other stratified rocks older than our granites, previously existing and broken down, pebbles from which were transported and imbedded in the sediments now constituting those oldest known rocks. So that we go back not only as far as we can absolutely see the rocks, but still farther, and we demonstrate that there are still earlier periods, when there were deposits of rocks yet to be discovered by geology, earlier than the earliest rocks we know, lower than the lowest rocks we know; and these being stratified rocks, we may say that water from the beginning of our knowledge has existed upon the surface of the globe. We have, then, no knowledge whatever of the primary nucleus. We see that by the action of water materials have been transported from one part of the surface of the globe to another, covering the former ocean beds with enormous accumulations of sediment; which, after a time, by this change in the relation of the parts, and by the increase of temperature beneath the landed part, have risen up and become, step by step, islands or continents. It is by this process that, age after age, the American continent has assumed its present form. But I desire to impress upon you this one truth; that we have, in our geological investigation, succeeded in going back one step beyond the existence of water and stratification —one step toward this original and so-called primary nucleus, a nucleus of molten matter. This original nucleus that has been talked about in geology, has produced no effect upon the surface of the earth; neither upon its mountain chains or any other of the great features of the continent. Neither have these features been produced by it or by materials derived from it. I have shown that in the form of the continent the materials composing it have been derived from the breaking down of pre-existing materials transported and deposited along certain lines, or spread out in mid-ocean and there accumulating uniformly. The inequalities upon the surface of the country are not due to any special action along these lines of elevation. Those mountain ranges, whether the Rocky Mountains of the West, the Appalachian chain of the East, or any other chain of mountains, so far as we know, are not due to any action or any forces along those lines, but only to the greater currents in the bed of the ocean near those lines, as I have shown you regarding the Appalachian chain. Everywhere the same law has prevailed. The transporting power of the ocean has deposited in the line of its currents larger quantities of material. The elevation has been a continental one, and not the elevation of a mountain or of a chain of mountains. The elevation of the eastern portion of the North American continent has nothing to do with the mountain chains constituting a portion of the continental elevation. Going back, then, step by step, from the more recent to the earliest times in relation to which we have any evidence whatever, we have no proof that the action of the interior of our globe has produced any of the great features of the globe. This idea of a great primary nucleus is only theoretical. It has not in it anything tangible. The earliest rocks of which we have any knowledge were deposited by the ocean under conditions similar to those which now exist. The conditions of the ocean currents are the same now that they have been from the earliest time. From the earliest history of the American continent, from the earliest history of any other, we know that the ocean currents have prevailed as they now prevail, moving northward and southward; and here, at least, the transporting power has generally been from the north toward the south and west; and we have abundant evidence that all the materials composing our continent have been derived in that way from the transporting agency of currents of water alone.

The Rabbit Plague of Australia.

