A MARINE AQUARIUM.

An aquarium, says Mr. R. M. Shurtleff in *Forest and Stream*, from the pages of which we select the engraving, though a very simple matter, was never understood till recently. Persons who keep gold fish in globes find it necessary to change the water frequently, and even then the fish do not remain in a healthy condition. If the tank be properly arranged, the water need never be changed at all. All animals breathe oxygen, and throw off carbon, while plants breathe carbon, and throw of oxygen. If we establish in our aquarium a proper balance of animal and plant life, both will thrive as in their natural homes.

Supposing that our tank has been selected, we should first place in it enough clean pebbles to cover the bottom to a depth of two inches. Above these we may arrange larger rock forms, and if done with taste and judgment it will add much to the beauty of our aquarium, and also furnish hiding places for the fish.

One of the best plants for the salt water aquarium is *ulva litissima*, which may be found in large fronds cast upon the beach after a strong wind has been blowing from the sea. Its color is rich dark green, and when in a healthy condition it is firm and crisp to the touch. Another very handsome plant that thrives well in the aquarium is *eatromorpha*. It is found in deep water, and can only be got by dredging. It resembles a mass of fine green threads, which, when untangled, are sometimes found to be thirty feet in length. *Entromorpha compressa* is a beautiful green plant found on nearly every shore at low tide. It grows in long grass-like leaves, that move in most graceful lines with every motion of the water. We have never found it very hardy in the tank. The plants of a brown color, though very beautiful for a time, will soon decay in the aquarium. Some of the red algæ do very well and are a great addition. The *Grinnella Americana* is one of the best. *Chondrus crispus* (Irish moss) will sometimes do well; and *solaria*, if found growing to a bit of stone, will live in confinement, but should not be exposed in much light. There are innumerable beautiful plants to be found at low water mark, that will always tempt us to try, and, if watched closely and removed if found decaying, will do no harm.

Our illustration shows many of the most interesting animals that are adapted to the marine aquarium. In the central part of the picture is a fully expanded sea anemone. Seen in this condition one can readily see why it has received the name of that beautiful flower. At times it appears a mere mass of jelly, and the fishermen along the coast have called it halibut slime, supposing it merely a mass of slime from that fish. The body of the anemone may be described as a double gelatinous sac; the inner sac is the stomach, the space between it and the outer membrane is divided by vertical partitions, each compartment being connected at the upper part with a hollow tentacle. The tentacles serve to catch, and convey to its mouth, such animals as happen within its reach. The anemone is reproduced by eggs that are thrown out in different degrees of development, sometimes as perfectly formed anemones. They also multiply by self-division: a portion of the animal, usually near the base, gradually separates from the main body. If closely observed for a few days a single row of tentacles will make their appearance, and increase in number with the growth. Though a low form of life, the anemones are among the most beautiful and interesting objects in Nature. In color, they vary from a light brown to a deep chocolate. They are found on the coast north of New York, very abundantly in the vicinity of Newport. To the left of them are three of a bright red color that were brought from Bermuda. They differ from the others in having less power of expansion to the body, and have fewer tentacles, but make up for the lack of grace in form by their gorgeous color. The general scientific name for them is *actinia*. Just above is shown a bunch of *serpula contortuplicata*. They belong to the *annelida* or worms proper. They breathe through the skin by sacs or gills. In the present genus the respiration is by gills which are elegant in form and brilliant in color, The body of the serpula is short, the hard tube in which it lives in the sand being many times the length of the animal. Projecting from the tube may be seen a fan-like appendage most beautifully tinted with bands of red and white. This fan is the serpula's gills, and aid it in procuring its food. If viewed with a magnifying glass, it will be seen that the exterior of the gill tufts is covered with wonderfully delicate filaments or cilia which are constantly waving in regular ripples; by this movement a current is produced

A MARINE AQUARIUM.

that brings in a multitude of minute animals upon which the worm feeds. The serpula is furnished with an arrangement for stopping its tube when it wishes to retire; this is a conical appendage developed from one of the little antennæ, which hangs from the tube and is called the operculum. One specimen in a tank has two kinds of plants growing from its operculum. When first placed in the tank the serpulæ are very sensitive, and pop into their tubes at the least jar. Near the serpula is shown the common shrimp, which is regarded as an excellent scavenger of the tank. The shrimps are so transparent that the food can be seen in the stomach, and we can almost trace the process of digestion.

