to blame for such misprints, for the American editor was doubtless responsible for the correction of the proof sheets.—Nature.

THE AQUARIUM AT THE PARIS EXPOSITION.*

THANKS to two artists of great merit, Albert and Henri Guillaume, ably seconded, in the technical work, by M. Boucheron, the old and sympathetic director of the permanent exposition of the Jardin d'Acclimatation; by M. Colhs, sub-director, and the entire personnel of that institution, who were placed under the orders of these gentlemen, Paris finally possesses a model aquarium worthy of the name, and one whose success, instantaneous from its opening, increases day by day. It is the delight of strangers, here from all parts of the world, to see the marvels of the Exposition, which is, in fact, the greatest and most beautiful manifestation of artistic and industrial genius yet produced by the civilized world.

To M. Henri Guillaume belongs the honor of having overcome the innumerable difficulties arising in the course of the construction of the aquarium, built, as it is, below the level of the Seine, and hence necessitating entirely novel processes of decoration. By the ingenious use of glass, and wonderful skill in the disposition of light, the impression of vast size and great distances given to the visitor is almost overpowering—really marvelous.

Before touching a hand to their gigantic undertaking, the Messieurs Guillaume constructed a rough model, embodying their general ideas, which, on exhibition, at once captured the full board of administrators of the Exposition, and received the felicitations of the Municipal Council, who at once and on the spot accepted the proposition of the Brothers Guillaume, which was to the effect that they should have the sole right to exploit the aquarium to the public for nine years, the Exposition year not counted in.

Justly proud of their success, and with the sympathetic encouragement which they received from all parts of the world, the brothers at once took possession of the terrain that had been allotted to them, on the Quai de la Conférance, and established their workshops. From the very first, the work was hindered by difficulties arising from the proximity of the river, but with a wonderful fertility of resource, every difficulty was met and overcome. They surrounded the spot on which their structure was to be reared, on all sides and below, with a wall and floor of béton (artificial stone made of hydraulic cement, etc.), which effectually shut out the water.

Another immense job was cutting away the wall of the quay, which, at that point, is 3½ meters (about 11 feet 8 inches) thick and 9 meters (30 feet) deep, in order to clear the way for the entrance to the aquarium. The steel work to receive the great slabs of glass was another source of great trouble and anxiety, as will easily be understood when we state that the pressure from this source amounted to about 7,500 pounds to the square meter. These "slabs" or plates were manufactured at St. Gobian, and were 2 by 3·5 meters (80 by 140 inches) in size, the average thickness being 33 millimeters (1⅓ inch). They weigh from 500 to 700 pounds each.

The design of the builders of the aquarium was to produce on the visitors the illusion that they were walking on the bottom of the sea. They did not content themselves with showing them through plates of glass the marine fauna and flora—the monsters of the deep, great and small—disporting themselves amid marine vegetation; but with consummate art, by mirrors, the management of light, etc., they gave to the surroundings an appearance of immensity most absolutely deceptive. One requires but little imagination to convince himself that the avenues actually stretch before and around him for miles and miles; that this coral cave is as great as the grotto of Antiparos, or that yonder mass of basalt springing from the sea is another Giant's Causeway. Look whither he will, the visitor seems to be isolated in immensity.

The frames supporting the huge plates of glass are of steel, but to avoid oxidation, the metal has been given a coating of minium, on which is another of a cement devised especially for the purpose. The fitting of these plates so as to insure absolute tightness of joint, over so great a surface, was another source of anxiety, and was worked out by slow experiment. For some reason, neither india-rubber nor caoutchouc could be used, and recourse was finally had to a mass formed of pine rosin, red lead, and mineral wax (ceresin).

The sea water for the tanks is taken from the open ocean at some distance from the land, in order to avoid the possibility of contamination, and a line of tank steamers, belonging to the great English firm of Burnett & Sons, are employed in constantly renewing it. The amount used daily is 350 cubic meters (over 900,000 gallons), and the greatest care is exercised to keep the liquid up to the normal standard of mid-ocean. Its density is taken at stated intervals, as is also the content in oxygen, etc., any departure from the mean being at once corrected; if the specific gravity gets too high, filtered spring water, and if too low, sea salt, is added.

