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NEW YORK, SATURDAY, APRIL 23, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE BATTLESHIP "MISSOURI" DISASTER.

The awful calamity that befell the battleship "Missouri" on Wednesday, April 13, when she was engaged in target practice off the port of Pensacola, is the latest of a series of similar accidents which have occurred within the past few years on our own and foreign warships. Some eighteen months ago, while the Russian battleship "Sissoi Veliky" was firing her forward pair of 12-inch guns, there was a terrific explosion, which killed every man in the turret, and completely wrecked the interior of the same. The massive top of the turret was blown bodily into the air, and half of it, falling backward upon the deck, killed twenty-eight men that were standing there in a group. About six months later there was an explosion during target practice in one of the turrets of the 12-inch guns of the British battleship "Mars," which resulted in great loss of life. Then followed the fatal explosion in one of the 8-inch gun turrets of our own battleship "Massachusetts." In each case it was impossible to determine definitely what was the cause of the explosion, the various boards of inquiry being able merely to suggest various conditions which might have rendered the explosion possible. In the present case, because of the fact that every officer and man that was in the turret of the "Missouri" was killed, it is likely that the disaster will have to be written down as one of the unexplained mysteries of which there are so many to be recorded in the history of the use of explosives both on sea and land. The least that we can say for the unfortunate dead is that at the present writing there is not the faintest shred of evidence that these noble fellows were doing aught but discharging their duties with that intelligent care and conscientious fidelity which have won for our navy its high reputation throughout the civilized world. Such accidents as these are a part of the perpetual risks which are taken by those who serve their country on the high seas—risks that are by no means confined to the hour of battle, but are present and are always seriously contemplated by officers and men when ammunition rooms are opened, guns are cast loose, and the terrific weapons of modern warfare are put to the test.

Most earnestly do we deplore the unseemly and officious haste with which such a large section of the press seem ready to rush into an ill-timed and most ungenerous suggestion of carelessness and incompetence, almost before the victims have breathed their last breath in obedience to the call of duty. Whether on the Russian "Sissoi Veliky," the British "Mars," or the American "Missouri," the victims of these shocking disasters are as fully entitled to the honors of naval heroism as if they had died in the fiercest climax of a great sea fight.

The board of inquiry, when it comes to investigate, will carefully sift out what scanty evidence is forthcoming, and if there be any blame, we may be assured it will be rightly placed. But just now it looks as though the only criticism that could be made is that the accident may have happened through the rapidity of the firing. If this is the case, it will simply mean that our gallant sailors have died because they were striving for that very proficiency in the handling of their guns, which it has been the effort of our own and foreign navies to promote to the highest degree.

The accident happened to a modern 12-inch 40-caliber gun of the latest pattern built for our navy These guns are probably the most effective 12-inch guns in existence to-day, having a greater energy per weight of gun than any 12-inch pieces at present in use in any navy. It should be distinctly understood that the accident is in no way attributable to the gun itself. Briefly stated, what happened was as follows:

The left-hand gun, which had already been fired several times during the target practice, was being loaded, and the projectile had been rammed home, together with two of the four 90-pound bags of powder which go to make up a 360-pound charge. The projectile, therefore, was in place, two bags or 180 pounds of powder were rammed up snugly against the base of the shell, and two other bags were in line with the breech of the gun and about to be rammed home, when the first half of the charge that was in place suddenly ignited (nobody knows nor probably will ever know why or how) and the gases, rushing out of the breech, ignited the 180 pounds of powder still remaining in the charging tray. This, of course, produced an enormous mass of flame and heat, and probably portions of the burning powder fell through the well, which opens through the floor of the turret, down to the handling room below. On the floor of the handling room were four charges, or about one and a quarter tons, of powder, which was immediately ignited, and added its awful volume of flame to that of the burning mass above. There is a mournful consolation in the certainty that in the suffocating fumes and fearful heat of that conflagration the death of the twenty-nine officers and men must have been practically instantaneous.

