The Etching of Glass.

In the opaque etching of glass it has hitherto been thought necessary to use certain expensive fluorine salts in the preparation of the etching solutions. It has quite recently been discovered by A. Lainer that comparatively cheap etching can be prepared. In Dingler's *Polytechnisches Journal* (*vide* t. cclxxii., p. 227) Lainer gives two recipes which obviate the use of the more expensive fluorine salts.

1. Two solutions are first prepared: (*a*) consisting of 10 grms. of soda in 20 grms. of warm water, (*b*) consisting of 10 grms. potassium carbonate in 20 grms. of warm water. Solutions (*a*) and (*b*) are now mixed, and to the mixture is added 20 grms. of concentrated hydrofluoric acid, and afterward a solution (*c*) consisting of 10 grms. of potassium sulphate in 10 grms. of water is added.

2. This recipe contains the following ingredients: 4 c.c. of water, 1⅓ grms. of potassium carbonate, 0·5 c.c. of dilute hydrofluoric acid, 0·5 c.c. of hydrochloric acid and 0·5 c.c. of potassium sulphate. This mixture is treated with hydrofluoric acid and carbonate of potassium until it produces the required degree of opacity on being tried upon a piece of glass.

Lainer considers that the addition of a small quantity of hydrofluoric acid to solution 1 brings about a fine granulated appearance on the surface that is treated with it. But it appears that there is a still simpler process than either of these; it was invented by Herr Kampmann, of Vienna. In preparing an opaque etching fluid Kampmann uses a wooden vessel, the iron fittings of which are protected from the corrosive action of the acid fumes by a layer of asphaltous material. This vessel is filled to about one-fifth of its contents with strong hydrofluoric acid, which is then partially neutralized by cautiously and gradually adding some crystals of soda; more soda is added, and the mixture is stirred with a small wooden rod. The point at which the neutralization of the acid should cease is indicated by the mixture frothing and becoming sufficiently viscid to adhere to the stirring rod. It is, perhaps, scarcely necessary to say that the acid fumes are highly injurious and that this process should be carried on in the open air, in order to allow the vapor to pass rapidly away. The most hygienic and satisfactory process of all would be to carry on the operation in a "draught cupboard."

The contents of this wooden vessel now consist of sodium fluoride and the unneutralized hydrofluoric acid. This mixture is now transferred to a wooden tub and diluted with from five to ten times its volume of water, according to the degree of dilution that is desired. It is objectionable to use this mixture in a too highly concentrated condition, for then the etched surface of the glass is irregular, coarse grained, and apparently strewn with tiny crystals; if, on the other hand, the dilution be too extreme, the etched surfaces will be transparent instead of opaque. Either of these two conditions of the etching fluid can easily be remedied, for if it be too strong water must be added, and if too weak a small quantity of hydrofluoric acid partially neutralized with soda must be mixed in.

A good recipe for preparing a small quantity of this etching fluid is the following: 240 c.c. commercial hydrofluoric acid, 600 grms. powdered crystallized soda, 100 c.c. water.

These etching fluids are best used by taking the following precautions. The glass is first thoroughly cleansed from all impurities, and is then provided with a rim of wax composed of the following ingredients: Beeswax, tallow, colophony and powdered asphalt kneaded together. The rim prevents the acid from spreading over those parts of the surface which it is not desired to etch. The glass is now etched for a few minutes with an ordinary etching solution (H.F.—1:10), which is then poured off, the surface being afterward washed with water and wiped as dry as possible with a piece of sponge.

The surface is now ready for the opaque etching fluid, which is poured on till it forms a thick layer. The operation is allowed to progress for one hour, when the liquid is poured away and the surface washed with water. Water is further allowed to stand on the glass until a thin film of silicate is observed to form; this film is then brushed off and the surface finally cleansed with water and the wax removed.