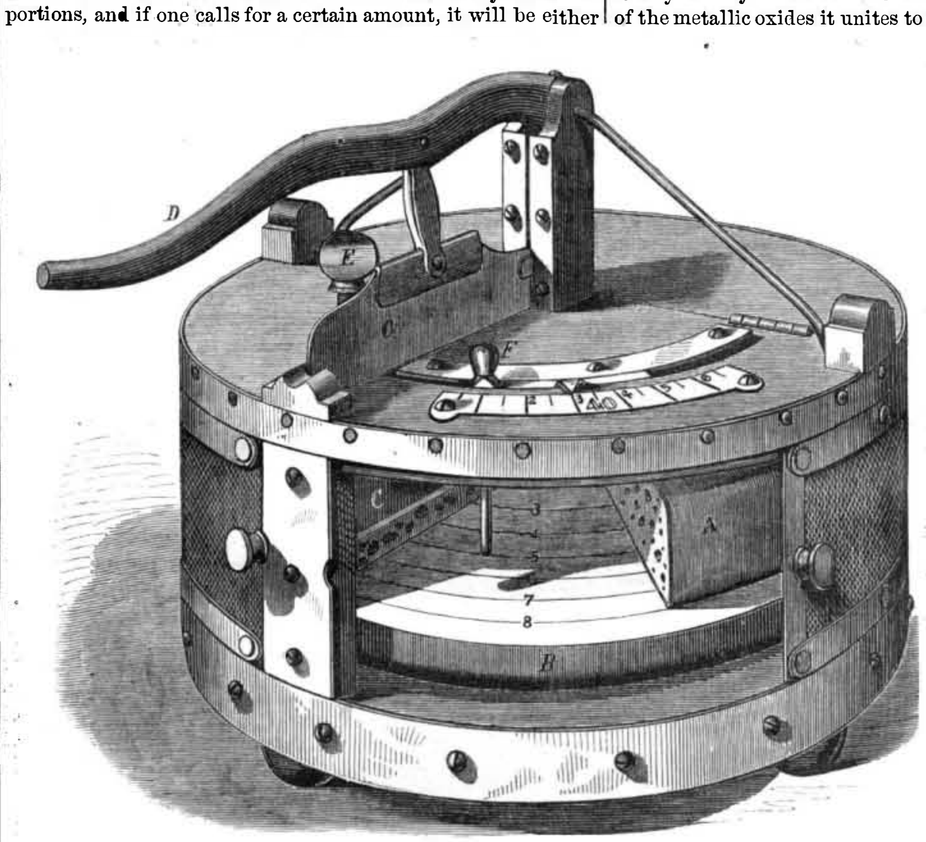
The rabbit originally brought from England into Australia is now threatening to become a plague of almost Egyptian magnitude in the distant and thinly populated plains. Only a year or two ago not a rabbit was to be seen save as a curiosity in a hutch; but the wild rabbit, most prolific of importations, has so increased in numbers in some parts of the country that it threatens to starve the very sheep out of their runs. Mr. William Robertson, a large landholder and squatter near Colac, has been put to a cost of four or five thousand pounds in the, as yet, abortive effort to exterminate these now considered vermin, and he estimates that it will cost him £10,000, in wages to trappers and killers before he will have achieved any marked success in abating the nuisance. "At the same time they are spreading more or less in all parts of the country, and I have seen them scampering about even in gardens near Melbourne. As food they greatly affect some of the most beautiful of our flowers—nothing, however coming amiss to them—and they are, therefore, becoming the terror of horticulturists. Now that the plague is on us in full force we can, of course, all very easily account for what no one foresaw. Any equally prolific animal, equally well circumstanced as to climate and feed, must become equally numerous in any country as thinly populated as ours. In England the wild rabbit meets with many destroyers; here there are very few. In England rabbit killing is sport; in Australia it is generally work to be paid for. Dead rabbits are daily hawked about the streets at six pence each, and the market is always glutted."

The Sword-Fish.

A marine insurance case is now being tried in England, which involves a serious question as to the power of a sword fish to inflict damage and endanger lives. The ship *Dreadnought*, an East Indiaman, was recently taken into port leaking badly from a small hole below the water line. Her owners demanded the cost of repairs from the insurance company, claiming that the hole was made by a sword fish. If it was not made by some external force, nothing can be collected. The insurance company answers that there is no instance on record in which a sword fish, having punctured the side of a vessel, has escaped without leaving his sword in the hole. The plaintiffs prove that a few hours before the discovery of the leak, the crew had seen a very large sword fish in the water, and had tried to capture it with lines and hooks. Prof. Owen delivered a scientific lecture on the sword fish from the witness-box during the trial. The sword of this fish, is the hardest bony material known; it has a sheath harder than the enamel of human teeth; within his personal experience the sides of two ships have been pierced by this submarine stiletto; the blade was usually left in the wound, while the hilt, or in other words. the fish itself, broke away. He quoted examples of this wonderful weapon being driven through fourteen inches of copper sheathing, felt, deal, and oak; his evidence simply demonstrated the enormous power of this formidable monster. In the case before him, Prof. Owen admitted that the fish, having passed its dagger through only three inches of wood, might possibly have withdrawn it. A precisely similar illustration was presented to him several years ago, except that the sword was broken, and actually stopped a leak which might otherwise have been fatal to the ship.

Improved Safe for Preserving Cheese.

