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NEW YORK, SATURDAY, AUGUST 1, 1903.

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 TORPEDO TUBE AND OUR NEW BATTLESHIPS.

If one were asked to name the most distinctive characteristic of the American warship, he would be safe in referring to its great battery power; and this is true, whatever page of the brilliant naval history of this country we turn to. When an American ship has cast loose for action against a ship of equal size, she has usually had the fight well in hand from the very start of it, and this for the good reason that she has carried on her decks a battery more powerful both in numbers and in power and excellence of the individual pieces. That the policy has been a wise one, is proved by the record of our naval victories; and while the successes were gained chiefly in the days of sailing frigates, wooden hulls and smoothbore guns (the naval actions of the Spanish war were too one-sided to have any bearing upon the question) it is the confident belief of the United States navy that in any future war the exceptional weight of our batteries may well prove to be the deciding factor.

The designs for our latest battleships, however, of the "Louisiana" and "Connecticut" class, are marked by an omission of one of the most effective offensive elements of the modern warship, an omission which may be considered so serious that it is questionable whether these ships, large, swift, and powerful as they are, can be reckoned as strictly first-class. We refer to the fact that no provision whatever has been made for the installation of torpedo tubes, and this at a time when the latest ships of the foreign powers are using, in large numbers, a torpedo which in range and accuracy is enormously superior to the torpedo carried at the time of the Spanish war. The reason for omitting the torpedo from our new warships is to be found in the disastrous behavior of this weapon in the two last naval wars—that between China and Japan and our own Spanish war of a few years later. In each war there were instances of vessels being destroyed by the explosion of their own torpedoes, "hoist with their own petard," and evidently it was considered by our Bureau of Construction that the risks to the ship that carried this weapon were so great as to offset the rare occasions on which it might be used to good effect against the enemy. The omission of torpedoes from our ships because of these considerations, would have been justified were it not that the risk of self-destruction has been removed by the perfecting of the under-water torpedo-launching device, which renders it possible to carry the torpedo at all times below the water-line, and therefore below the protective deck, where it is secure from the enemy's shell fire. Contemporaneously with the development of the under-water discharge tube, there has been a remarkable improvement, thanks to the invention of the gyroscopic steering gear, in the torpedo itself, so that torpedo range is to-day extended to from 1,500 to 3,000 yards or more. It is a fact that instead of the modern torpedo constituting a frightful element of danger to the ship that carries it, the risk to the user has been entirely eliminated, and the weapon is perhaps the most deadly element in the armament of a modern warship. So important has the under-water torpedo become, that it is certain to exercise a more powerful modifying effect upon the tactics of a future naval battle than any other element, whether of speed, armor, gunfire, or maneuvering power, in the modern fighting ship. Clear proof of this was given in the series of naval war games recently played at Portsmouth between two parties of British naval officers representing the American and German navies, and published in the Scientific American Supplement. In several of the engagements of this war, the absence or comparative absence of torpedoes from American ships, and the ample supply carried by the Germans, proved to be the controlling factor, not merely in the tactics as laid down or followed by the opposing fleets, but also in the actual stress of the battle itself, more ships being lost and more battles won by the under-water torpedo than by any other element. The under-water torpedo is not merely a weapon of enormous offensive power, but it is equally valuable for defense. If a ship having no torpedoes be disabled, say by derangement of her steering gear, she becomes an object of easy attack by a much less powerful vessel carrying torpedoes, for the larger vessel being unable to maneuver, her enemy can approach her from the quarter in which she herself will be least exposed to gunfire, and when she is within torpedo range, can sink her powerful but helpless enemy with deliberation. On the other hand, should the disabled vessel possess an armament of four or five well-distributed torpedo tubes, she would possess sufficient power of retaliation, even if her batteries were silenced, to prevent any ship of the enemy from attempting to use the ram.

In view of the most serious nature of this omission from the "Louisiana" and "Connecticut," it is a question well worth considering as to whether, at this early stage of the construction of the hulls of these ships, it would not be well to make such changes as would admit of installing at least four broadside torpedo tubes below the water-line. Each installation would not weigh more than 35 tons—say about 140 tons for the four. If it should prove difficult to allot the necessary weight and space, the vessels could well afford to sacrifice some of their enormous battery power above water in order to gain an under-water battery whose actual and moral effect would be of far greater value. If anything is to be done, it should be done quickly, and if the change be not made at once, we venture to say that it will be a cause of lasting regret to every officer who may be called upon to command these two magnificent ships.

ELECTROCHEMICAL DISCOVERIES.