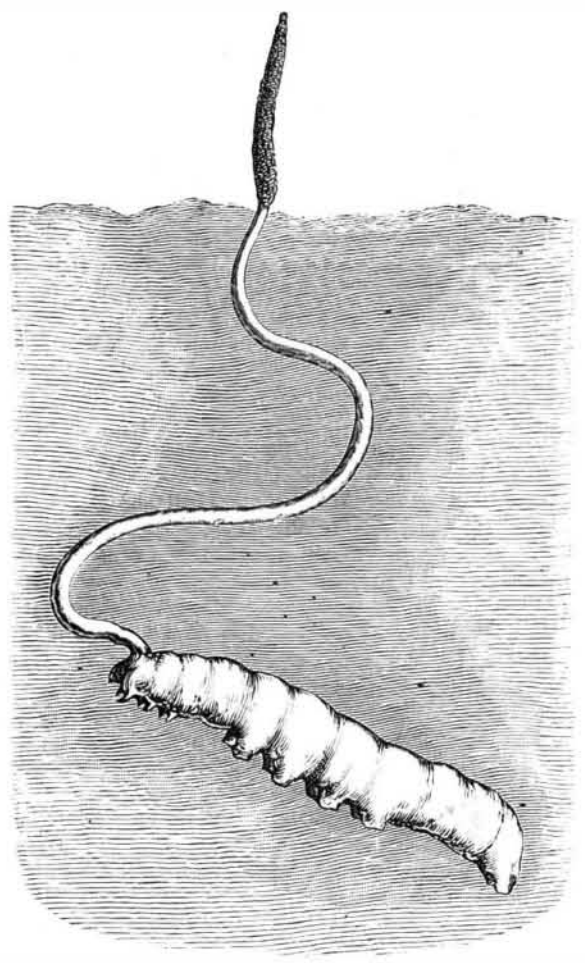
By varying the action of this opaque etching fluid or paste various degrees of opacity may be produced, and if the opacity be greater than that which is desired the surface can be cleared to any extent by using the etching solution of hydrofluoric acid.

Progress of Chilian Trade.

F. H. Haley, of Manitowoc, Wis., has been in Chicago the past ten days busily engaged in packing, marking, and shipping to Chili the enormous amount of machinery, furniture, implements, etc., recently purchased in this locality by J. Thompson Rei, the ambassador for the Chilian government. Mr. Rei, the Chilian representative, purchased fully $500,000 worth during his thirty days in the United States. His purchases consisted of carriages, wagons, thrashers, plows, wheelbarrows, trucks, reapers, mowers, fanning mills, iron bedsteads for hospitals, feed cutters, furnaces and heaters, mining machinery, and a general line of furniture. In Chili they are sparing no effort or expense to make their schools as good as any in the world. They are taking from America drawings and plans for school buildings, studying the many plans for heating, lighting, and ventilation, and the manner of laying out grounds, styles of fencing, material for substantial walks, the best methods of teaching, arrangements of recitation rooms, and in fact adopting daily all of the better methods of American ideas to produce the very highest results in education. Mr. Rei was constantly repeating that the sympathies of Chili were with the United States, and our methods, designs, and manufactured goods were far superior to any other he had yet studied.—*Carriage and Wagon Maker.*

GROWTH OF A WOODEN CATERPILLAR.

The oddest insect in existence—so odd that unless it were vouched for and explained scientifically would be considered a hoax—is the aweto. It is not easy to decide whether it ought to be classed under the fauna or flora of New Zealand, for it is as much vegetable as animal, and, in final stage, it is a vegetable, and nothing else. This is the vegetable caterpillar, called by naturalists *Hipialis virescens*. It is a perfect caterpillar, and a fine one also, growing to three and a half inches. Until it is full grown it conducts itself very much like any other insect, except that it is never



THE "AWETO," OR VEGETABLE CATERPILLAR.

found anywhere but in the neighborhood of the rata tree, a large scarlet-flowered myrtle, and that it habitually buries itself a few inches underground. Then, when the aweto is fully grown, it undergoes a wonderful change. For some inexplicable reason, the spore of a vegetable fungus, the *Sphæria Robertsii*, fixes itself directly on its neck, takes root, and grows, like a diminutive bulrush, from six to ten inches high, without leaves, and with a dark brown head. This stem penetrates the earth over the caterpillar, and stands up a few inches above the ground. The root grows simultaneously into the body of the caterpillar, which it exactly fills in every part, without altering its form in the slightest degree, but simply substituting a vegetable substance for an animal substance. As soon as this process is completed, both the caterpillar and fungus die, and become dry and hard, but without shriveling at all. The thing is then a wooden caterpillar, so to say, with a wooden bulrush standing up from its neck. *Papier mache*, perhaps, would better describe it than wood. It can be taken out of the ground entire, and preserved for any time. Where the aweto is found many specimens can be obtained. It is a light green when alive, and the Maoris eat it in its soft state, when it resembles marrow. When dry, they powder it for use as a flesh dye in tattooing.