Safes for protecting cheeses, when cut, from the attacks of flies, are common enough; they are used in every well managed grocery; but their contents are often mutilated in so miserable a style that the satisfaction in purchasing a bit of cheese is alloyed by the consideration that its shape is such that it cannot be subdivided into convenient and symmetrical portions, and if one calls for a certain amount, it will be either short or excessive in weight. This is an annoyance to the purchaser and a loss to the seller. The object of the device shown in the engraving is to obviate these difficulties.



BULGIN'S IMPROVED CHEESE SAFE AND CHEESE CUTTER.

The safe is in general construction similar to those in common use, the sides being covered with wire gauze. But the cheese is received on a revolving circular platform, one half of the cover and side opening to admit it in the usual manner. The face of the platform is divided into concentric circles numbered to show their relations, or the relative weights of the cheeses the platform receives. The cheese, A, being placed on the platform, B, concentric with one of the circular lines, it is cut by means of the knife, C, worked by the lever, D. The thumb screw, E, has a flat revolving head on its lower end that engages with the top of the cheese by which it may be held in position while being cut, and be prevented from rising when the knife is withdrawn. The pin, F, passes through the cover or top of the safe, the knob being used to slide a segmental strip having a pointer that designates on a fixed and graded segment the proportionate weight or amount of the cheese to be cut, the downward projecting portion of the pin coming in contact with the cut face of the cheese, and serving as an additional guide to the amount to be cut. The front of the safe is composed of two sliding doors seen open in the engraving.

Patented July 7, 1868 to Edwin G. Bulgin. Letters of inquiry may be addressed to W. G. Bulgin, Vienna, N. J.

GLASS--ITS COMPOSITION.

The discovery of glass was no doubt in the first instance accidental. Whether credit is given to the statement of Pliny in regard to its origin or not, it is scarcely conceivable that in the manufacture of pottery, and some other arts known from the earliest periods, the materials of which glass is composed should not have come together and have been fused so as to have become glass. His account is that glass was discovered by mariners, who, compelled to seek the shore as a refuge from a severe tempest, discovered glass in the ashes of a fire with which they cooked their food. Whether this event ever happened or not, it is quite certain that it might have happened, as the sand of many beaches, with the ashes of some kinds of fuel would, when fused together inevitably form glass, as will be seen upon a consideration of its composition.

Glass may be composed of various materials, but one is essential to all glass, viz., silica. The other materials may be potash, soda ash, lime, alumina (the oxide of aluminum which with some impurities constitutes the various clays), minium (red oxide of lead, red lead), magnesia, etc., which may be varied in their proportions to suit the quality of the glass required; the purity of the materials, of course, regulating the fineness of the product.

Silica is the oxide of a metal called silicon or silicium. It is found nearly pure in quartz, and is with various coloring matters, the substance of agates, opals, flints, etc. Its purest native form is that of rock crystal, of which beautiful specimens are found in England, Scotland, California, and other parts of the world. These crystals are cut into proper shape for ornaments and lenses for spectacles called pebbles. The latter are considered superior to those made of glass. Sand and sandstone are quartz more or less pure. Glass can be made with quartz and flints pulverized, but sand if sufficiently pure is preferred, as it obviates the expense of pulverizing. Sand to be useful for making clear white glass, should be free from earthy matters and certain metallic oxides. The latter give various colors to glass, and when present to any great extent, unfit the material for anything but the coarser varieties of work, as green bottle glass, etc.

Silica has been shown by chemists to be an acid. As it is insoluble in water however, its acid properties do not readily appear. Alkaline solutions, and hydrofluoric acid, dissolve it very readily. With the alkalies, alkaline earths, and some of the metallic oxides it unites to form salts called silicates, for the most part insoluble in water, or in acids, except hydro-fluoric acid, but soluble in strong alkaline solutions. Thus a strong solution of potash will eventually dissolve through an ordinary glass bottle if kept in it long enough.

Glass is a fused mixture of some of the silicates of potash, soda, lime, magnesia, alumina, and lead. These silicates might be formed separately and fused together afterwards, but the requisite homogeneousness is better obtained by mixing in the proper proportions the materials of which they are composed and melting them together, the combinations taking place during the "melt."