The water is kept in constant motion, the circulation being maintained by a natural flow from one tank to another, a portion finally escaping from the lowest or last tank. The escape water can be purified by washing with compressed air, and is returned to the tanks again.

Entrance to the aquarium is gained through two great doors, which open on a vestibule which recalls the grottoes of the coast of Brittany. To this vestibule, full of elegant boutiques or shops, where almost everything conceivable that is connected with marine life, at least, is sold, the public has free access. Here the visitor may buy books bound in nacre, ornaments of mother-of-pearl, fish scales, coral, etc., too numerous to mention. Here, too, embowered with gorgeous marine vegetation, with seaferns, corals, etc., is that great and well-known piece of statuary, the chef d'ouvre of Gauquie, the Triumph of Amphitrite.

A vaulted passage, straight and somber in aspect, built of rocks and corals, conducts one to the aquarium, where all the known and procurable fauna and flora of old ocean are "on exhibit."

The object that first catches the eye of the visitor is a shipwrecked vessel, the hull traversing one of the largest tanks, and seeming, by the deceptive arrangement already spoken of, to lose itself in the perspective. To add to the illusion of looking into the depths of the ocean, the floor is transparent, and beneath it electric projectors throw vari-colored lights through the tanks, disclosing the algæ, the fish, mollusks, crabs, lobsters, etc.

There are nine tanks in all. In the first is a reconstruction of the famous sunken temples of Puzzoli, submerged in the Bay of Naples, and discovered in 1750. In this tank is a great display of Pleuronectides or flat fish (soles, limandes, turbots, flounders, etc.), whose dark color and flat shape are an admirable natural protection against their enemies. By lying close to the bottom and keeping still, they escape any but the sharpest vision. In this tank, also, are the sea urchins, echini, etc.

In the second and third tanks (the tanks are separated by a very small space, and this is concealed by the arrangement of sea-weeds and marine vegetation generally), we are shown a sunken vessel, reposing on the bottom of the sea. It is the remains of the "Graf von Bismarck," of Bremen, which was sunk in the harbor of Cherbourg, and there found and bought by the concessionaires of the aquarium and resurrected for this purpose.

In this, which is the largest of the basins, are found the sea tenches, the rays, the torpedo fish, the various varieties of sharks, the Thallassites, Cheloneæ, turtles, gobies, crabs, sea spiders, etc. Here, too, are Schandriæ and plungers, and one may watch them, with their lanterns, circling around the rocks and marine debris.

The fourth tank contains crustaceans and various varieties of sea-anemones, whose rainbow hues transform the tank into a parterre of brilliant flowers. Here, too, we see night-shining pelagiæ, the shizostomes, and sea spiders, while on the borders, lobsters, crabs, etc., are engaged in epic combat.

The fifth tank, in which are large and beautiful stalactites, and the bottom of which is garnished with massive blocks of ice, contains the codfish, sturgeons, and other fish of Arctic seas, among them the redoubtable sea scorpion.

The sixth is adorned with basaltic rocks, black and gray, originating from discharges of lava from submarine volcanoes. Here are turbots, sea-spiders, hermit crabs, those queer crustaceans which have naturally a shell over the head and chest only, but are bare elsewhere, and which take possession of the empty shell of any other creature they may find—and an infinite list of others.

Polyps, zoophytes, madrepores, occupy the seventh tank, but the especial guests here are the corals, which are in great number and variety. Here are trees, alive and growing, belonging, not to the vegetable, but to the animal kingdom, and owing their growth to the slow but constant increment from the calcareous secretion of a polyp of the genus Alcyon. Here, too, we see the sea-dogs amid arches, volutes, curves, whorls, casks, ladders and the myriad other forms of coral architecture.