Among the many explanations of the disaster, it has been suggested that there may have been what is known as a "back blast." That is, that when the breech was opened, a certain amount of unburned gases, remaining in the gun after the previous discharge, were blown back through the breech, and meeting with the oxygen of the air, ignited. The "back blast" is not an uncommon occurrence during the firing of big guns, especially if the wind is blowing toward the muzzle of the gun; but the flame produced is instantaneous and not very fierce, the officers being able to stand within a foot or two of the flash without suffering any harm. It is difficult, however, to understand how this could have caused the ignition of the charge; for when the breech is opened the ammunition carriage is, of necessity, some distance below the breech of the gun, being at the time on its way up from the handling room below, so that if there was any back blast, it must have happened several seconds before the powder was hoisted to the breech of the gun, and in that interval of time the gases remaining in the gun would probably have cooled down below the ignition point, and the danger would be passed. Furthermore, the shell had been rammed home into place at the forward end of the powder chamber, and its copper rifling band was practically sealing up the bore. That there was any burning fragment of the "canvas" bags, in which the powder of the previous round was held, remaining in the gun, is extremely unlikely, for the reason that the so-called "canvas" is made of pure wool, to insure its immediate combustion when the charge is fired, and the fierce white heat of the gases in the powder chamber at the instant of explosion is such that every fragment of the bag is instantly consumed. Furthermore, the breech box, powder chamber, and bore of the gun are drenched with a powerful spray of water between each round. From the above considerations it will be seen how difficult it is to connect the explosion of the smokeless powder with the ignition of left-over gases or burning fragments from the previous round. As we have said, the disaster is at present a profound mystery. It is very doubtful if the forthcoming investigation can do much to solve it.

THE ADVANTAGES AND DRAWBACKS OF TURBINES FOR OCEAN STEAMERS.

Further particulars of great interest that have come to hand regarding the report of the turbine commission will, in some respects, cause considerable surprise. In the first place, it was found that, contrary to the generally accepted belief that there would be a considerable economy of weight in the turbine as compared with the reciprocating engines, the use of turbine machinery to develop the 70,000 horse-power required for the new Cunarders will mean a saving of only 300 tons over the weight that would be required if reciprocating engines were used. This statement is rendered the more significant when we learn that the commission advised the steamship company not to rely upon this saving by adding 300 tons to the cargo or other accommodations, but rather to hold it in reserve to be incorporated in the motive power, if need be, as the designs of the turbine machinery are worked out.

The commission admit that the most important disadvantage of the turbine is the lack of economy at low speeds; but they consider that, as the new ships will always run at a uniform speed of 24½ knots, this consideration does not enter into the problem. They state that because of the high sustained speed, the turbines may be depended upon to realize their best economy, and the coal and steam consumption will be superior to that of reciprocating engines. At the same time, it is surprising to learn that, although the tests made on land between reciprocating and turbine engines when both were engaged in driving electrical generators showed a marked superiority in economy for the turbine, especially where superheated steam was used, the tests made in the English Channel between a turbine-propelled vessel and one driven by reciprocating engines showed a superior economy of only two per cent in favor of the turbine. Marked economy, however, is predicted for the large turbines because of the great reduction of the staff in the engine room, and of the small amount of lubricating oil used, and the absence of this oil in the exhaust steam.

The arrangement of the power on four shafts will provide two steam units, each with one high and one low pressure turbine; and should there be any breakdown of one shaft, turbine, or propeller, it would be possible to continue under the three remaining shafts. But for the reason that the turbine can carry a much greater overload than the reciprocating engine, it will be possible to reduce this twenty-five per cent of lost power so very materially that the speed would probably not fall more than a mile or a mile and a half per hour below the normal speed; that is to say, one of the new turbine boats would be capable, if she fractured a shaft, of proceeding on her voyage at a speed of from 23 to 23½ knots an hour. Here alone is a great gain in efficiency which, in itself, we think is sufficient to guarantee the very radical step which is about to be taken.