The process of melting is performed in large pots made of refractory clay, placed in a conical furnace with a chimney at the apex. The heat is carried to a very high point to insure perfect combination and fusion, and is continued from ten to thirty hours, according to the kind of glass to be made. The heat is kept up as constantly as possible day and night, as much loss would accrue by allowing the furnaces to cool and re-heating them. In order that the temperature of the furnace shall be kept as even as possible the coal is added lump by lump, being thrown in through a small hole in the side of the furnace by a man who performs only that special service. Each furnace contains a number of these pots with an aperture to correspond with each, at proper intervals around the cone. From each of these apertures the fused glass is taken as wanted and manipulated so as to form the various articles of glassware in use. These manipulations, comprising what is technically known as "glass-blowing," will form the subject of a future article.

Dr. Ure makes the following classes of glass, based upon their chemical composition:

1. Soluble glass, sometimes called waterglass—a simple silicate of potash or soda, or both of these alkalies—so called because it is soluble in water.
2. Bohemian or crown glass; silicates of potash and lime.
3. Common window and mirror glass; silicates of soda and lime; sometimes also of potash.
4. Bottle glass; silicates of soda, lime, alumina, and iron.
5. Ordinary crystal glass; silicates of potash and lead.
6. Flint glass—silicates of potash and lead with larger proportion of lead than crystal glass—so called because it was made originally with powdered flint.
7. Strass; same as preceding with still more lead.
8. Enamel; silicate and stannate or antimoniate of potash, or soda or lead. A stannate of potash or soda is a compound of stannic acid, formed by the combination of oxygen and tin, with either potash or soda. An antimoniate of potash or soda is a compound of antimonic acid, formed by the chemical union of antimony, and oxygen with one or the other of those alkalies.

The quality of glass depends very much upon the method of manufacture as well as the materials employed. In particular the process of annealing is a very important one, as if this be neglected or imperfectly done, articles of glass are so brittle as to be almost worthless for any practical use. The manner in which annealing is performed will be hereafter described. To give the proportions used in various manufactories for the different kinds of glass would occupy too much space. We give, therefore, an analysis of only one variety, the best English crystal glass, made by the chemist Berthier.

Silicic acid	59·20	parts.
Oxide of lead	28·20	"
Potash	9·00	"
Oxides of iron and manganese	1·40	"

Now it will be seen that in this glass there is iron, which we have stated gives a green color to glass; in fact it will be seen below that it is capable of giving many other colors; but it also contains manganese, which in common with arsenic possesses the property of decolorizing the alkaline silicates when colored by other metallic oxides.

This leads us to the means whereby color of any desired tint can be imparted to glass. In an article published in No. 2, current volume, an allusion was made to the use of the oxides of cobalt, copper, gold, etc., as surface colors for glass. When these and some other oxides are melted with thesilicates, they become a part of the mass and color it throughout without impairing its transparency. Thus, oxide of cobalt gives a brilliant blue; oxide of copper, green; oxide of gold, a ruby red; oxide of antimony, orange yellow; uranium, a delicate greenish color very beautiful but costly; suboxide of copper, brilliant red, but renders the glass almost opaque, etc., etc. A dirty yellow may be given to glass by the admixture of soot or powdered charcoal. The beautiful Bohemian ruby glass is of very complex composition. It contains gold, peroxide of tin, peroxide of iron, oxide of lead, magnesia, lime, soda, potash, silica, and arsenic. Manganese gives a splendid amethystine tint to glass.

Some of these colors change after the glass is made. This is the case with the copper red, which at first is nearly colorless, but becomes red upon reheating after it is cooled. Blueish or greenish colored glass becomes by exposure to sunlight almost colorless from the combined effects of air and light. Glass containing lead is frequently affected by sulphureted hydrogen gas, becoming opaque upon its surface from the formation of sulphide of lead. The glass used by chemists is for the most part free from lead; the presence of the latter being in many cases a serious inconvenience.

M. Bontemps has shown that all the colors of the solar spectrum can be obtained by the use of oxide of iron in different proportions and by different degrees of heat. Similar conclusions have been arrived at in regard to the oxide of manganese. These differences of color are ascribed not to chemical combinations but to molecular conditions.