It is certain that the caterpillar and fungus were made for each other, as the *Hipialis virescens* is never found without *Sphæria Robertsii* growing out of it, and *Sphæria Robertsii* is never found without this caterpillar with it. Our engraving was made from one by the London *Graphic* from a sketch by Major-General Robley, and the specimen is in the possession of Comte L. De Jouffroy d'Abbans, French consul at Zurich.

Compound Locomotives.

The Baldwin Locomotive Works has issued a pamphlet containing the results of the extended series of experiments made by Mr. George H. Barrus, of Boston, in April, May, and June, of this year, of the four-cylinder compound and a simple locomotive on the Baltimore & Ohio road.

The two locomotives were built for the Baltimore & Ohio, and are in regular service on that road. They are both comparatively new. Both are standard passenger engines, and are duplicates in every respect, except as to cylinders. They are eight wheel type, and have 66 in. driving wheels. The compound has 71,515 lb. on the drivers and 33,965 lb. on trucks; the standard engine has 72,460 lb. on drivers and 33,000 lb. on trucks. The engines have 58 in. wagon top boilers extending back through the cab, and the ordinary link motion, with reversing lever. They have extended smoke boxes fitted with screens, straight stacks and plain exhaust nozzles, one for each side of the engine. The fire box is fitted at the front end with a fire brick arch. The valves of the standard engine are ordinary D-valves, and are balanced by the introduction of packing strips along the four edges of the upper surface. The compound has four cylinders arranged in two independent sets, one on each side of the engine. On each side is one high pressure cylinder and one low pressure. The high pressure cylinder is placed vertically above the low pressure cylinder, and the two piston rods are attached to a crosshead common to both. One rod takes hold above the guides and the other at the same distance below the guides, and the guides are on a line with the centers of the driving wheels.

The average consumption of coal for four round trips between Philadelphia and Washington was 14·9 per cent less in the compound than in the standard engine; and the consumption of steam per horse power per hour during the selected periods of the runs which have been analyzed was 5·5 per cent less in the compound engine than in the standard.

The compound engine is more economical in the use of steam when running at slow speeds than at high speeds. The steam consumed when running at a speed of 257 revolutions per minute (50·4 miles per hour) was 25·69 lb. per indicated h. p. per hour, while that at a speed of 176 revolutions per minute (34·5 miles per hour) was 20·86 lb. per indicated h. p. per hour, a difference of 19 per cent.

The tests furnish ample reason to expect a saving of coal on freight trains, and on accommodation passenger trains making frequent stops, of not less than 30 per cent.

The compound steams freely, and without undue exertion on the part of the fireman. It starts from a state of rest quite as promptly as the standard engine. No difficulty is encountered in moving the fastest trains on schedule time, and in making up a reasonable amount of lost time.

Why Some Men do not Succeed.

Two of the most successful men on the North American continent were recently asked the question, "What are the causes of poverty?" One replied, "Ignorance and incapacity." The other said that the prevalent cause is "The number of young men who are wanting in decision and fixity of purpose. If they get into a good place at the start, they should stick to it, knowing that by perseverance, industry, and ability, they win promotion in due course as vacancies occur. But they see or hear of some one making a fortune in Wall Street, or in ranching, or in mining, and away they go to try their luck. When they lose, as they do in ninety nine cases out of a hundred, that is the end of them; they can never settle down to ordinary ways of earning a living after that, and their descent is rapid." This reason hits the nail square on the head. Go where we will, we will find men who commenced life under the most favorable circumstances, but who are such complete financial wrecks that there is but little hope for their reformation. They may be honest and temperate; they may even possess natural ability of a high order, but lacking in steadiness of purpose, they will never succeed. Had they sufficient will force to stick to one thing, no matter how disagreeable it might be at first, were they content to advance slowly, they would have no reason now to talk of the "luck" of those who have pushed forward into the front ranks.

