Correspondence.

Remarkable Change in Holly Wood.

To the Editor of the Scientific American:

Recently I discarded a few scraps of one-quarter-inch thick holly wood, throwing them on the ground floor of a shed. A few weeks later these pieces again came under my notice. I found them colored a beautiful light greenish blue, through and through, and emitting a damp stable-like odor. A few weeks' exposure to sun and rain apparently effected no change in the wood other than removing the odor. Will some of your readers explain this to me through the columns of the Scientific American. C. B. Fowler.

Anacostia, D. C.

Uniformity of Fleet Individuals.

To the Editor of the Scientific American:

Happening to have read a letter from Mr. Lehmann in a recent number of the Scientific American, I would like to offer a few slight improvements, or what I think would be such, upon his suggestions.

First of all, I must say that I have always felt, as he does, that it was ridiculous to place the two "Maines," of 18 knots, in the same squadron as the two "Kentuckys," of only 16½ knots; or the two "Alabamas," of 17 knots, with the "Indiana," of 15½.

It seems to me, however, that Mr. Lehmann, in his proposed rearrangement, has overlooked the following facts: 1. Three of the later "Connecticuts," which he includes in it, will not be commissioned until the beginning of 1908, about. 2. The "Texas" has been put out of commission permanently. 3. According to his proposition seven ships would have to go about 11,000 knots, in addition to voyages already ordered.

Besides these points he advocates four squadrons containing eight, five, four, and six ships, respectively, whereas it is to be preferred that all squadrons should be of the same size; at least, all in the same fleet. Mr. Lehmann, I may add, has slightly underrated the speed of the "Iowa," "Oregon," two "Kentuckys," and one or two of the other ships.

For all these reasons, then, I propose the following arrangement:

North Atlantic Station.

First battleship squadron: Three "Maines," two "Connecticuts." Speed, 18 knots.

Second battleship squadron: Five "Virginias." Speed, 19-19½ knots.

Third battleship squadron: Two "Alabamas," two "Kentuckys," one "Iowa." Speed, 16¾ knots.

First cruiser squadron: Two "Tennessees," one "St. Louis," two "Columbias." Speed, 22-23 knots.

Asiatic Station.

Second cruiser squadron: Four "West Virginias." Speed, 22¼ knots.

Third cruiser squadron: Two "West Virginias," two "St. Louis." Speed, 22¼ knots.

Fourth cruiser squadron: Two "Albanys," two "Raleighs." Speed, 19-20½ knots.

Pacific Coast Station.

Fourth battleship squadron: One "Alabama," three "Oregons." Speed, 15½ knots.

(And perhaps) Fifth cruiser squadron: Four "Chattanoogas." Speed, 16½ knots.

It will be observed that each of the squadrons in the Atlantic would contain five ships, and each of those in the Pacific would contain four ships, in this arrangement; also that it would only be necessary to transfer three large ships from one seaboard to the other, as against seven, according to Mr. Lehmann's proposition.

In conclusion, I thoroughly agree with him that such an arrangement into squadrons homogeneous in speed, would greatly increase the efficiency of our battle fleets.

This was, moreover, proved by the performance of the five "King Edwards," in the recent British maneuvers. Alfred Jaros, Jr.

Watermill, L. I.

A recent dispatch from France announces the death on September 5 of Albert Tissandier. Tissandier, accompanied by his brother Gaston, who was still more widely known as a navigator of the air, gained great fame by making a successful flight from Paris on October 14, 1870, during the siege by the Prussians. The brothers made several unsuccessful attempts to re-enter the beleaguered city by means of a balloon. Albert Tissandier was born at Anglure, Department of the Marne, in 1839, and some twenty-five years later began his active career as an architect. He was later sub-inspector of works of the city of Paris, and was afterward attached to the staff of the Opera. After the Franco-Prussian war the two brothers devoted much time to the study of aerial navigation, and made a number of ascensions, during one of which they ascended to the height of nearly 8,000 yards. Gaston, who was not only widely known as an aeronaut, but as a distinguished chemist and well-known writer on scientific subjects, died September 8, 1899.