The group of industrial establishments that have grown up around Niagara in the past few years to delve deeper into the mysteries of electrochemistry, are rapidly transforming many lines of business and trade manufacturing. The supply of electric power in large units has primarily been responsible for this marvelous growth; but purely experimental companies are now carrying on exhaustive tests and experiments to develop new industries for the benefit of mankind, and their work is receiving critical attention from all parts of the world.

Industrial electrochemistry and electrometallurgy have already accomplished wonders in the field of manufacture. Carborundum has become a staple product of the electric furnace, displacing in many trades nearly all other abrasive materials. In the past year it has become an important factor in the steel trade, and some seventy-five tons per month are demanded for this industry alone. More recently tungsten and ferro-tungsten have been satisfactorily produced in the electric furnace, and the use of these in the steel trade for manufacturing self-hardening and high-speed tools has steadily increased.

The manufacture of aluminium, zinc, and manganese in the electric furnace has also achieved considerable importance, and promises for the near future far-reaching developments. There are several factories now engaged in manufacturing aluminium at Niagara Falls and Massena, and their total output is considerable. Commercial phosphorus is satisfactorily made by mixing the finely-powdered phosphate material with carbon and sand in the electric furnace, and then, when heated, distilling the phosphorus from the mass, and collecting it under water.

The development of the carborundum industry led to the manufacture of artificial graphite, which is now produced by passing the amorphous carbon through the electric furnace, and obtaining a pure graphite with merely a fraction of one per cent of ash. Even the direct graphitization of anthracite coals has been successfully accomplished, a granular graphite being obtained which can be extensively used for lubricating purposes. This graphite is easily manipulated with machine tools, and is of great service in many trades. In 1901 over two million pounds of this graphite were made in this country, and much more in the year just closed.

The electrolytic production of caustic alkalies and chlorine has proved of the greatest importance to the world of trade. The chlorine produced is used for making bleaching powders, which in turn has revolutionized the bleaching trade here and abroad. The production of sodium by electrolyzing fused caustic soda has developed rapidly at Niagara and other places where large electric units are supplied at low rates. The production of sodium is now conducted on a large scale.

The application of the electric furnace to steel manufacturing has also received a good deal of attention in France and by the Niagara people. Experiments have been conducted to manufacture steel from pig iron in the electric furnace, and also to smelt the ores directly and manufacture and refine the material in two connected furnaces. At St. Etienne, France, iron ore has been treated most successfully in specially-prepared electric furnaces, and new factories are being projected for carrying the work forward on a commercial scale.

The manufacture of carbon bisulphide by directly treating in the electric furnace charcoal and sulphur is now in operation at Penn Yan, N. Y., where a daily output of 10,000 pounds is an average. The electric furnaces employed for this work at the Penn Yan factory represent the largest yet made in any of the electrochemical industries in this country. They are sixteen feet in diameter and about forty feet high, having a capacity sufficient to make a larger daily output than any similar factory in the world.

The production of nitric acid by electrochemical methods is a new process that promises extensive changes in our agriculture. The manufacture of nitric acid from the nitrogen and oxygen of the air in sufficient quantities for commercial uses has been the dream and hope of scientists for years. At Niagara experiments have been conducted successfully in producing commercial nitric acid by using a high-tension current in an air chamber, by which a yield of one pound of nitric acid is obtained for every seven horse-power-hours. Steps are now being taken to establish the production of nitric acid on a large commercial scale, and while further experiments in this field will be conducted, they will be simultaneous with the practical work of making the product.

So remarkable have these and similar industries become, that purely experimental companies have been formed within the past year to investigate further in electrochemistry at Niagara for the sole purpose of discovering new processes to patent. They do not intend to establish any commercial factories, but to dispose of the rights to their patents and discoveries to industrial companies which can easily be organized later. They represent the modern wizards of practical chemistry, seeking new discoveries in a field that has already proved exceedingly rich. The experts who compose these experimental companies are searching for definite results along lines already indicated by past successes. Starch, for instance, is receiving considerable attention from the electrochemists, and it is believed that this will soon be produced by some electric process. Likewise artificial rubber is a substance that is attracting the ambitious, and results already obtained justify the chemists in continuing their experiments with this object in view. The recent scare in prices of good rubber, and the lessening supply of crude rubber, stimulate the workmen to greater effort in the field of electrochemical experiment.

There are many other lists or groups of products of great commercial value which the experimenters are trying hard to produce artificially by chemical reactions with the high temperature electric furnace and current. Ammonia, cyanides, and silicides are among the most promising of these, although not by any means the only ones. The manufacture of artificial camphor is now assured, and calcium carbide is now produced on an enormous scale. One company converts barium sulphate into other needed barium salts. Barium hydrate is now produced so successfully that its price enables the different trades to use it in many minor ways. Both the sugar and paint trade—two widely distinct industries otherwise—employ barium hydrate on a large scale.