Another cause of poverty is a lack of self-confidence. Many men seem to have no faith in themselves, consequently no assertiveness, no independence, no pluck, and no push. They are afraid to stand up and speak for themselves, preferring to lean on others. They are afraid to make an investment, because of the possibility of failure; they are afraid to tell what they can do, as they might make an error in doing it; they are cowards in every sense of the word. This is often the result of early training. A boy, naturally timid, is kept in the background so persistently, and his mistakes are so severely criticised, that he grows up into an entirely useless man. Push and fixity of purpose will always bring a measure of success.—*The St. Louis Miller.*

Regulations for Modern War Ships.

The following are among recent regulations issued by the Secretary of the Navy; fifty years ago the issuance of such orders would have been unintelligible and considered as evidence of lunacy:

I.—WATER-TIGHT DOORS AND VALVES.

1. The water-tight doors and valves in the engine and fire rooms and coal bunkers shall be under the charge of the senior engineer, and all others under the executive officer. These officers shall, under the captain, be responsible for the condition of the doors and valves, their freedom from all obstructions, and readiness at all times for immediate use; they shall personally examine and test them at least once a week, reporting the result for entry in the log.

2. It is the intention of the department to provide the shrieking or slide whistle for use as a signal to close water-tight doors on occasions of emergency. Should none have been provided, then some signal will be improvised for that purpose. Care shall be exercised that this signal is accessible to the officer of the deck, and kept in readiness at all times, day and night, at sea and in port: also that it can be readily and distinctly heard in all parts of the ship.

3. The captain shall, during an action or when at sea, in a fog, or at night, and at other times when a sudden collision may occur, have all practicable water-tight doors and valves closed, taking into consideration the necessities of the occasion and the requirements of the officers and crew. Even in action, certain communications in the engine and fire rooms, coal bunkers, magazines and ventilating conduits, will, of necessity, be kept open until the last moment.

4. He shall have men detailed, whose duty it shall be, upon the alarm of fire, or when the signal is given, to proceed with all possible speed to close the water-tight doors and valves, and then report them closed to the officer of the deck. There shall be a sufficient number of men so detailed to provide for all possible absentees from sickness or other causes.

5. He shall have frequent exercises, without previous warning, in order to practice the men so stationed at their duties, and enter in the log the time required to fully perform them.

6. He shall take precautions for the escape, by means of ladders through hatches, ventilators, and other openings, of those below in compartments; and shall require search to be made and warning to be given by those stationed to close the bulkhead doors.

7. He shall assure himself that the duty of examining and working all cocks, valves, slides, doors, outlets and hatches, in connection with the ventilating apparatus, pumps, and water-tight compartments, once a week, is faithfully performed.

II.—HULL AND DOUBLE BOTTOMS.

1. The captain of every iron or steel ship in commission shall appoint a permanent board of three officers, to be assisted by such other persons as may be necessary, for the purpose of examining and reporting upon the condition in respect to corrosion of the under-water outer hull each time it is accessible, and of all parts of the outer top sides, inner hull and double bottoms during the last week of each quarter. The reports will be made upon prescribed forms to the bureau of construction and repair.

2. In addition to these inspections a weekly examination of the ship for the same purpose shall be made by the executive officer and senior engineer, the result being entered in the log. The senior engineer will confine his examination to the engine rooms, fire rooms, coal bunkers and the double bottoms under them; the executive officer will examine the other parts of the ship.

3. Every ship not sheathed shall be docked, cleaned and painted at least once in six months when possible. Under no circumstances shall more than one year elapse without docking, except by authority of the Secretary of the Navy.

4. A sufficient quantity of cement, composition, and paint, such as is used on board to prevent corrosion, shall be kept on hand. The inspections and examinations provided for should be the means of detecting any places showing corrosion of a serious nature. When such places are discovered they must, at the first possible opportunity, be carefully scaled, dried and again coated with anti-corrosive material.

5. The report on the under-water outer hull shall include a statement as to the structural condition of all valves and ports, the rudder, propellers, shaft struts and tubes, torpedo tubes, bilge keels, and other fittings; also the date of the last cleaning and painting, the kind of paint or composition used and its condition.

III.—PRECAUTIONS.