Magelssen Synthetic Clay.—The Rediscovery of a Lost Plastic Material and Modeling Method.

Throughout Greece and Italy may be found large collections of terra cotta figures of ancient divinities and mythological heroes, most of which are fashioned with remarkable skill, and many of which reach an artistic perfection that seems well-nigh unattainable by modelers of our own day. Tanagra figurines we call them, for the reason that those first brought to public notice, as well as some of the most beautiful examples since found, came from the cemetery of Tanagra in Bœotia.

How these figurines were made has puzzled every sculptor that has ever examined them. That they were baked during some stage of the process of their making seemed certain. Beyond that nothing was known. Attempts to secure the same effects in modern clay have proven dismal failures. The use of the material was not confined to small figures. Indeed, statues of considerable size were often fashioned in this ancient clay. Thus the colossal group at Monte Cavallo in Rome was probably first modeled in clay, dried, and then copied in bronze or marble.

One characteristic is common to ancient clay or terra cotta statuettes and large works in clay. Without exception they are provided with one or more orifices. In the Tanagra figurines the orifice is usually very large and square and is located in the back. It has commonly been regarded as a means of suspending the model from a hook. The presence of the opening in larger works, hardly intended for exhibition in that fashion, has never been satisfactorily explained. It has been suggested with more reason that the openings were provided for the escape of vapor.

Every modern sculptor and every modern physicist knows the impossibility of securing a satisfactory bond between clay and wood or iron. In drying or baking the object the iron invariably expands, and clay, as its water evaporates, shrinks, with the result that it cracks on its iron support and eventually crumbles away. That some support must have been used in ancient terra-cotta figures of more pretentious dimensions, mechanical considerations would alone presuppose; that they dried or that they were baked without cracking is a startling inconsistency in the light of modern experience.

A Norwegian sculptor, Christen Daa Magelssen, after a study of these ancient masterpieces extending over a period of more than thirty years, a study which has involved countless experiments with various plastic materials, has discovered the secret of the ancient modeler's success. Contrary to current archeological supposition, that success was not due to superior craftsmanship, but to the choice of a material which would lend itself to the utmost freedom of treatment, which gave no unpleasant reflections, due to the presence of unneutralized alumina, and which could be dried or fired without cracking and without dropping from its support. The composition of that material, or at least a material resembling it in its attributes, Mr. Magelssen has discovered.

A long, painstaking study of Greek tanagras convinced Mr. Magelssen that the figures had been built over an inflammable core, and then fired, with the result that the core was burned out, leaving the figure intact. Because such a feat was impossible with modern clay, impossible because the clay would crack on the core, he was convinced that the ancient modelers used a clay differing in physical properties from that with which modern sculptors are familiar.

Broadly stated, Mr. Magelssen has invented a synthetic clay. He crushes to a powder any natural rock, such as granite and gneiss, rich in silicates and alumina, in short, a rock resembling clay in chemical composition as closely as possible, and to this powdered rock he adds sulphuric acid and iron sulphate in quantities varying with the chemical composition of the particular rock employed. No organic matter of any kind is added, wherein this synthetic clay differs most from the clay of nature. Clay is the only substance which when fired is preserved in permanent form. The impurities, such as organic matter, are the cause of the clay's cracking over iron or wood.

Magelssen clay has been examined and approvingly commented upon by the foremast archeologists and sculptors of Europe—among them such noted authorities as Mr. Cecil Smith, of the British Museum; G. Körte, of the Imperial German Archeological Institute of Rome; Vilhelm Bissen, the Danish sculptor; Luigi Guiglielmi, an Italian sculptor who fills a professorial chair at the Accademia di San Lucca; and Mr. Franklin Simmons, a well-known American sculptor residing in Rome.