Most crystal glass is partially dissolved by boiling water, as it has a very large proportion of alkali. Glasses rich in alkalies have also a more powerful attraction for water than others.

The extent to which articles of glass now enter into domestic use, as well as certain branches of the arts, renders this material one of great interest and importance. Its peculiar nature gives rise to very peculiar methods of manufacture, which in the skill and taste required for their performance and the beauty of their product are unexcelled by any other department of industry.

The chief seat of the glass manufacture in the United States is Pittsburgh, which contains in the city proper and its immediate vicinity sixty-eight glassworks, making over half the glass consumed in the country. In a subsequent article we shall take our readers through some of these busy hives, and show them by what unique means and adroit operations some of the beautiful glass articles in common use are formed.

The Zirconia Light.

Messrs. Tessie du Motay & Co. have patented an invention for improvements in preparing zirconia, and the employment of the same to develop the light of oxyhydrogen flame. The specification is as follows: "Zirconia, or oxide of zirconium, in whatever manner it may be extracted from its ores, can be agglomerated by compression; for example, into sticks, disks, cylinders, or other forms suitable for being exposed to the flame of mixtures of oxygen and hydrogen without undergoing fusion or other alteration. Of all the known terrous oxides it is the only one which remains entirely unaltered when submitted to the action of a blowpipe fed by oxygen and hydrogen, or mixtures of oxygen with gaseous or liquid carbonated hydrogens. Zirconia is also, of all the terrous oxides, that which, when introduced into an oxhydrogen flame, develops the most intense and the most fixed light.

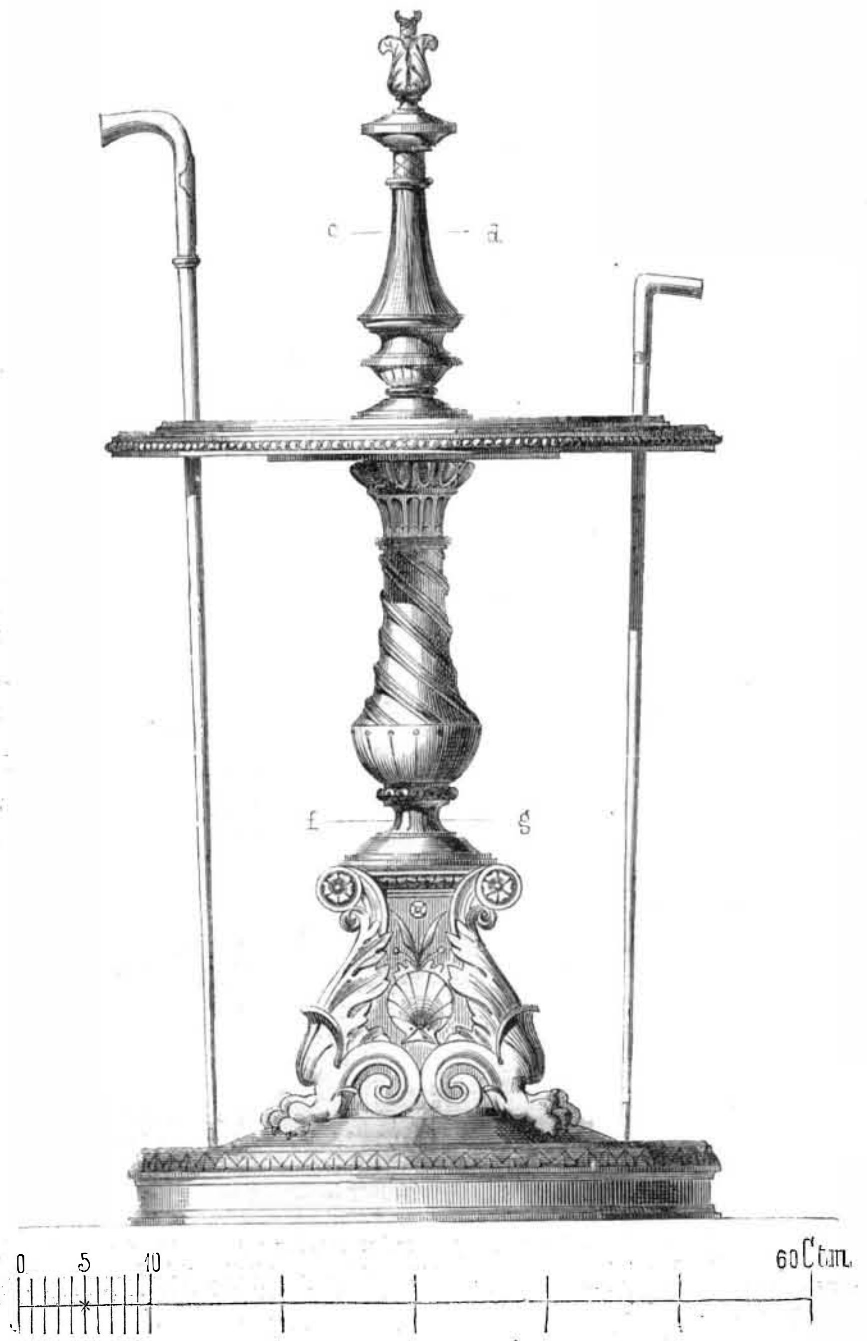
"To obtain zirconia in a commercial state I extract it from its native ores by transforming by the action of chlorine in the presence of coal or charcoal the silicate of zirconium into double chloride of zirconium and of silicium. The chloride of silicium, which is more volatile than the chloride of zirconium, is separated from the latter by the action of heat; the chloride of zirconium remaining is afterwards converted to the state of oxide by any of the methods now used in chemistry. The zirconia thus obtained is first calcined, then moistened, and submitted in molds to the action of a press with or without the intervention of agglutinant substances, such as borax, boracic acid, or clay. The sticks, cylinders, disks, or other forms thus agglomerated, are brought to a high temperature, and thus receive a kind of tempering or preparing, the effect of which is to increase their density and molecular compactness.

