping away parts of the serrated surface for the light shade by a tool formed something like a burnisher. The masses of the strongest light are first begun and scraped pretty smooth, and some parts where there is no shade, are burnished. The next lower graduations of shade are then scraped down after which the reflected lights are entered upon. Various proofs of the work are taken during the progression of the engraving.

This style of engraving is fast banishing all other kinds of steel engraving out of the field. It is exceedingly soft and rich in tone, so much so indeed that is has been condemned by some as being too tame in character throughout. We are glad that this argument against the art can no longer be advanced. Within the past year Mr. Ritchie of this city has produced Mezzotints possessing all the vigor of the line engraving combined with the rich shade of the mezzotint,—it is a new discovery in the art, which is fast earning a proud name to the inventor, and which in other hands would perhaps be worse than useless, for he combines like Albert Durer and Hogarth and Sartain, the qualification of artist and engraver.

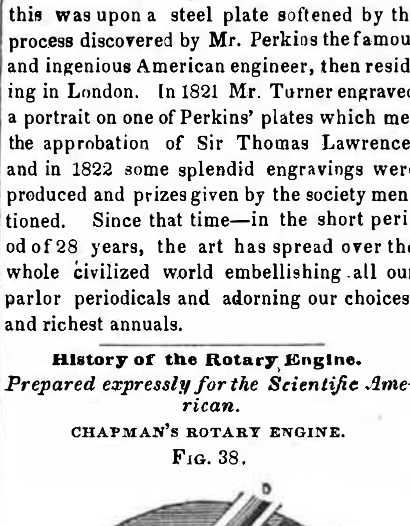
It is difficult to tell who was the first discoverer of mezzotint engraving. It was practiced on copper for a long time before it was tried on steel. Mr. Turner an eminent London engraver, states in the Transactions of the Society for the encouragement of the arts, that James Watt was the first who suggested unto him the use of steel plates for the mezzotint. This was in 1812. No work of the kind however, was produced until 1821, and this was upon a steel plate softened by the process discovered by Mr. Perkins the famous and ingenious American engineer, then residing in London. In 1821 Mr. Turner engraved a portrait on one of Perkins' plates which met the approbation of Sir Thomas Lawrence, and in 1822 some splendid engravings were produced and prizes given by the society mentioned. Since that time—in the short period of 28 years, the art has spread over the whole civilized world embellishing all our parlor periodicals and adorning our choicest and richest annuals.

History of the Rotary Engine.

Prepared expressly for the Scientific American.

CHAPMAN'S ROTARY ENGINE.

FIG. 38.



This is a rotary patented in 1810, invented by Mr. William Chapman.

A represents a drum, packed on its two ends, and revolving within an interior cylinder C C, so that a channel is formed between the two cylinders in which the steam acts upon the flaps F G. I is a cavity filled with hemp, which effectually stops up the passage or channel; an adjusting screw K tightens up the packing as it wears; D is the the steam pipe, and E the escape pipe. The steam being introduced at D presses upon the valve or flap F, which recedes from the pressure, until the valve G having reached the roller H, is shut into the cavity L, and passes under the stop I. As soon as it has cleared the stop, a pin on the outside strikes a lever attached to the spindle on which the flap is hung, opening it out again as before, so that it fills up the passage and receives the action of the steam, allowing F to be shut at the proper place, without interrupting the revolution of the axle.

By the flap wing valves employed by Mr. Chapman, there could be no possibility of keeping the engine tight, as they would wear down the most obdurate steel surface in a very short time. It must have made a great deal of noise—like the rattling of a lot of tilt hammers We saw one in operation in this city not long ago constructed upon the same principle. It was an entire failure and so will every one formed in a like manner. The rattling of the valves over the roller H, reminded us of the noise in the Nail Works.

" Such rattling and such thumping O,
With cranks and cams and battering rams
That made a wonderous pounding O."

Steam Colors.

Roller printing calicoes. Steam Black: 1 pint of red liquor of 18 dgs., 2 pints iron liquor of 24 dgs, 1 gall. logwood liquor at 8 dgs., 1 3-4 pounds starch, and about 1 pint pyroligneous acid at 7 dgs.; all these materials mixed promiscuously and boiled for a few minutes to form a mucilage, the goods to be steamed about half an hour.

STEAM BLACK FOR THE BLOCK.—10½ pints of logwood liquor at 6 dgs. Fa., 14 ounces of logwood British gum and 12 starch, 3 ounces sulphate of copper, 1 ounce copperas and add a little sugar of lead and nitrate of iron, and if intended for goods of silk and wool, add tour ounces of what is known as the " extract of indigo ;" never put in the nitrate of iron before the mixture is cold.

STEAM REDS.—1 gall. of cochineal liquor at 6 dgs. Fa., 1 pound starch, 3 ounces oxalic acid, 4 ounces of the cristal of tin. The cochineal liquor is boiled with the starch for a few minutes: when the mixture is half cold add the oxalic acid, and when dissolved add the crystal of tin. A cheaper but less brillant red may be made by substituting peachwood for cochineal.

Waterproof for Boots.

Put a pound of tallow and a half pound of rosin in a pot on the fire; when melted and mixed, warm the boots and apply the hot stuff with a painter's brush until neither the sole nor the upper leather will suck in any more. If it is desired that the boots should immediately take a polish dissolve an ounce of wax in a teaspoonful of lampblack. A day after the boots have been treated with the tallow and rosin, rub over them this wax in turpentine, but not before the fire. Thus the exterior will have a coat of wax alone, and shines like a mirror. Tallow or any other grease becomes rancid, and rots the stitching as well as leather; but the rosin gives it an antiseptic quality which preserves the whole. Boots and shoes should be so large as to admit of wearing cork soles. Cork is so bad a conductor of heat that with it in the boots the feet are always warm on the coldest stone floor.

Electrical Fishes.

The Gymnotus Electricus, found in South America, and the Torpedo, a species of fish frequent in the Mediterranean, are the most remarkable of those fish which have the faculty of giving off electricity. The electrical action of the torpedo, depends upon an apparatus apparently analagous to the Voltaic Pile, which the animal has the power of charging at will, consisting of membranous columns filled throughout with laminæ, separated from one another by a fluid. The absolute quantity of electricity brought into circulation by the Torpedo, is so great that it effects the decomposition of water, has power sufficient to make magnets, and gives very severe shocks and the electric spark. It is identical in kind with the galvanic battery.