The chief characteristics of Magelssen clay are its remarkable plasticity and its ability to withstand intense heat without shrinking or cracking. Small heads and figures made from this synthetic clay bear so striking a resemblance to antique Tanagra figurines that Mr. Magelssen's theory of the process which was probably employed by the ancient modeler seems most plausible. The objects are built over a core of wood shavings or the like, which core is burned out. An orifice is naturally provided for the escape of the gas and smoke, in order to avoid distortions which might be produced by the internal pressure of the vapors. This explains the significance of the large opening which is invariably found in Tanagra figurines, and which, as we have stated, was long thought to have served as a means of suspending the object from a nail, despite the circumstance that the opening was sometimes most unhappily located for such a purpose. Iron rods may be used as supports for larger works, and the clay will adhere to them without the slightest danger of destroying the bond between the two diametrically opposed materials during firing and subsequent cooling. Casting in plaster is unnecessary. It is, therefore, possible to model groups of colossal size, to bake them together with the iron skeletons by which they are upheld, and to point them out in marble from the dried clay. Mr. Franklin Simmons gives it as his opinion that Magelssen clay "is beautiful to work in, as the artist is able to finish his work more rapidly than in the common clay; also to see the forms more clearly, thus being surer of what he does." To the same plasticity, and above all, to the felicitous light effects, Mr. Magelssen attributes the wonderful technique of the ancient sculptor. Mr. Magelssen has lectured with success in Rome on his process and hopes shortly to deliver a public address in New York.

Industrially the invention is of vast importance, inasmuch as it is now possible to shape clay into coils, thin bent pipes, and thin and light vessels of any size.

Floating Oysters.

Some time ago an oyster-breeder in Morbihan, named Martine, called the attention of the Académie des Sciences to the appearance of unknown algæ that threatened to ruin the oyster-beds established at the mouth of the river Vannes. These algæ (which the breeders called *ballons*—balloons) assume the form of little brownish-green leather bottles or wine-skins, which stick to the oysters, and which, microscopic at the start, very soon reach the size of a large hen's egg. Formed of a very thin, elastic and rather frail coat, these bottles, usually full of water, fall in upon themselves at the moment of low tide. They become empty then by the rents in their exterior; but, in virtue of their elasticity, they fill up again with air. At the return of the tide, they thus form a float more than sufficient to raise up the oyster that serves them as support. Therefore at each great tide, when the beds are wholly uncovered, the oysters are seen to disappear in the offing upon this automobile alga.

According to M. Bornet, we here have to do with the *Colpomenia sinuosa*, very frequent in all warm seas, abounding notably in the Mediterranean and in the tracts adjacent to the Atlantic. It was pointed out for the first time at Cadiz at the beginning of the last century, and has never been seen farther north. It no doubt came upon the hull of a vessel, and, having found in the gulf of Morbihan a suitable water, it multiplied there. Hitherto no other effective means has been found of combating this alga, than to sweep the beds with prickly fagots. It is to be hoped that a rigorous winter will be sufficient to cause it to disappear.

The Current Supplement.

Dr. Alfred Gradenwitz describes the Boffalora-Ticino power plant in the opening article of the current Supplement, No. 1608. Excellent illustrations accompany his text. The second installment of the digest of regulations and instructions concerning the denaturation of alcohol is published. Mr. Henry Hess writes most instructively on ball and roller bearings. To the naval reader the article on the minor navies of the world will be found of interest. A very good review is presented of the fixation of atmospheric nitrogen as it was discussed at the German Bunsen Society. Those who are under the impression that the present popularity of reinforced concrete is a fad will have that impression removed by the excellent article on the progress and logical design of reinforced concrete. The splendid treatise on mercury vapor apparatus by Percy H. Thomas is concluded. Prof. A. E. Outerbridge presents a very good summary of recent progress in metallurgy. The Parisian Museum of Accident Prevention is described and illustrated. The accidents which are prevented are those caused by factory machinery.

The Frahm apparatus for frequency or speed measurement by means of resonance—either mechanically or electrically set up—with one or more of a series of vibrating tongues of known periodicity has now been in use for over two years, and has proved very satisfactory. Numerous attempts to make it a self-recording instrument have, however, failed, chiefly owing to the friction between the recording pen and the paper. This difficulty, says the Electrical Engineer, has been overcome by making the record photographically.