Attached to the lower part of the rock work are more of the brown, and some of the beautiful little white, anemones. It is almost impossible to describe their form, as they are so changeable. At times hanging from the rock to which they are attached, the tentacles drooping like the petals of a withered flower, again the body stands erect, the tentacles extended to their utmost limit, and in constant motion. Suddenly a part of the body will be contracted as if a string had been drawn tightly around it, and sometimes there will be two or three of these constrictions at the same time. Again, they will assume the form of a rose, and one never tires of watching them. Some days they appear of an opaque white or cream color; an hour later we find them so nearly transparent that the interior divisions of the body can be clearly seen.

At the lower left hand corner is shown a mussel (*modiola plicatula*), and above it the soft clam (*mya arenaria*). The black mussel (*mytilus edulis*) is not shown in the drawing, but is a useful member of the aquarium family, as it lives upon the little animalculæ that sometimes become so plentiful in the tank as to obstruct the view. The star fishes are curious and interesting, but are hardly safe for the aquarium, as they are ravenous eaters, and will probably destroy the shell fish we most wish to preserve. They have a singular way of feeding. Placing themselves upon the animal they wish to devour, the digestive sac is turned inside out so as to enclose their prey, and the animal is sucked from its shell.

The hermit crab (*pagurus longicarpus*) is shown inhabiting the shell of a *tritia trivitata*. These curious little crabs have no armor of their own, and so take possession of any mollusk's shell that happens to fit them—usually one of the *buccinum* family. The rock crab should not be introduced, unless it is a very small specimen, as they over turn the rock work, and are blessed with an appetite that is never satisfied. The spider crab (*labinica canaliculata*) is interesting and less destructive. It loves to dress itself with bits of plant, or anything that comes handy, and then parades with as much evident satisfaction as any dandy.

At the extreme right of the picture is shown a bunch of *tubularia*. This plant-like object is formed of a number of tubes branching in all directions; the end of the tube appears a flower, its petals opening and closing constantly. These heads live a few days, then drop from the stem to be replaced by a new head that may be seen slowly traveling up the tube. The sea horse (*hippocampus Hudsonius*) is another strange little animal that we should possess if possible. Its natural food is the *serpulæ* which it sucks from the tubes, but it will feed upon the soft part of a shrimp or clam. At the top of the illustration is shown a branch *sertularia*. In a picture of this kind only a faint idea can be given, as the beautiful little animals that have formed it are scarcely discernible with the naked eye.

Nearly all the animals we have named can be found on our own coast. Those who prefer to do so can purchase them of dealers. In conclusion we would say that the care of a marine aquarium can be only a source of pleasure to any one who loves Nature. These animals have been drawn from a glass jar holding about twelve quarts of water. For many months it has supported twenty or thirty anemones, besides many other animals, and has always been in a perfectly healthy condition. The only care required was now and then the addition of a little fresh water to replace that evaporated.

A Purple Cyanide as a Dyestuff or Pigment.

When cyanide of potassium is added to an acid solution of a copper salt, a red color is produced which has already been mentioned by different observers. The substance formed is very changeable, at least in the liquid where it is formed. It is decomposed by acids, alkalies, cyanide of potassium, and even decomposed spontaneously, the color changing to yellow. It is precipitated by insoluble cyanides; hence when a dilute acid is added to the red solution, the dye is at once thrown down along with the cyanide of copper. If the precipitate thus obtained is treated with sulphuretted hydrogen, it is decomposed and the substance set free. This substance can combine with iron, like cyanogen, so as to conceal the properties of the iron. This compound is very permanent, and has lately been studied by G. Bong, who gives the following directions for its preparation:

Cyanide of potassium is added in excess to an acid solution of a copper salt until the red color at first formed has disappeared, when a ferric salt is at once added. On the addition of the iron salt, of course, a copious precipitation of Prussian blue takes place, and the liquid again turns to a dark purple-red. To separate the coloring substance from the alkaline salts in the liquid, a dilute acid is added which precipitates it and the cyanide of copper. This precipitate is combined with the Prussian blue, which also contains a considerable quantity of the coloring substance, and then treated with a boiling solution of carbonate of ammonia, in which it dissolves. As the cyanide of copper also goes into solution, it is separated by again precipitating it with an acid and treating the precipitate with sulphuretted hydrogen. The coloring substance thus liberated now contains a certain amount of hydroferrocyanic acid, which is removed after neutralization by acetate of lead. It is now filtered, and the purification completed by precipitating with a silver salt and treating the precipitate with sulphuretted hydrogen.

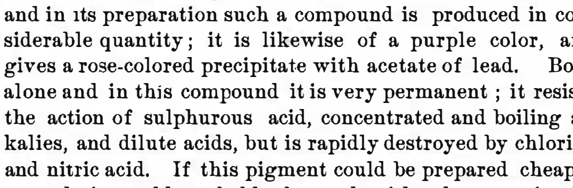
This purple-colored compound crystallizes very indistinctly. To determine its composition Bong precipitated it with acetate of copper. When dried at 212° Fah., the rose-colored precipitate had the following composition: Carbon 24·31, nitrogen 28·04, hydrogen 1·88, iron 13·66, copper 17·67, oxygen 14·44. Total, 100·00. These numbers correspond to the formula $Cu, Fe Cy_4 (HO)_4$.

