SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) .... $3.00 a year
Scientific American Supplement (Established 1876) .... 5.00 "
Scientific American Building Monthly (Established 1885) .... 2.50 "
Scientific American Export Edition (Established 1878) .... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, New York.

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