An Electrical Method of Testing Mineral Waters.

Mineral waters can be tested easily by the new electric method which consists in finding the electrical resistance of the water. D. Negreano, of Paris, shows that this resistance is almost always a physical constant and has a given value for each kind of water, thus showing the difference between it and other mineral waters. This method may prove to be a valuable one in practice. The following are some of the values which he found for some of the leading mineral springs of the Continent, giving the values in ohms per cubic centimeter at 18 deg. C. Caciulata spring, Roumania, 328; Slavic No. 1, 114; No. 3, 48; No. 6, 27.5; Vichy Celestins, France, 140; Vittel, Grand Source, 500; Evian, Cachet, 1,280. Other tests showed that the resistance diminished with the temperature, and provided the interval is not too large, the resistivity R_t at a given temperature, compared with the resistivity R at the standard of 18 deg. C. can be expressed according to the following equation $R_t = R\ [1 - a\ (t-18)]$, in which a is a coefficient of temperature variation which is found for each specimen. Generally a is near 0.02. For the above series of mineral waters, the values of a are as follows: 0.019; 0.24; 0.023; 0.024; 0.023; 0.027; 0.026. The important point about the above researches lies in the fact that the resistivity of natural mineral waters seems to be constant at a given temperature and it is also different from the value of artificial or imitation mineral waters stated to be obtained from the same springs. As an example, Vichy Celestins water showed 140 ohms per cubic centimeter at 18 deg. C., while artificial Vichy water showed 112 ohms. With Evian water the results were 1,280 and 1,120 ohms respectively. These results show that the method can be easily applied in detecting mineral waters and guarding against imitation.

Origin of the Pearl.

The origin of the pearl in the shell of the oyster, or other bivalve or mollusk, has been the object of a considerable amount of investigation and speculation. Among the more recent studies of the subject may be noted those of M. Seurat, recorded in the Comptes Rendus. This naturalist finds that in pearl oysters from the Gambia lagoons, in the South Pacific, the pearls are due to a small worm—a sort of tapeworm. In cysts on the body and mantle of the oyster he has found true pearls surrounding a nucleus which he has shown to be one of these worms. Like other tapeworms, this one, concerned in the production of pearls, requires a second host in which to complete its development. And M. Seurat considers that the ray is the second host in this case, for he has found in the spiral intestine of this fish small tapeworms, which he regards as the adult form of the larval worm of the pearl oyster. The author has named this new species of tapeworm *Tylocephalum margaritiferae.* The view has been held that the pearl is a secretion formed, as it were, in self-defense for the surrounding and isolation of an injurious foreign body.

Suggestions for the Deaf.

In the apartment of Mrs. Anna M. Town, of Utica, N. Y., is an arrangement of electrical lights that is of practical service to those who cannot hear the ringing of the door bell and telephone bell. When the telephone bell rings in the rear of the apartment, a brilliant light flashes up in the front room and remains lighted until turned off.

This light is so arranged that it flashes into the looking-glasses of three rooms. A light can be placed in every room if desired. The electric door bell is arranged in a similar way, the light being of another color. The arrangement has been in use two years, proving satisfactory and inexpensive. Most deaf people can hear over a telephone. By adopting this plan a telephone is quite as useful to a deaf person as to one who can hear. In case of illness, when the ringing of bells is to be avoided, this arrangement seems an admirable one. When the lights are used, the bell is also retained. A movable bulb that can be taken to any part of the house is a great convenience. The door bell in that case is silent.

Marconi Stations in Canada.

The Canadian government is still further extending the organization of the Marconi stations, which they have established for communication with ships, and from point to point along the coast. When two new stations at Father Point and Seven Islands are completed, there will be a continuous Marconi system from Quebec right up to Labrador on the one side, and to Cape Race on the other.

According to the Engineering and Mining Journal manganese bronze has practically driven aluminium bronze out of the market, or to such an extent that the disparity in the quantities used is very great. This condition has taken place not because of the superiority of manganese bronze over aluminium bronze, but because it is cheaper—containing nearly half zinc—and may be more easily cast.