This substance is likewise precipitated by salts of zinc, mercury, and silver. All these precipitates are pink or purple, very beautiful, and of remarkable brilliancy. They are soluble in alkalies. Iron salts yield no precipitate, nor do lead salts except in the presence of ammonia, when a blue-violet precipitate is formed. When treated with sulphuretted hydrogen, these precipitates yield purple-red and acid liquids, which undergo change in the air, especially if warm, forming Prussian blue. When these liquids are neutralized with alkali, purple compounds are formed, which are permanent in the air, soluble in water, slightly so in alcohol, and insoluble in ether. Their coloring is exceptionally great. These pigments will unite with ferrocyanides, and in its preparation such a compound is produced in considerable quantity; it is likewise of a purple color, and gives a rose-colored precipitate with acetate of lead. Both alone and in this compound it is very permanent; it resists the action of sulphurous acid, concentrated and boiling alkalies, and dilute acids, but is rapidly destroyed by chlorine and nitric acid. If this pigment could be prepared cheaply enough, it would probably be used with advantage in the arts, on account of its resistance to chemical re-agents and light, the variety of its shades, and its brilliancy. It does not color fibers directly, but can readily be fixed on them from slightly acid solutions, if they are previously mordanted with metallic oxides.

MUSICAL TELEGRAPHY IN PARIS.

It is now proposed to utilize the La Cour system of musical telegraphy in Paris, in connection with the project of M. Bourbouze of sending telegraphic messages without wires. M. Bourbouze conceived the idea, during the siege of Paris in 1870, that the river Seine might be used as a conductor, so that the beleagured city could hold communication with the provinces without the enemy suspecting the fact. Tests actually proved that the plan was feasible, but before it could be carried into practical effect, the armistice was declared, and so the device became unnecessary. M. Bourbouze has recently again brought forward his idea, and proposes to use the water in the mains and pipes of the city as a conductor. Every one having the necessary simple apparatus could

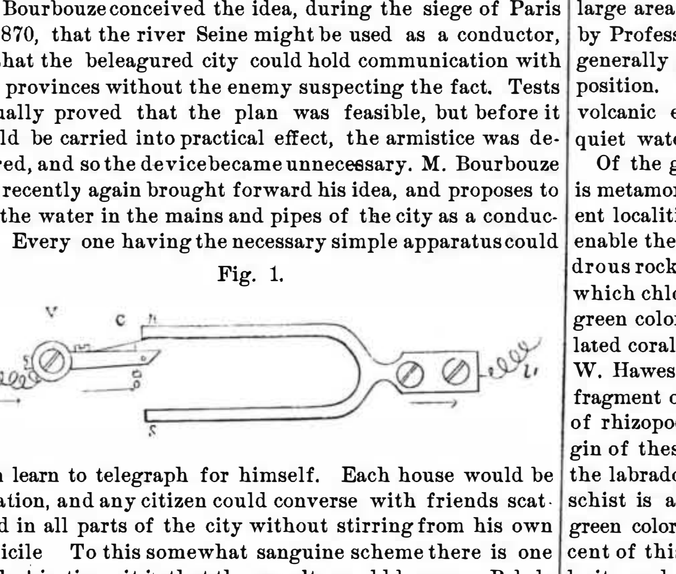
Fig. 1.



then learn to telegraph for himself. Each house would be a station, and any citizen could converse with friends scattered in all parts of the city without stirring from his own domicile To this somewhat sanguine scheme there is one fatal objection; it is that the result would be a new Babel; for hundreds would telegraph simultaneously, and unless each despatch had some easily distinguishable characteristic, inextricable confusion would follow.

As stated in the beginning, it is suggested that M. La Cour's musical telegraph may furnish a means of transmitting distinguishable despatches. The invention was described recently in the SCIENTIFIC AMERICAN SUPPLEMENT, but the annexed engravings, which we take from *La Nature*, will serve to render its mode of operation more clearly comprehensible.

Fig. 2.



When the most common phenomena of acoustics are recalled, for example, the transmission of a melody played by an orchestra which is perceived by an entire audience at long distances from the players, it is not easy to analyze the effect. Physics tell us that the sounds produced by each instrument have their own tonality and their distinct measure; in other words, the notes from a violin, a flute, or a trombone correspond to different vibrations, transmitted through the atmosphere and characteristic for each note. Besides, the rhythm in the succession of notes, which makes the measure in music, produces the cadence, constituting, with the tonality and the timbre of the instruments, the *ensemble* of the air which affects us. The transmission is so precise that the ear, from the medley of sounds, instantly distinguishes a discordant or untimely note.