One important feature of all these new industries is the stimulating effect they have upon widely separated trades and manufacturing industries. By producing materials on a large commercial scale, they enable other trades to utilize them in ways never before considered possible. With the cheapening of the products their use becomes universal. They have thus directly tended toward lessening the cost of production of articles in common use. Synthetic electrochemistry is thus proving in its quiet way one of the greatest trade revolutionizing factors the world has ever known. The unlocking of secrets by man's ingenuity is always fascinating and stimulating, but when they in addition help mankind by placing within the means of everybody articles which were formerly considered luxuries, the result is something that holds the admiration of all. From Niagara, Massena, Penn Yan, and other places where large electrical units are easily obtained, the world of science and trade hope for revelations that more than rival the visionary acts of mythical wizards of old.

NORDENSKIOLD'S SHIP CRUSHED IN THE ICE PACK.

The whaler "Vega," in which Nordenskiold went through the Northeast passage, was crushed and sank in Melville Bay, on May 31. After a difficult journey of 300 miles in open boats across the ice, the crew reached the nearest settlement, and returned home. No lives were lost. The "Vega" was a steam whaler bought for the expedition. She was built in the years 1872-3 at Bremen, of oak, with an ice skin of greenheart. She was rated at 299 register tons, loading about 500, was 150 feet in length, breadth of 29 feet, and depth of 16 feet. She was fully rigged as a bark and was considered a good sailer. Her crew consisted of eighteen seamen of the Swedish navy and three Norwegian walrus hunters. She was provisioned for two years. After passing East Cape, Behring Strait, July 20, 1879, the "Vega," on September 2, arrived at Yokohama and returned to Sweden after circumnavigating the globe.

THE HEAVENS IN AUGUST, 1903.

BY HENRY NORRIS RUSSELL, PH.D.

We are abundantly favored with evening views of the planets at present. Venus and Mars light up the west after sunset, and, as they disappear, Saturn and Jupiter arise to take their places. Uranus is also in sight, but is not conspicuous.

At 9 P. M. on the 15th, Venus has not long set. Mars will soon follow her, but he is still a few degrees above the western horizon. The most conspicuous star in the western sky is Arcturus, which is about half-way down from the zenith.

Far to the southward, beyond Ophiuchus and Serpens, is Scorpio, still well visible just past the meridian, while Sagittarius is farther east.

Following up the Milky Way from these constellations, we first reach Aquila, after a vacant region. Then come Cygnus and Lyra, the latter almost directly overhead.

The great square of Pegasus is the most conspicuous configuration in the eastern sky. To the north of it are Andromeda and Perseus, just rising, and to the south are Aquarius and Capricornus, themselves inconspicuous, but now rendered bright by the presence of Jupiter and Saturn.

Cassiopeia is on the right of the pole, Draco almost above it, and Ursa Major on the left.

Hercules and Corona, which lie between Vega and Arcturus, complete the list of conspicuous constellations now visible.

THE PLANETS.

Mercury is evening star throughout August, but will not be easy to see, as he is too far south of the sun. Even at the end of the month, when he is farthest from the sun, he sets but 40 minutes later. On the 28th he is in conjunction with Venus, but the two planets are far apart—more than six degrees—and too near the sun to be well seen.

Venus is also evening star, and is conspicuous during the earlier part of the month, reaching her greatest brilliancy on the 12th. But as she is now rapidly swinging into line between the earth and the sun, she sets earlier and earlier from night to night, and by the end of the month she will be hard to see. Her apparent motion among the stars is small, and she remains in Virgo, about midway between Spica and Regulus, throughout the month. On the 1st she sets at about 9 o'clock, but on the 31st she disappears before seven.

Viewed with the telescope, she appears as a crescent, which steadily narrows as the month advances, the illuminated portion of her disk varying from one-third on the first to one-tenth on the 31st. In her present position, Venus appears larger with the same magnifying power than any other planet ever does, and it is easy to see the crescent phase with any powerful field-glass, that is, one which magnifies six or eight diameters. Even with an instrument of half this power, the crescent phase can be detected by a trained eye.

Mars is evening star in Virgo and Libra. On the 1st he is not far from Spica, and sets at about 10:10 P. M., but at the end of the month he vanishes an hour later.

On the 29th he passes south of the third-magnitude star Alpha Libræ, at a distance of about 1½ deg. The two objects will afford a pretty field for a low-power glass, as the star in question is a wide double, whose companion is just too faint, and too near its primary, to be seen with the naked eye.