THE BATTLESHIPS "DREADNOUGHT" AND "SOUTH CAROLINA."

Popular interest in naval affairs varies greatly with the events of the hour. Just now it is particularly keen, having been stimulated by the recent and very successful trials of the battleship "Dreadnought"—the first battleship designed and built since the Japanese war to embody the lessons of that famous struggle. Moreover, a few weeks prior to these trials, the contracts were let for the construction of two United States battleships, the "South Carolina" and the "Michigan," which also have been planned to meet the modern conditions of naval warfare as exemplified in the same war. On the following page, these two types are shown in a spirited picture, which affords an excellent opportunity of comparing their likenesses and very marked differences. The "Dreadnought" was completed in September of the present year, and the "South Carolina" and "Michigan" are to be completed in the spring of 1910.

By the courtesy of the Japanese government the British Admiralty was allowed to have a representative on several of the Japanese warships during the whole series of operations. They were present on the battleships that fought on August 10 to repel the great sortie at Port Arthur, and they were also present in the conclusive battle of the Sea of Japan. They brought home with them a large amount of valuable data, which was placed at the disposal of the Chief Naval Constructor, Sir Philip Watts; and it was this information that determined the salient features of the "Dreadnought." The novel characteristics of the ship, then, are based upon the following lessons of the war:

First, the enormous superiority of the 12-inch gun when used at the long ranges at which future battles are likely to be fought.

Second, the advisability of mounting the battery so as to obtain a maximum concentration of fire in every direction.

Third, the guns must be so positioned with regard to each other that the blast of one gun shall never inconvenience the crew of any other gun.

Fourth, the advantage of mounting all guns behind heavy armor, and, if possible, within turrets.

Fifth, the advisability of as wide a separation as possible of the gun positions, so as to limit the destructive effects of a well-placed shell.

Sixth, the necessity of reducing to a minimum all top hamper, such as masts, boat cranes, stays and shrouds, and superstructures built of light shell plating, which serve merely to intercept and burst high-explosive shells.

Seventh, the marked advantage of large displacement in affording lofty gun platforms and superior stability in a seaway.

Eighth, the undisputed advantages, both strategical and tactical, of high speed and generous coal supply.

Lastly, and perhaps most important of all, the necessity of providing several armored positions (conning towers), from any one of which the fighting of the ship may be carried on.

Let us now see in what way provision has been made in the "Dreadnought" to meet these requirements.

First, the armament consists of ten 12-inch, 45-caliber guns of a new pattern, with the unprecedented service velocity of 2,900 feet per second, capable of penetrating 22 inches of armor at 3,000 yards and 17½ inches at 5,000 yards.

Second, by mounting three of the turrets on the center line of the vessel and one on each broadside, and cutting down the forecastle deck to the level of the main deck in the line of dead-ahead fire of each of the turrets on the broadside (the decks and bulkheads being specially strengthened to resist the blast), the "Dreadnought" can concentrate six 12-inch guns dead ahead or dead astern and eight 12-inch guns on each broadside.

Third, the turrets have been so situated with regard to each other, that in no position in which the guns can be brought to bear will their blast inconvenience the gun detachment in any of the other turrets. When the guns of the two turrets on the beam are firing dead ahead, the detachment in the forward gun turret on the forecastle deck will be well up above the line of blast. When these guns are firing astern, the two after turrets on the main deck will be too far removed to be seriously affected.

Fourth, all the 12-inch battery is mounted within revolving turrets protected by 11 inches of sloping Krupp armor, equivalent in its resisting qualities to at least 15 inches of vertical armor. Throughout all the engagements of the Japanese war the gun detachments that were housed within the heavy turrets were practically immune from the effects of shell fire.

Fifth, the principle of wide separation, which has proved to be so advantageous in land operations as, for instance, in the advance of an attacking body of infantry, is of equal importance as a defensive element in the placing of the guns and their gunners on a warship. The principle has been admirably worked out on the "Dreadnought," where the 12-inch turrets, as viewed from the broadside, are separated by fully 100 feet of distance from center to center of turrets. The chances of a single shot doing injury to two turrets is very remote. Similarly, shots aimed at the ship as a whole must be limited in their destructive effect to a single turret, its guns, and its gunners.