EXPERIMENTS MADE AT THE LABORATORY IN THE CATACOMBS; EFFECT OF DARKNESS UPON ANIMALS, ETC.

M. Armand Viré gives an account of some experiments which have been carried on at the biological laboratory of the Catacombs. The laboratory was installed in 1896 for the purpose of observing the influence of light and darkness upon different animals. It has two distinct parts, one of which is underground and is located in that part of the Catacombs lying under the Jardin des Plantes, while the second part consists of an aquarium building in the Zoological Gardens. In the first portion the experiments are carried out upon animals which are constantly kept in the dark. On the contrary, it is the subterranean animals which are observed in the second part, and they are exposed to daylight in order to study the modifications which may be thus brought about.

Regarding the normal animals which are kept in the dark, these are especially the Crustaceæ, Batrachians, and different varieties of fish. The crustaceans (*Gammarus fluviatilis*) showed the following phenomena: The gray pigment disappears by patches which increase in size until the entire disappearance of the color. The eye remains normal at first, but after a year it becomes slightly modified in the forepart, although upon dissection no change is remarked in the retina or the optic nerves. On the contrary, the organs of smell, touch, and taste show a marked hypertrophy at the end of a few months. Their length increases gradually until the organs have their dimensions tripled. The observations seem to show that the organs which are now useless, such as the eye, tend to subsist for a considerable time, and this explains in a certain degree the presence of these residual organs in a number of animals, and which could not be accounted for except by this conservative action of the organism. The parts which now become more useful, such as the hearing, touch, and smell, owing to the disuse of the eye, take at once a development which accords with their increased functions.

In the case of the fish a singular phenomenon was observed. After remaining for five years in the dark, the eye of an eel increased in size until it became double its usual volume. This fact would appear to be in contradiction to the preceding, if it is not remarked that the optical nervous system is somewhat reduced, showing thus that the hypertrophy of the external organ will no doubt give place later on to an atrophy. This fact has been observed as far back as 1831 by Eudes Deslongchamps, upon an eel which was taken from the bottom of a well. Another fact remarked in connection with the fish is a reduction of the length in the dark. In the case of twelve gold cyprins (*Carassius auratus*), six were placed in the Catacombs and six in the light. The food was the same for the two portions. After two years the specimens kept in the dark changed their color to a pinkish white. Their length became only one-half that of the second lot, which retained their fine red tint.

The subterranean animals which were kept in the light in order to observe the modifications which might occur were mainly crustaceans (*Niphargus Plateaui*, obtained from the Catacombs and elsewhere; *Vireia burgunda* and *V. berica*, from the Italian caves), and batrachians (*Proteus anguinus*, from Austrian caves). The crustaceans lack the eye and optical nervous system, that is, all the organs which are capable of receiving luminous impressions. The latter specimens have the eye atrophied and covered by the general tegument. Nevertheless, all the specimens are sensitive to light and show by very distinct reactions that light is disagreeable to them. This is probably not a direct perception of the light, but a sensation of a chemical order which is transmitted from the pigment cells to the brain by the general nervous system. In fact, after several months experiment, the Proteus commences to assume a color; at first this is light and diffused, then it becomes darker, ending in a violet black.

coloration with occasionally a series of small yellow patches, except under the head and body, which remain white. With the crustaceans the action is much slower and as yet only slight black patches have appeared on the skin. It is expected to make a series of experiments upon mammals in the underground laboratory as soon as a good system of ventilation is installed in order to supply the necessary fresh air.

THE CAVES AND DENE-HOLES AT CHISELHURST.

BY M. H. H. MACARTNEY.