Jupiter is on the borders of Aquarius and Pisces, and is rapidly becoming conspicuous in the evening. At the beginning of August he rises at about 9:15, and a month later at 7:15. He can be instantly recognized by his brightness, which far exceeds that of any of the fixed stars.

Transits of his satellites, interesting to watch with good telescopes, occur before midnight on the evenings of the 7th, 14th, 16th, 23d, and 30th. The 16th is a particularly interesting night, as all four satellites take part in the performance, though not all at the same time.

Saturn is in Capricornus, and is visible all night long, passing the meridian at a little before 11 P. M. on the 15th. Though very far south, he is a fine telescopic object.

Those who have been following his aspect for the last few years will notice a change in the appearance of his rings. Two or three years ago, the elliptical outline of the rings was unbroken by the planet, but now the ellipse has narrowed so much that the ball of the planet projects beyond it on both sides.

This is an effect of perspective, due to the fact that we now see the rings more nearly edgewise than we did in 1900. The rings will appear to narrow with increasing rapidity until 1907, when they will actually present their edges to us, and vanish from view except in the most powerful telescopes. Then they will open out again, but we will see the southern face of the rings, instead of the northern one, as at present. This disappearance of the rings was a great puzzle to the earlier astronomers, and it was a long time before the true explanation of the apparently discordant observations made at different epochs was discovered. But this discovery opened the way for an even more perplexing question. How did the rings get there, and how do they continue to stay there, consistently with the law of gravitation? The subject has occupied the attention of many distinguished mathematicians, and one theory after another had to be abandoned, till at last a fairly satisfactory one was found.

If the rings were solid, calculation shows that if they were not enormously stronger than any known substance, they would be torn to pieces by the enormous forces set up by the attraction of Saturn itself. Moreover, it has been further shown that, even if a sufficiently strong substance could be found, the motion of a solid ring would not be stable. It would resemble the condition of an egg balanced on its small end. So long as the egg is left alone, it will continue to stand in this position; but the slightest jar will cause it to fall over. Similarly, a solid ring of Saturn, if it was started right, might go on indefinitely; but at the slightest disturbance by any outside force, it would deviate more and more from its original position, until it finally came into collision with the other rings or the planet, and destroyed the whole system.

As the attraction of the satellites of Saturn affords just such a disturbing force, it is clear that the permanent existence of the ring proves that it cannot be solid.

It has indeed been shown by Prof. Clerk-Maxwell that the rings might be stable if they were loaded with heavy masses at certain points. But when the rings are seen edgewise, they show a smooth and even line, which grows all the more uniform as the power of the telescope and the steadiness of the air increase. So this theory must also be given up.

After proving that a liquid ring would in like manner break up into pieces, Maxwell showed that a stable system could be found. According to his theory, the rings of Saturn consist of a multitude of small particles, each of which revolves about the planet in a practically circular orbit, almost as if the others were not there. They are so close together that we cannot see them separately, and the whole mass of them is opaque (like an ordinary cloud). He proved that under these circumstances, if the particles were small enough, their motion would be stable. Such a system would behave like an egg lying on its side. A small disturbance only causes it to oscillate about its former position.

Maxwell's theory of the rings has since received several striking confirmations. To begin with, the innermost of the rings (the so-called "crape ring") is transparent, and the planet can be seen through it. This can be explained by supposing that the particles of which it is composed are so far apart that we can see through between them.

Certain peculiarities in the way in which the rings reflect varying amounts of light at different angles of incidence can also be explained satisfactorily on this theory, and on no other.

But the most striking proof of all was first obtained at the Lick Observatory by the late Prof. Keeler, who applied the spectroscope to determine the motion of the rings in the line of sight.

If the ring rotates like a solid body, its outer edge must move faster (more miles per second) than the inner. But on Maxwell's theory the reverse would be the case, as the inner particles, like the inner planets of the solar system, would move faster than the outer ones. Prof. Keeler's photographs show that this is actually the case, and are by themselves sufficient to prove that the ring is made up of innumerable pieces.

How the rings came to be formed is a still more difficult problem. But it is interesting to notice that it has been shown that a satellite of any size, revolving as near the planet as Saturn's rings are, would be torn to bits by the tidal forces due to the planet. It is therefore not unnatural to regard the rings of Saturn as representing one or more satellites spoiled in the making—broken apart by tidal forces (or prevented from ever gathering together) and spread out by the action of these same forces into the thin, flat sheet that we see.