Suppose now a series of three tuning forks vibrating continuously and producing, respectively, 100, 300, and 500 vibrations per second. It is easy to perceive that each fork may interrupt and establish an electric current with intermissions regulated by the number of its vibrations. If, then, there be three other forks identical with the first, each set being located at an extremity of the conductor between them, the trio at one end will affect those at the other; and further, if one fork be impressed with a cadence which does not coincide with its regular vibrations, then its corresponding fork will likewise emit the same discordant sounds.

The above very briefly states the principle of the invention, but it is sufficient to show that the indefinite multiplication of despatches over the same conductor is feasible, each current, moreover, being distinctly individualized.

Fig. 1 represents the device for transmitting the vibrations of the fork to the conductor. The arm, *n*, of the fork vibrates in contact with the platinum tongue, *c*, the position of which is regulated by the screw, *v*. A current entering at l^2 is closed, when the extremity, *n*, touches the plate, *c*, and is open when contact is broken. Nothing further is needed than the opposite wire, *l*, connected with the fork as shown.

Fig. 2 shows how the character of an intermittent current is recognized. L L is the main line traversing the station. A B C are three forks similar to those at the point of transmission. The fork, B, for example, which is in unison with the current, will be thrown into vibration while the rest will remain silent. This fork, B, will then touch the platinum plate, *c*, Fig. 1, and will establish in the circuit, $b\ b^1$, a local current of the battery, U, the poles of which are respectively applied at *a b c* and $a^1\ b^1\ c^1$. The local current will likewise be intermittent, according to the measure of the fork, but by reason of the velocity of the pulsations it will manifest itself in many cases as a constant current, either by operating a chemical decomposition, or by deviating a magnetized needle, or by exciting an electro-magnet.

The New Hampshire Greenstones.

The greenstone formation of New Hampshire covers a large area in the northern part of the State, and is referred by Professer Hitchcock to the Huronian age; the rocks are generally green, with remarkable uniformity in their composition. Yet they are inter-stratified, apparently not by volcanic eruption, as they appear to have accumulated in quiet waters.

Of the group of greenstones, the most prominent member is metamorphic dioryte, which varies in its texture in different localities, some of the specimens being so coarse as to enable the crystals to be mechanically separated. A hydrous rock, metamorphic diabase, is also very common, in which chlorite is a prominent ingredient, imparting a light green color. In this rock, organic remains, such as a tabulated coral resembling a *chætetes*, are found, and Mr. George W. Hawes states that there is little doubt but that it is a fragment of a rhizopod mass or foraminifer. The presence of rhizopods is additional evidence of the sedimentary origin of these rocks, and it suggests a source for the lime of the labradorite and other mineral constituents. Chlorite schist is also found in these greenstones; it is of a light green color, and gives off water when heated. Twelve per cent of this mineral consists of various oxides of iron. Dolerite and argyllite are also found in the formation, the former containing: Silica 40·25, iron oxides 15·82, lime 10·31, titanic acid 6·53. In the latter, silica 60·49, alumina 19·35, iron oxides 6·46, and magnesia 2·89 were found.

Bat Guano.

That a little creature, not very common in the North, could congregate, in sufficient numbers to make extensive deposits of excrement which have a commercial value, seems almost incredible; but in numerous caves, from Virginia to Texas, are found deposits of this material sometimes reaching 20,000 tuns in extent, and yearly increasing. During the war it was thought to extract niter from it for powder making; but though the manufacture was somewhat successful, the nitric acid was present in such small quantities as to render it so expensive as to be abandoned at the close of the war. The material has been used as a fertilizer to a slight extent, and is found to exert considerable influence on the crops treated. The attention of Mr. McMurtrie, chemist to the Department of Agriculture, having been called to the matter, analyses have been made of samples collected. These are all of a similar light to dark brown color, according to the moisture, except those containing much insoluble matters, which resemble soil, of which they probably largely consist. The physical condition when air-dried is excellent, both for handling and application, being finely pulverulent. The analyses fairly represent the average composition, which, according to the valuations of Professor Goessmann, the Massachusetts State Inspector of Fertilizers, adopted by the department, show them to possess a value of from $15 to $55 per tun for use as fertilizers. The values compare favorably with those of fish fertilizers, and even of Peruvian guano. Microscopical examination shows the material to consist largely of the hard parts of insects upon which the bats feed. Mr.