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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.

FAILURE OF THE ISHAM SHELL.

The Isham shell, of which so much has been heard during the past few years, has at last received its quietus in a test which has just been made at the Sandy Hook proving ground. The shell was designed on the theory that, if a projectile charged with high explosive be burst by impact against the outside of armor plate, it will produce the same destructive effects that are secured when a high explosive shell is carried through the armor and burst within the interior of the ship or fortification. It was only a few years ago, as recorded in the columns of the SCIENTIFIC AMERICAN, that tests of two projectiles representing the two theories above mentioned, were made about the same time against armor plate of the same thickness, and backed up by similar structures, each representing the side of a warship. One was the present army high-explosive shell filled with maximite and dunnite, and designed to penetrate the plate and burst in the rear of it; the other was the Gathmann shell, carrying an enormous charge of high explosive and intended to burst on the front face of the plate. Gathmann believed that the mere detonation of the charge against the plate would demolish both the plate and its backing, driving it rearwardly. He claimed that if one of his shells struck the side of a warship, a large area of the ship's side would be blown bodily inward. The experts of the Army Ordnance Board believed that his theory was wrong, and advised strongly against the appropriation of money by Congress for a futile experiment. The tests were carried out and the armor plate was only slightly dished by the earlier shots and cracked through by the last. Very different were the results obtained with the army shells filled with maximite, and with other shells filled with dunnite, the charges inserted in the shells being very small, compared with those used in the Gathmann projectiles.

The shells were carried entirely through the armor and tore the backing literally into shreds, thereby giving a dramatic illustraton of what would happen in case of penetration of the thick armor of a battleship.

In the tests recently made of the Isham shell, an armored target representing a section of a battleship was set up, and the shell was fired with a velocity corresponding to the probable striking velocity at battle ranges. It exploded on contact and merely dished the face of the armor a few inches inward. The officers in charge of the tests claim that, had the plate been built into the elastic structure of a ship, the results would have been even less marked than they were.

RESCUE OF THE FIALA-ZIEGLER EXPEDITION.

The cablegram announcing the rescue of the Fiala-Ziegler expedition by one of the three rescue parties that have started during the last two years in search of the explorers, tells briefly the fate of one more of the many ill-fated attempts that have been made to solve the final mystery of the far North. The "America," which had been specially fitted and provisioned for the trip, sailed in charge of Mr. Fiala, from Trondhjem, Norway, with a complement of thirty-seven people, on June 23, 1903, for Franz Josef Land, where it was the intention to pass the winter, and set out early the next year on expeditions in dog sledges. On June 15, 1904, a relief expedition sailed from the same port, carrying provisions and general supplies; but on account of the ice and fog it was unable to reach the "America" and returned to Norway on the third of the following month. Mr. W. S. Champ, who had charge of the relief expedition, then chartered the arctic steamer, "Terra Nova," and in the following summer, on July 14 last, sailed from Tromsoe, Norway, in another attempt to find the "America." By dint of arduous labor the relief ship was pushed through until the rescue party found the members of the Ziegler expedition at Teplitz Bay, Franz Josef Land.

According to Mr. Fiala the rescue was timely, the expedition having been cut off from all communication with the outside world for two years past. The "America" wintered in Teplitz Bay where, early in the winter of 1903-04, she was crushed by the ice and became a total loss. Fortunately the party found the large supplies of stores which had been left at Franz Josef Land by various relief parties. Three separate attempts were made to reach a high latitude, but they all failed.

As far as the interests of geographical knowledge are concerned, the expedition must be regarded as a distinct failure, the farthest north recorded being 82 deg. 13 min. As early as the year 1827 Parry had reached the same latitude. So did Aldrich in 1875; while Markham, Lockwood, and Peary all attained higher latitudes than this. The farthest north was made by Nansen, with a record of 86 deg. 14 min. in 1895, and the Duke of Abruzzi, who reached 86 deg. 33 min. The cable dispatches announce that the scientific work that was planned for the expedition was successfully carried out by Mr. W. J. Peters, of the United States Geological Survey.

It should be stated that yet another relief expedition, headed by Dr. O. L. Fassig, of Johns Hopkins University, left London in May in the arctic steamer "Belgica," taking the Greenland route. A message was received from the expedition on August 7, stating that no member of the Ziegler expedition had been seen.