"I can also compress in molds shaped for the purpose a small quantity of zirconium capable of forming a cylinder or piece of little thickness, which may be united by compression in the same mold to other refractory earths, such as magnesia and clay. In this manner I obtain sticks or pieces of which the only part exposed to the action of the flame is of pure zirconia, while the remaining portion which serves as a support to it is composed of a cheap material.

"The property composed by zirconia of being at once the most infusible, the most unalterable, and the most luminous of all the chemical substances at present known when it is exposed to the action of an oxhydrogen flame, has never before been discovered, nor has its property of being capable of agglomeration and molding, either separately or mixed with a small portion of an agglutinant substance.—*Chemical News.*

Stick and Umbrella Stand.

We herewith reproduce from the *Workshop*, published by E. Steiger, 17 North William street, New York, the annexed unique and beautiful design for an umbrella stand, which speaks not only for itself but the excellent character of the publication.



STICK AND UMBRELLA STAND.

LYCEUM OF NATURAL HISTORY.

This Society met at its rooms at the Mott Memorial Library on the evening of December 28th, and after the usual preliminary business, Dr. Schweitzer, of the School of Mines, stated that he had made a qualitative analysis of the green substance discovered by Mr. E. G. Squier in the Peruvian girl's dressing case. It contained silicate of lime with some alumina. He did not consider his investigation satisfactory, as owing to the small quantity given him, he was unable to make a quantitative analysis.

Professor Eggleston (in the chair) inquired what was the coloring matter. Was it of an organic nature?

Dr. Schweitzer—Undoubtedly so. The coloring matter was of a decided grayish blue, which on ignition turned white.

Dr. Feuchtwanger stated that near Rockwell, in Canada, he had met with specimens of phosphate of lime which when broken open showed crystals which contained a round hole. he asked for explanation as the phenomenon was extremely rare.

Professor Eggleston pointed out that this hole occurred at the conjunction of the crystals. He supposed it was caused by some accident in the course of formation.

A member stated that it had a geodic aspect.