Sixth, the masting of the "Dreadnought" is self-supporting, that is to say, it does not depend upon shrouds and stays to be held in place; and it is of enormous strength. Each mast consists of a tripod made up of three steel tubular legs of great stiffness, and this tripod arrangement renders it impossible for a single high-explosive shell to bring the mast down. One of the legs might, indeed, be entirely shot through, and the structure yet retain sufficient strength to stand erect. Moreover, stays and shrouds, which are particularly vulnerable to high-explosive shells, are done away with, even the smokestacks being unstayed and self-supporting; and, except for a short superstructure at the after end of the forecastle deck, the ship is free from light deck houses and structures which, as the Japanese war showed, merely served to intercept and burst the shells.

Seventh, the large displacement of 18,000 tons and the broad beam of 82 feet enable the "Dreadnought" to carry her guns at a great elevation, the axis of the forward pair being 34 feet above the water line, and the axis of the other guns from 26 to 28 feet above the sea level. Moreover, her great size conduces to slow movement and long easy roll in a seaway—most important considerations for the gun pointer.

Eighth, on the high seas just as much as upon land, mobility is of prime importance; for mobility means the power not only of concentrating in force and quickly at some desired point in the enemy's country, or upon the high seas, but it also means the ability to make a rapid change of formation while the tactics of the actual fight are being developed. In this respect the "Dreadnought," which has recently shown a sea speed of 21½ knots an hour on a continuous run of 172 knots, is most favorably placed. She is driven by quadruple turbine engines; and the fact that her coal consumption is probably about 1.5 pounds per horse-power hour, coupled with her large coal capacity of 2,700 tons, will give her an unusually wide radius of action at cruising speeds.

Lastly, at least one great naval battle of the Japanese war, the sortie of August 10, was lost by the Russians at a time when matters were going pretty evenly between the contestants, because at a critical moment the conning tower and bridge were wrecked by a single 12-inch shell, the admiral killed, and the ship left without a controlling hand. The "Dreadnought" is provided with three separate conning towers, each provided with a complete set of telephones, telegraphs, etc., from each of which it will be possible to fight the ship. One of these is immediately below the navigating bridge at an elevation of about 45 feet above the water line; the other is just forward of the aftermost smokestack, and the third is located between the two after turrets.

Altogether, it must surely be admitted that, considering how soon after the war the plans of the "Dreadnought" were decided upon, Sir Philip Watts has turned out an exceedingly powerful and effective ship.

Our own battleships, the "South Carolina" and "Michigan," are equally creditable designs. When we consider that they are of 2,000 tons less displacement than the "Dreadnought," it must be admitted that in offensive quality, at least, they are, in proportion to their tonnage, fully the equal of the British vessel. On the other hand, the "Dreadnought" is already in commission, having successfully completed her speed and gunnery trials; whereas it will be over three years before the "South Carolina" goes into commission. The armor on our ships is slightly heavier, and, being smaller vessels and shorter, they present smaller targets, and therefore are less liable to be hit; although this is somewhat offset by the fact that the bigger ship takes longer to sink, and can stand a proportionately larger amount of hammering. Taking the military features of the "South Carolina" seriatim, as in the "Dreadnought," we find that:

First, she carries eight 12-inch, 45-caliber guns, having a service velocity with nitro-cellulose powder of 2.700 feet per second, and that her shells are capable of penetrating 19 inches of armor at 3,000 yards, and 15 inches at 2,000 yards.

Second, by mounting one of each pair of turrets, forward and aft, some 8 feet higher than the adjoining turret, a maximum arc of training is obtained for all of the guns, four guns firing dead ahead and dead astern and eight on either broadside.

Third, the above system of mounting serves also to obviate all difficulties from blast interference; for our naval designers are satisfied that, even when one pair of guns is fired directly across the roof of an adjoining turret, there will be no serious inconvenience caused to the gun crews. The excellent character of