Chiselhurst, the little Kentish town eleven miles out of London, is very proud of itself just now. And with good reason. Its long-despised chalk pits, of which nobody took any account except when from time to time somebody fell down them, now turn out to be ancient British cave-dwellings which can vie in extent with the Breton subterranean dwellings in La Vendée of which Victor Hugo makes mention in his great novel "Quatre-Vingt-Treize." The last summer was the first year that they have been recognized for what they really are, and therefore they have not as yet been fully explored. But enough has already been done to give the visitor a good idea of the haunts of the ancient British troglodyte, and to show that these caves are among the most marvelous triumphs of early engineering.

From the Chiselhurst station to the caves is only a few minutes' walk, but even in that short time I passed over historic ground; for close to the caves is a double rampart some twenty feet deep, the sole remains of the old covered way which led into the British camp, portions of which are still to be seen. Just beyond is a hill crowned with woodland which forms the extreme outskirt of the mighty Anderida Weald. In this hill lies the entrance to the caves. As I stood for a moment peering into the inky darkness, my guide switched on the electric light. Fancy electric light being installed in these old caves! It was hopelessly incongruous. But the effect was splendid. I looked down a long gallery some 150 feet long, 12 feet high, and 15 feet wide, the chalk walls of which took the green and pink tints of the light in a way which would have been impossible in a cavern of rock. The whole scene reminded me of a representation of Aladdin's cave at a Drury Lane pantomime, but there were no stalagmites and stalactites, which are indispensable to the stage cavern. The walls of this first part are roughly hewn with the pickaxe in a very different fashion to the walls of the Temple itself, which we afterward visited. We came almost immediately upon the first of the many dene-holes. These dene-holes are shafts, about 3 feet 6 inches in width, coming straight through the thanet sand into the chalk, and were made by the ancient Britons during the Keltic or Iron Age. The shafts serve a two-fold purpose. The Britons not only shot their grain down them, but in times of danger swarmed down them themselves either by means of steps cut in the sides or by a notched pole. At the bottom of each dene-hole were six or eight compartments, in which the people lived till the danger had passed away. An attack on these refuges must have been futile. For as only one man could possibly descend at a time he must have fallen an easy victim to the Britons awaiting him at the bottom. Or, again, to try and smoke out the refugees must have been equally futile, since the British wasps need only have given a few blows with their picks upon the soft walls to make an entrance into the next set of chambers, with which the ground is literally honeycombed. But to-day these sets of chambers are not the self-contained flats that they used to be, for when the Romans captured Kent they cut passages intersecting these chambers in the hopes of thus destroying the power of the Druids. The dene-holes too are almost all blocked up and built over, but I was shown one up which I looked to see the sunlight 85 feet away in a villa garden. It was like looking up a huge factory chimney.

By this time we had left behind the electric light and depended only upon a single hand-lamp. We had now come to the Druids' treasure-chamber, the size of which can be clearly traced upon the ceiling. But though the chamber has been broken down, the passage leading from it toward the Temple is still perfect. And a tiny, little zig-zag passage it is, only wide enough to admit one man at a time and not high enough to allow a fair-sized man to stand upright. On both turns it is guarded by a chamber large enough to allow the sentinel to swing an axe. The seat, too, on which the sentry sat and waited for "something to turn up" still remains, and I seized the opportunity to sit down and make a few hasty notes. The passage was once still more secure, the entrance being a hole at ground level, so that the sentinel had merely to bring his axe down on the head of the would-be Bill Sykes as he crawled along on his belly.

Just a little way beyond the end of this passage my guide suddenly stopped and turned his lamp upon a cranny in the roof. "Look up there," he said in an awe-inspired tone; "there are the petrified remains of an ichthyosaurus who was caught here when the sea receded from this part of the land." One great dark leg is all you see, the body of the creature being imbedded in the chalk. My guide now showed signs of giving me some statistics "pitched in the key of emotion" based upon the fact that the sea takes 100 years to form an inch of chalk, but providentially we had now come to the well supplying the place. The present depth of the well is 53 feet. I lit a piece of paper and dropped it down. As it fluttered down I could see how carefully the sides had been "flinted-in," if I may coin the expression, while the steadiness of its flame testified to the purity of the air.