Professor Joy said: It will be in the recollection of members that Professor Graham, Master of the Mint, discovered on May 16, 1867, the occlusion of hydrogen gas in meteoric iron. It would now appear that he had discovered a new metal, or rather had demonstrated the existence of a very old metal. In a letter to Professor Horsford that eminent scholar states that he is preparing a paper for the Royal Society on certain experiments of his with palladium, magnesium, and hydrogen, which have resulted in the discovery of what appears to him to be a white magnetic metal, hitherto unknown, with a specific gravity of 2. He thinks it is the metalic base of hydrogen. This, said Professor Joy, is a discovery of remarkable importance—one that the gentleman who prepares the cable telegrams for us would have announced at once had he sufficient knowledge of its interest. We must, however, now wait for further particulars until we find them in the proceedings of the Royal Society.

Professor Eggleston spoke briefly and emphatically of the importance of this discovery.

Professor Joy said—The regular subject for our discussion this evening is pisiculture, a study of comparatively recent date. It was in 1763 that a German named Jacobi first published in the *Magazine of Hanover* a paper on the subject. It did not, however, attract much attention, and his discovery appears to have been lost and practically forgotten. In 1840, or thereabout, a fisherman of the department of the Vosges, named Reme, entirely illiterate, discovered by his own observation, the art of artificially propagating fish. In 1843 the administration of that department took the matter up, and in its official journal, published in 1844, a report on the subject. It was not until 1848 that the French Institute took up the subject. In 1855 he had purchased at the French Exposition a guide to fish culture. Little progress had been made in the art hither o, so that in the year almost elapsed we are barely on its threshold. He asked Mr. Gilmore to state his experience on the subject.

Mr. Gilmore said that, interested as we all are in the study of natural history, it did not seem to him that sufficient attention has been paid to the fish. His observation had shown him that fish were most intelligent. When in Japan, he had seen in the fish pond of one of the American Vice-Consuls, fish that knew the Consul, and would approach him, while timorous of every one else. He knew this to be characteristic of tame carp he had seen in various parts of Europe. It struck him that the tunny—a fish well known in the Mediterranean for several thousand years—knew America before the *genus homo* did, at least before Europeans. It was well known that the tunny in the autumn season rushed up the Mediterranean in hordes like buffaloes to the Black Sea, whence after spawning they returned, and in the month of March were seen pouring through the straits of Gibraltar westward. They then disappeared, and it was stated by some—even by naturalists of position—that they remained inanimate at the bottom of the sea. Some time ago when coming across the Atlantic he was walking one night on deck with the captain of the steamer, who had called his attention to the fact that at certain seasons he met large shoals of tunny crossing the Atlantic. It did not surprise them, therefore, to find that in the month of September large numbers of tunny are found in the neighborhood of the Gulf of St. Lawrence and the coast of Labrador. Recurring to the subject of artificial fish propagation, he stated that it was known to the Chinese twelve hundred years ago, who made use of their large inland rivers to support their teeming population. About fifty years ago it was introduced into England. He thought that it made greater progress in America than in had in England. He had heard there of the exertions of Mr. Seth Greene of this country. Mr. Frank Buckland, formerly an officer of the army, and now her Majesty's Commissioner of Fisheries, had paid much attention to the subject. Mr. Gilmore then proceeded to describe the artificial culture of salmon and trout. It was well known that the salmon was migratory. The season of its migration varied according to the temperature of the water. They ascended the rivers early if the water was cold, and not until December if it were warm as in the South of England. They ascend the river with but one object, which is to deposit their ova. After overcoming all difficulties intervening, they ascend as near as possible to the head water of the rivers. The female then forms a deep furrow in the sand and deposits her ova. While doing this she guards them against all the other denizens of the waters. When she has accomplished her task, the male fish comes and deposits the milt which impregnates the eggs. Both then cover up the eggs with sand. Those anxious to propagate the fish artificially throw a net over the female when she comes to deposit the egg, and by bending her back slightly over a pannikin, the eggs are expressed. There are generally 1,000 eggs to every pound a salmon weighs. Suppose then in the case of a twenty-pound salmon but half the eggs are matured, what an immense amount of fish is produced by one salmon! After the ova are expressed the milt are obtained in the same manner from the male fish, by dropping it into the pannikin the ova are impregnated. They are then placed in boxes built with steps, which, however, are hollow and partially filled with