1. An iron or steel unsheathed ship must never be attached to the moorings or chains used for a sheathed ship nor moored close alongside of the latter.

2. Great care must be observed that no articles of copper or bronze or filings of the same, or rust scale, are allowed to rest on the bottom in immediate contact with the iron or steel; and that the leaden pipes, strainers and other painted or varnished parts in the bilges are kept in good condition.

3. Bronze screw propellers must be coated with the same anti-corrosive paint or composition and in the same manner as the hull. Zinc protectors must be placed near them.

4. Whitewash must never be applied to any iron or steel parts of the ship.

5. An incandescent electric lamp of high power, with a portable connection, should be used for examining the condition of double bottoms, the interior of boilers, and other dark places.

6. When about to examine, clean, or paint double bottoms or boilers, the following cautionary measures must be adopted:

First.—They should be opened up and well ventilated, a connection being made to a fan system if possible.

Second.—This done, the purity of the air should be tested before entering by burning a candle on the bottom at least five minutes.

Third.—Working parties inside must always maintain communication with some one outside; they must also have with them a lighted candle, and withdraw should it begin to burn dimly.

7. No naked light is to be taken into a coal bunker until it is ascertained that no explosive gas is contained therein. Special precautions in this respect should be taken for some days after coaling. The ventilation of coal bunkers should receive careful and constant attention.

Quicksilver.

During the calendar year 1889, according to the statistics presented, California produced 26,464 flasks or 2,024,496 pounds. California has eleven mines in operation with 36 furnaces employing 937 hands, of whom 521 worked underground. The amount of cinnabar ore mined was 95,714 tons. The capital invested in the sixteen establishments is $1,333,114, of which $680,470 is represented by the mines and real estate, $222,300 in furnaces, houses, etc., and $146,150 in machinery, tools, etc. The total expenditure for the year was $845,911, of which $626,289 were for wages. The cost of producing the quicksilver per flask averaged $33.31 per flask of 76½ pounds, or 43½ cents per pound.

The price of quicksilver, which on January 1 was 69 to 71 cents per pound, is now 74 to 76 cents, according to quantity.

Its principal uses are in amalgams for recovering the precious metals, in making vermilion, fulminate of mercury for use in cartridges, in thermometers, steam gauges, and all kinds of mechanical instruments. In the form of corrosive sublimate it is not only an excellent disinfectant and antiseptic, but is employed to a considerable extent in the preservation of timber used in underground or underwater construction, as, for instance, says the *Commercial Bulletin*, by the Locks and Canal Co. at Lowell to preserve their bulkheads, gates, etc.

But in that industry which is popularly supposed to consume a great deal of quicksilver, viz., the making of looking glasses, very little is employed. Mirrors are now covered almost entirely with a solution of pure silver precipitated or sprayed on to the glass. After this is done the glass would be still transparent were the backs not painted over with a brown or other dark colored paint of a certain chemical composition, first introduced from Bohemia by a firm in this city just before the war.

In the old way of making mirrors the glass was covered with an amalgam of quicksilver and tinfoil, and whereas the silver-backed mirrors are ready for handling the next day, the quicksilver and tinfoil required two weeks before the amalgam was sufficiently hardened for handling. The quicksilver process makes the best and most enduring work, the painted backs of the silvered glasses being apt to change color in spots. The quicksilver method is, however, the most expensive, which largely explains the reason for its decadence.

The production of quicksilver throughout the world during the past ten years is put at 1,093,611 flasks, of which the United States produced 407,675, and Spain, Austria, and Italy 685,936 flasks.

What's in a Name?

The London *Electrician* calls attention to some curious coincidences between the names of inventors and mechanical appliances which have given rise to absurd mistakes. It was commonly supposed years ago that the Brush machine was so called on account of some special kind of brushes, and that the Lever arc lamp derived its name from two peculiar levers in its mechanism. "The Ball dynamo has no spherical armature, as might be supposed. The Short electric railway system is not specially adapted for lines of limited length. Bright shackles are never polished, and the Siemens galvanometer has nothing to do with the mariner's compass, with which beginners sometimes confound it. The Parsons engine is not a clerical device, and the Upward battery has nothing in common with Excelsior carbons. Such popular errors may be excused, however, when we find a recognized text book explaining the Daniell cell as being so called because of its constancy." In this country a large number of people have always thought that the Bell telephone was so called because of the bell that was attached to it, and so widespread was this belief, that the Long Distance Telephone Company made it serve a commercial purpose by adopting the bell as its trade mark

New Aleutian Volcano.