We were now in the very Temple itself, built in the Druidical sign of the circle. The walls here are exquisitely made, and still bear the marks of the triangular iron pickaxes with which they were fashioned over 2,000 years ago. The floors, too, are much harder in this part than elsewhere. Apparently a cement was made of burnt flints and chalk and the floors were then flooded. There are six altars still surviving, which seem to be arranged in pairs. The first and the last are single altars, two are double altars, and two have priest-chambers attached to them. These priest-chambers also are beautifully made and are semi-circular in shape. In one the natural understratum of the chalk has been washed by iron pyrites which has given the roof a lovely color rather like that of a copper-beech. It is a significant fact that these altars follow the sun, being almost exactly orientated; which certainly seems to indicate solar worship as the religion of the ancient Britons. The altars themselves bear no traces of any ornamentation. It has been conjectured that they were used for human sacrifice. The caves beyond the Temple, which were our furthest point (though my guide told me that he had explored another five miles), are, curiously enough, built in the rough sign of a cross. Whether this is accidental or not is unknown. The nave, as it were, has innumerable dwelling rooms and passages opening off it. This part in fact is a regular labyrinth and may have been designedly made so. The part of the Minotaur was played by my guide's pet dog, which had missed him and came tearing out of the darkness after us in a very eerie fashion. An interesting point about these dwelling rooms is that they are never placed exactly opposite to one another, so that the inmates of one could not have overlooked their neighbors across the way. Another remarkable thing is the extraordinary acoustics of the place; the whispering gallery of St. Paul's is not in it. And so back again through the Temple, and the treasure-room passage, and the first great gallery, out into the bright sunshine. For me to attempt to criticise the various theories which have been put forward about the place, would be out of place here. I have contented myself with jotting down the history as told me by the guide. One thing may be confidently predicted: we do not as yet know anything like as much about these caves as we shall after further exploration. And experts are now hard at work upon them.

NEW PROCESS OF MANUFACTURING OZONE.

For the past few years the great importance of ozone for hygienic and industrial purposes has been more and more recognized. The general use of this potentiated form of oxygen was, however, restricted on account of the expensive method of its manufacture. The English engineer Elworth is now said to have found a process for manufacturing ozone that is much simpler than those used heretofore and that permits of a larger production.

Ozone is by him produced in an apparatus into which atmospheric air is forced by means of an air pump. An electric alternating current of 3 amperes at 130 volts, transformed to a potential of 1,100 volts, is then introduced. Through electric discharge in the apparatus, ozone is engendered. The air introduced into the apparatus is forced through an ingenious system of pipes; and, having become highly ozonized, escapes with great velocity through a pipe which conducts it *ad libitum* to the places and the objects intended to be treated with ozone.

The firm of Koelle & Held, of Stuttgart, has for some time past made interesting experiments with these apparatus, which are still continued. It has been proven so far that a much larger quantity of ozone is obtained than by previous methods. The apparatus works very quietly and without any interruption.

It is evident that such an increase of production means a cheapening of the price of ozone and, therefore, a more extended use. The apparatus takes up but little room and can be used wherever the necessary alternating electric current of sufficient power is available, either through a small motor or from larger electric establishments.

Ozone, on account of its great oxidizing power, is well adapted for supplying oxygen to closed rooms, such as theaters, hospitals, manufacturing shops, etc., for purifying drinking water, for the purification of sewage, bleaching of leather, treating oils, etc.

If the new apparatus fulfills expectations, it may result in new possibilities for public hygiene, as also for many industries.

SCIENCE NOTES.