The charms of this tank and the never-ceasing source of wonder are beautiful sirens that glide around amid the waves, yet have no real existence; they are forms projected into the water by electrical appliances concealed from the observer, but they appear to be actually there, and to be made of solid flesh.

In the eighth tank are also polyps, principally sponges—strange creatures whose life-history is not yet fully known, but which are composed of almost innumerable species. Here, too, are mullets, crabs, and a great variety of marine life, including that queer gasteropod mollusk commonly known as the sea hare (why, the Lord only knows, since there is absolutely nothing about it to remind one of a hare).

The bottom of the ninth and last tank is covered with pebbles and rocks of various sizes, and in this there is an innumerable host of little fish, such as the hippocampus, sea-horses, and all sorts of queer crawling and swimming things. The rocks of the bottom are covered with turtles, crabs, etc. Here a perpetual battle royal wages between the various denizens, to the great entertainment of visitors, and especially of the small boy.

* Adapted from the Journal d'Hygiene for the National Druggist.

PROF. SPRING'S EXPERIMENTS ON PLASTICITY.

IN an article contributed to the Revue Générale des Sciences, Prof. Spring, of Liège, has summarized a number of his experiments on the agglomeration of materials under heat and pressure, says The American Architect. With all plastic bodies he finds that pressure alone is needed for the welding together of discrete particles, and if the particles under pressure consist of different metals capable of forming alloys, these alloys may be produced by the application of pressure only. Thus, copper and tin filings mixed together and compressed produce bronze, while copper and zinc filings form brass under the same conditions. On the other hand, a mixture of zinc and lead filings will not alloy any better under pressure than the two metals do when melted together. This welding together of the particles of a metal under pressure, and the production of alloys by mere compression, is attributed to the formation of a solid solution at the interfaces under pressure. Molecules of one fragment of iron will thus penetrate into the next, and, similarly, molecules of a fragment of zinc will pass into the body of an adjoining fragment of copper. This molecular mobility, however, differs from ordinary evaporation in that, for its exhibition, the presence of a mass into which the molecules can diffuse is needed. A molecule only passes from one fragment to another provided that it is replaced by a second molecule from the second fragment. To further investigate the matter, cylinders of different metals, having ends as flat as it was possible to make them, were prepared, and pairs consisting of one cylinder piled on another were placed in a stove and kept there for from three to twelve hours, at a temperature at least 360° Fah. below the melting point of the most fusible of the metals; and in the case of platinum, the stove temperature was 2,880° Fah. below the fusing-point of the metal. Nevertheless, a couple of superimposed platinum cylinders subjected to a pressure merely due to the weight of the topmost welded together in this stove, and the same was the case with all the couples in which the two constituents were one and the same metal. In fact, on turning up the cylinders afterward in the lathe, the joint could not be detected. When the pair consisted of metals capable of alloying with each other, union again took place; and in the case of the zinc-copper couple, a layer of brass $\frac{1}{1000}$ inch thick was plainly visible at the joint. On the other hand, metals incapable of dissolving each other such as zinc and lead, and zinc and bismuth, showed no signs of union when treated in the manner described. Prof. Spring has also extended his experiments to sand and grains of limestone and similar constituents of the earth's crust, in order to ascertain if the agglomeration of these materials into rock could be brought about by pressure alone. This was found to be impossible even when the pressure used was equivalent to that of a layer of rock 30 miles thick. Prof. Spring finds, however, that under high pressure water is capable of dissolving a fair amount of silica, which is deposited when the pressure is removed, and suggests that the cementing together of the grains of sand and carbonate of lime forming the bulk of our sedimentary rocks may have been effected in this manner. A solution of silica traversing a layer of sand, without the application of great pressure, will also deposit a cementing layer of silica; but to obtain success a slight pressure is necessary in order to keep the grains in contact during the contraction of volume accompanying the splitting up of the silicic acid, just as in gluing together two pieces of wood pressure is necessary until the joint has set.