Uranus is evening star in Ophiuchus. His position on the 15th is in right ascension 17h. 24m., declination 23 deg. 29 min. south—about 1½ deg. north and 2 deg. east of the third-magnitude star Theta Ophiuchi. He comes to the meridian a little before 8 P. M. and is just visible to the naked eye.

Neptune is in Gemini, and rises about 2 A. M. on the 15th.

THE MOON.

Full moon occurs at 4 A. M. on the 8th, last quarter at midnight on the 15th, new moon at 3 P. M. on the 22d, and first quarter at the same hour on the 29th. The moon is nearest us on the 21st, and farthest away on the 6th.

She is in conjunction with Uranus on the 3d, Saturn on the 7th, Jupiter on the 11th, Neptune on the 19th, Mercury and Venus on the 24th, Mars on the 27th, and Uranus again on the 30th. None of the visible conjunctions is close.

BORELLY'S COMET.

Photographs of the region of Borelly's comet, 1903, G, were taken at the Harvard College observatory on May 28, 1903, at 19h. 45m. G. M. T., and May 30, at 19h. 52m. G. M. T., about three weeks before its discovery. The positions of the comet at these times were for 1855, R. A. 21h. 49m. 27s., Dec. —19 deg. 6.1m.; and R. A. 21h. 50m. 15s., Dec. —18 deg. 33.2 m., according to the observations of Fayat. Astron. Nach., 162, 291. In both cases, the position of the comet was near the edge of the plate. An object closely resembling the comet was found on the first plate in R. A. 21h. 48m. 43s., Dec. —19 deg. 16.8 min., and of about the magnitude of the stars —19 deg. 6193 and —19 deg. 6198. These stars appeared on the second plate, but no image of the comet was found in the corresponding position. Its computed brightness on these dates should have been about one-sixth of that at the time of discovery. It was therefore probably too faint to appear on these plates, but that cannot be determined with certainty until more accurate elements have been computed. Plates covering the region of the comet were also obtained at Arequipa on May 14 and May 29, and probably on May 4, 1903, but they have not yet been received in Cambridge.

EDWARD C. PICKERING.

WHITE SPOT ON SATURN.

On July 1, after observing Jupiter for some time, I directed my 10-inch reflector to Saturn, and found the details sharply defined. The dusky north polar cap was very distinct, and so was the dark belt on the north side of the equator. The belt was darkest and more strongly outlined on its southern side, probably by contrast with the bright equatorial zone. I soon noticed a large bright spot on the north side of the belt, and in a position nearing the western limb of the planet. It was followed by a diffused dusky marking. The luminous spot must have been on the planet's central meridian at about 14h. 1m., but this is only a rough estimate, as the marking was far past transit when I first saw it. It is to be hoped that this feature will prove fairly durable, in which case it may be expected to furnish an excellent means of redetermining the rotation period of Saturn.

A telegram from Kiel which has been widely published, states that Barnard, of the Yerkes Observatory, saw a white spot in Saturn's N. hemisphere central on June 23, 15h. 47.8m. Williams Bay time. Allowing for the difference of longitude, this would be 21h. 42m. G. M. T. Adding eighteen rotations of Saturn of about 10h. 14m. will bring us to the time when the spot was approximately in transit as observed at Bristol, and there seems no doubt as to the identity of the objects.

This disturbance on Saturn will recall Prof. Asaph Hall's white spot seen in the winter of 1876-7, and followed from December 7 to January 2. A number of transits of this object were observed by Hall, Eastman, Newcomb, Edgecomb, and A. G. Clark, and from the data obtained the former found the rotation period of Saturn to be 10h. 14m. 23.8s. ± 2.30s. mean time.

The spot lengthened out into a bright belt, and soon lost its distinctive character.

Should the present object remain visible, it will be on or near the central meridian of Saturn on July 10, 13h., July 13, 12½h., and July 16, 12h. 10m.—W. F. Denning, in Nature.

The problem of piercing a glacier by means of boring has at last been solved, says the New York Sun, with results of real scientific interest in experiments made last August on a glacier near Vent, in the Tyrol. At a distance of about one and a quarter miles from the tip of the glacier where its breadth is 2,130 feet and the height of its surface above sea level 8,530 feet, a boring in the middle reached rock at a depth of 500 feet. Taken along with measurements of rate of movement, surface melting and temperature the experiment enabled the following conclusions to be drawn: First—the temperature of the ice is at the melting point throughout the whole mass on the tongue of the glacier. Second—the bed of the glacier is trough-shaped. Third—the ice moves more slowly at the bottom than at the surface. The bore holes were filled up with pieces of wood, which will serve for many years to come as indexes of the rate of movement and of surface melting.