BIDS FOR THE MANHATTAN BRIDGE.

Over two years ago the Bridge Commissioner of this city asked the Board of Aldermen for the necessary appropriation for the construction of the greatly-needed Manhattan Bridge, across the East River. The Board flatly refused to make any appropriation, and, as a consequence, New York city has been subjected to two years of needless delay and untold discomfort. The present bridge engineer, who was responsible for the delay, has designed, or caused to be designed, a new structure, bids for which have only recently been called for. The lowest of the five bids that have been received was $7,255,000 for the superstructure steel work, and this was made by the firm that built the approaches and the suspended roadway of the Williamsburg Bridge. It now becomes possible to compare the cost of the new design with that of the design that was rejected, and the probabilities are that the new structure will prove to be the more costly and that it will take from a year to a year and a half longer to build. If this should prove to be the case (we hope to take up this matter in fuller detail in a later issue) New York city will have had another object lesson in the supreme folly of allowing its municipal engineering works to be made the sport of politics. It begins to look as though, by the time this bridge comes to be opened, which will certainly not be earlier than the year 1910, New York city will have paid the penalty of three or four years' delay and several million dollars expense for which the public at large will receive no compensatory return whatever.

ELECTRIC LOCOMOTIVES FOR THE NEW YORK CENTRAL.

In recent issues, both of the SCIENTIFIC AMERICAN and SUPPLEMENT, we have given illustrated articles on the subject of the elaborate tests that have been made by the New York Central Railroad of an experimental electric locomotive, designed for handling the express traffic within a radius of 35 miles of the New York terminal station. These tests have been carried out on a six-mile stretch of track on the main line of the company's system, west of Schenectady, and they have now been continued steadily for such a long period of time, that the engine may be said to have experienced practically every conceivable condition of weather, load, and track. The data gathered in this way are so eminently satisfactory, that the company has placed orders for electrical equipment, which are said to aggregate over $6,000,000 in value. The order includes thirty-five electric locomotives for the through express service, and 175 cars which are to be used in the suburban service. Each of these engines will weigh about 95 tons and will develop normally 2,200 horse-power, although this amount can be exceeded when it is necessary. They will be carried on eight 44-inch driving wheels, all coupled. Although the draw-bar pull considerably exceeds that of the most powerful steam express locomotives of the day, the concentrated load on the drivers will be considerably less than that on steam locomotives. Each engine will be able to haul at schedule speed a train of about twelve cars, equivalent to a load of about 500 tons. The electric locomotives will be coupled to the main line incoming express trains at Croton, where there will be a running shed and shop conveniences for both the steam and electric locomotives. The expresses will be run into and brought out from New York city entirely by electric power. The same conditions will prevail at White Plains, twenty-five miles out from New York city, on the Harlem division, where the steam locomotives will be uncoupled and the electric locomotives will take their place. It is expected that this equipment will be ready for work within the next twelve months, by which time sufficient progress will have been made with the change of tracks to admit of a partial use of the electrical service.

RAILROAD AND OTHER ACCIDENTS IN THE UNITED STATES.

Accident Bulletin No. 15, of the Interstate Commerce Commission, opens with the following statement: "The number of persons killed in train accidents during the months of January, February, and March, 1905, as shown in reports made by the railroad companies to the Interstate Commerce Commission, under the Accident Law of March 3, 1901, was 232, and of injured 3,713. Accidents of other kinds, including those sustained by employes while at work, and by passengers in getting on and off the cars, etc., bring the total number of casualties up to 909 killed and 14,397 injured." There is probably nothing in all the current literature of the day that the railroad companies dislike quite so much as the modest little pamphlet, published quarterly, from which the above quotation is taken. They claim that the bald statement of losses and injuries, as presented in these bulletins, gives undue and misleading prominence to what, according to their point of view, is merely a detail of the vast operations of our railroad system. They claim, with perfect propriety, that the total number of accidents should be considered in relation to the total number of passenger miles.

During the past few months the technical journals that are specially devoted to railroads have taken up the question from the railroad company's point of view, and are attempting to mitigate the horror of our casualty list by pointing to the enormous number of passengers that are carried without any mishap. The question, however, is not how many do we carry, and how many do we kill, but rather how does the proportion of killed and wounded to total number carried in the United States compare with the proportion of killed and wounded to total number carried in other countries. As everyone knows, the proportion is notoriously larger in the United States.