Every vessel from the Aleutian Islands arriving at San Francisco nowadays reports the liveliest sort of doings along that volcanic chain. The subterranean energies that are incessantly seeking a means of escape to the surface have massed their forces along that line of volcanic vents, and are making a display of pyrotechnic brilliancy and awful energy that is seldom seen anywhere. It is now reserved for a very few spectators, most of whom are badly frightened by the exhibition.

Volcanoes that have not smoked for many years have suddenly become flaming chimneys, connecting with the molten regions beneath our feet. The grandest spectacles and the most remarkable phenomena are connected with New Bogoslov, which reared its head above the waters about eight years ago. At one end of Unalaska Island is the pass between the islands leading to the seal-breeding grounds of the Pribylov group. Bogoslov, a little mass of volcanic rock, is only about forty miles from this channel, and all vessels going to and from the sealery have a fine chance now to see the volcano in all its splendor.

Old Bogoslov was puffing away with other volcanoes when Levasheff discovered it 122 years ago; but ten years later, when Cook passed within seventeen miles of it, it was quiet. Two years after that time it was in a mild state of eruption, and in 1796 the island was reported to be rising from the sea.

The greatest changes at Bogoslov have occurred when no one was there to see. Big surprises have once or twice awaited vessels from the south that approached the island without knowing that momentous happenings had occurred. For the first fifteen years of this century Bogoslov kept gradually adding to his stature, but from 1815 until 1882 no eruptions are known to have occurred. In 1883, however, a most surprising discovery was made. A new Bogoslov had risen from the sea, probably in 1882, in front of the old volcano, with which it was connected by a gravel isthmus. The new island was 700 feet above the sea. It was a mass of flames and sulphuric vapors, and could not be inspected at close range until some officers of the cutter Corwin had the temerity, in 1884, to land on its smoking sides. It was nothing but a mass of ashes and volcanic debris, and down its slopes extended many crevices, from which stifling fumes and steam issued. These crevices were so hot that it was impossible to take the temperature, the mercury bursting the bulb in its surprise at the violent expansion. Once since then the new volcano has been ascended for a short distance, and in 1888 its height was still reported to be about 700 feet.

This new island had been thrown up by an eruption at the bottom of the ocean, which had gradually spread ashes over the ocean bed, covering a wide area, until they finally appeared above the surface and a new land was born. It was a splendid object lesson in the making of volcanic islands. But still greater wonders were in store for this neighborhood.

In February, this year, the new island with its little craters illumined the Arctic winter for many miles around. The night was almost as light as day, except when clouds of pumice dust filled the air. Several other little islands suddenly rose above the surface to join their elder sister. All of them had risen from profound depths. Their foundations are laid on the ocean bed three-fourths of a mile below the surface. It can be readily imagined, therefore, that a perfectly enormous quantity of ashes and debris have found exit through the crater or craters at the bottom of the ocean.

It is estimated that on February 22 the ashes from New Bogoslov rose to a height of about five miles, and the column of smoke, a dense black pillar, was computed to rise fifteen miles in the air. Such a sight as this is seldom witnessed in any part of the world. The natives of islands thirty or forty miles distant were terribly frightened, and thought they were going to be buried in the ashes that fell far and wide over that region. According to the most recent reports, when the new islands are not vomiting smoke and dust, steam jets often almost conceal them from view, and the hissing noise they make can be heard at a distance of several miles.

There is no telling where this new activity on our western borders will end. Other volcanoes in that neighborhood, which have long been inactive, are adding their lava, cinders, and ashes to the general commotion. Natives are moving to the parts of their islands most distant from the volcanoes. At night the scene is said to be most beautiful, for from one to another of these volcanoes stretching along the Aleutian Islands great tongues of flame shoot from craters, and rise toward the zenith like northern lights. It is a spectacle worth going far to see, but although it is adding some new islands to the domain of Uncle Sam, few will be able to see the process by which it is done. —*New York Sun.*