THE EXPLOSION OF POTASSIUM CHLORATE.

POTASSIUM chlorate is an endothermic compound. The transformation $ClO^3K = KCl + O^3$ disengages + 11·9 cal., developing 35·5 liters of oxygen, or for one gramme, 97 cal. and 273 c.c.

However, potassium chlorate is not classed ordinarily with explosive bodies. It does not detonate under the influence of progressive heating, though it is decomposed with rapidity and an elevation of temperature, which may rise even to incandescence, when a small retort, containing a hundred grammes, is heated with naked fire.

I have caused it to detonate under ordinary pressure, in an open vessel and in an inert gas, by operating according to a method, or rather a principle, which I enunciated some time since as applicable in general to the reactions of endothermic systems. I refer to the reactions which preserve their indications and approximate value when the temperature is raised. It is sufficient to place it quickly in an inclosure, raised previously and kept at a temperature sensibly higher than that of the commencing decomposition. It is also necessary that the mass of matter composing the inclosure shall be so large that the introduction of the quantity of decomposable matter at the ordinary temperature may not be such as to lower materially the general temperature within.

I have shown how picric acid can be made to detonate, a compound which burns tranquilly when it is fused in a capsule heated over a gas jet, and is ignited in contact with the air.

The same phenomenon, that is, the explosion, will occur with potassium chlorate. For the purpose a glass tube is used, of a diameter of 25 or 30 mm., closed at one end, suitably supported, and heated almost vertically, keeping it enveloped by the flame of a large gas burner for a length of 50 to 60 mm. until the bottom of the tube and this length of tube shall have been carried to the temperature of the red without, however, melting the tube.

Meanwhile, a glass rod, one of whose extremities has been drawn out to a thread, is dipped several times in a mass of pure potassium chlorate, which has been fused in a porcelain capsule and allowed to cool until it commences to solidify. Some decigrammes of the solidified salt are collected on the end of the glass thread in an ovoid form.

When the tube is quite red, the rod is introduced, bringing the potassium chlorate within about 10 mm. of the bottom of the tube, taking care that it does not touch the tube at any point. In a few minutes, the potassium chlorate is liquefied under the influence of the radiation from the sides of the tube and the enveloping flame, and it flows slowly, drop by drop, on to the bottom of the tube, still kept at the red. Each drop explodes the instant it comes in contact with the glass, with a distinct sound, and a white smoke proceeding from the vapor of the chlorate. But the explosion is not propagated to the portion of the liquid salt remaining on the thread of the glass rod. The sound of the explosion is clear, though a little prolonged, like that of a slow powder.

The experiment is not difficult. It is the same as with the detonation of picric acid. Both take place within an inert gas. I have made it in nitrogen with picric acid.

Picric acid detonates still more readily if the operation is in the atmosphere or in oxygen, as might be expected, because the heat of the total combustion is added to that of the pyrogenous decomposition.

Potassium chlorate also detonates more readily if heated in a hydrocarbonated flame, its oxygen combining in part with the carbon and the hydrogen, causing a new disengagement of heat. This observation occurs in a recent and very interesting report of Col. Ford, Chief Inspector of Explosives in England, relative to an explosion that occurred in 1899 in a manufactory of potassium chlorate. But it is not sufficient to prove that pure potassium chlorate would be explosive by itself, without the intervention of any combustible body. The presence of the latter concurs in determining, in a manner more prompt and more easy, the explosion of the chlorate.

This is a suitable place to remark that the precise conditions I have described for the experiments with potassium chlorate and with picric acid may be realized in a great fire, affecting the roof or the walls of a storehouse containing a considerable quantity of either of these substances. The case referred to above is in point. It was the explosion of 156 tons of potassium chlorate in the factory of the Kurtz Chemical Works of the United Chemical Company, Limited, in the Borough of Saint Helena, London. Five men were killed, forty or fifty wounded, and buildings of considerable size destroyed. The conditions I have described were realized on a large scale. The chlorate