Mr. F. V. Coville, in the National Geographic Magazine, gives an interesting account of how the Indians of the desert obtain drinking water from the barrel cactus. It was among the desert hills west of Torres, Mexico. The Indian cut the top from a plant about five feet high, and, with a blunt stake of palo verde, pounded to a pulp the upper six or eight inches of white flesh in the standing trunk. From this, handful by handful, he squeezed the water into the bowl he had made in the top of the trunk, throwing the discarded pulp on the ground. By this process he secured two or three quarts of clear water, slightly salty and slightly bitter to the taste, but of far better quality than some of the water a desert traveler is occasionally compelled to use. The Indian, dipping this water up in his hands, drank it with evident pleasure and said that his people were accustomed not only to secure their drinking water in this way in times of extreme drought, but that they used it also to mix their meal preparatory to cooking it into bread.

Uranium is one of the rare metals for which there is a limited demand. The present world's consumption amounts annually to about 300 tons of uranium ore, yielding from 3 to 13 per cent of the metal. For several years Colorado has supplied the United States output, nearly all of which goes to Europe. France, England, and Germany are the principal markets. Uranium is a hard, very heavy (9.184) moderately malleable metal; it resembles nickel and iron, and has the color of nickel. At ordinary temperatures it is not affected by air or water; at red-heat, however, the surface oxidizes. The chief ore of uranium is the oxide, called pitchblende or uranium. It occurs also as the phosphate and arsenate. The ores are found in Gilpin and other counties of Colorado; in Cornwall, England; and in Saxony, Germany. Buyers of the ore generally pay from $15 to $20 per unit, according to the percentage of uranium contained. Until recently uranium salts were used chiefly as a pigment in painting on porcelain, in photography, and as a coloring ingredient in glass manufacture. It is now being used experimentally in the manufacture of alloys of iron and of aluminium. Uranium increases the hardness and elasticity of steel, also the hardness of aluminium, but this use has not yet become sufficiently important to cause an increased demand for the metal.—Engineering and Mining Journal.

The trustees of the Carnegie Institution, founded at the city of Washington by the munificence of the well-known philanthropist, Andrew Carnegie, at their annual meeting in December, 1903, took the necessary steps to establish what is now to be known as the "Department of International Research in Terrestrial Magnetism." An allotment of $20,000 was made, with the expectation that, if the proposed work should be successfully organized, a similar sum would be granted annually for the period requisite to carry out the plan submitted by the writer and published in Year Book No. 2 of the Carnegie Institution. It is proposed to set aside $10,000 for office expenses (reduction, discussion, etc., of existing observational data) and $10,000 for observational and experimental work; a portion of the latter sum may be reserved annually and allowed to accumulate for some large undertaking. The general aim of the work is "to investigate such problems of world-wide interest as relate to the magnetic and electric condition of the earth and its atmosphere, not specifically the subject of inquiry of any one country, but of international concern and benefit." The prime purpose, therefore, of this department is not to supplant any existing organization, but rather to supplement, in the most effective manner possible, the work now being done, and to enter only upon such investigations as lie beyond the power and scope of the countries and persons actively interested in terrestrial magnetism and atmospheric electricity.

THE CURRENT SUPPLEMENT.

Mr. Emile Guarini opens the current SUPPLEMENT, No. 1477, with an account of the Berlin telephone exchange. The excellent article by M. Danne, preparator to M. and Mme. Curie, on radium, is concluded. His series of articles may well be considered the most exhaustive discussion of radium and radio-activity that has thus far appeared. Another article that should attract some attention is Dr. Erlwein's discussion of the purification of potable water by means of ozone.

Mr. Frank C. Perkins begins an article on the development of the electric mining locomotive. "The Hospitalier Ondograph" is the title of an article which describes a new instrument for graphically recording current and potential variation of alternating currents. Mr. Hiram Percy Maxim furnishes some data, that are certainly startling, on the cost of operating automobiles for commercial purposes. Mr. Israel C. Russell's paper on "Recent Volcanoes of Southwestern Idaho and Southeastern Oregon" is concluded.