One of our contemporaries, however, raises an excellent point when he claims that the undue prominence given to railroad accidents is due to the fact that accidents through other means of travel are not officially recorded by the government. The same journal asks whether it would not be advisable to have other commissions appointed to collect and have power to enforce the submitting of statistics of electric railway and street railway accidents, and accidents through the growing use of the automobile. We are so far in agreement with our contemporary that we think immediate steps ought to be taken by Congress to appoint such a commission and empower it to collect statistics of accidents as complete as thos furnished to the Interstate Commerce Commission.

Particularly is it desirable that statistics of automobile accidents should be reported and classified in quarterly bulletins. We are satisfied that were statistics available for the whole of t e United States, the total number of killed and in. red would prove so large as to cause a thrill of horror to pass through the whole nation. Both the general public and the owners and drivers of the automobiles themselves, require the protection that is undoubtedly afforded by governmental supervision of accident statistics. Considerations of humanity alone should prompt Congress to take up this matter as a question that is assuming national importance.

BOMBS FOR HAIL IN SWITZERLAND.

In a note which he recently presented to the Académie des Sciences, M. Vidal shows the efficacy of the new hail-destroying bombs which he has invented. On the first of August of last year, a severe storm which was condensed on the highest summits of the Bernese Alps at altitudes above 10,000 feet, came down through the narrow valley of the Rhone. With great speed it passed across the northeast end of Lake Leman, over the rich plains of the Vaud canton, then ended at the Lake of Neuchatel. All the localities were much damaged by hail, except the small towns of Lonay and Echichens. These were the only places where the bombs were fired into the air, and this seems to be a good proof as to the efficacy of this means of preventing hail. Besides this, M. Vidal brings out a point in meteorology discovered during the storm and hitherto completely unobserved. The clouds seemed to have been banked in, and were only allowed to follow a certain path. It is remarked that all the localities which lay higher than 2,200 feet altitude escaped damage by the storm. We thus have a valuable indication as to the height of the storm-clouds, and it seems certain that they kept at a very short distance from the ground. He considers that even when formed at a high altitude in the upper layers of the air or on the snow-covered tops of mountains, the storms tend to approach the soil, and the more so as they are more highly charged with water or hail. It is due to the low altitude that the rockets and bombs against the hail are so effective. They are easily fired, and explode

in the air at 1,200 or 1,500 feet altitude. He proposes the study of the map so as to find the habitual paths of storms, then to place advance guard posts which protect a certain region by firing the bombs and prevent the rain from changing to hail. The question of protection against storms is a scientific problem and the official observatories could greatly aid in the solution, which is so important in the agricultural districts.

INVENTIONS OF ANCIENT ROME: SOME FORERUNNERS OF MODERN INGENUITY.

BY ALEX. DEL MAR, M.E.

The mechanical and other inventions of the Romans, whether original with themselves or borrowed from the nations they conquered, were so numerous that, in order to describe them, first with the object to note how largely we are indebted to antiquity for the devices now in common use, and second, to derive from these inventions such practical advantages as they may suggest—for some of them yet await adoption—it is necessary to divide and classify them. In this arrangement, the inventions pertaining to agriculture naturally take precedence over all others.

Pliny's boast that "the Roman people has never shown itself slow to adopt all useful arts," is not without a substantial basis of truth. The notion which has been advanced in modern times, that the Romans were steeped in bloodshed, tyranny, and voluptuousness, is altogether erroneous. They were a warlike and pleasure-loving people; but they were also hard-working, industrious, and inventive. The number and prominence of their agricultural publications alone afford ample evidences of their industry. After twenty centuries of social cataclysms, we still possess the treatises of Cato, Varro, Columella, and Pliny, to say nothing of the bucolic almanacs of Ovid, Virgil, Manilius, and others.

One of the most important inventions or adaptations of the Romans was the two-course system, begun with cultivating the land and letting it lie fallow in alternate years, and ended with sowing it alternately with cereal and root crops. The specialization of guano was carried so far as to value the manure of thrushes, pigeons, and domestic fowls and other animals, in the order named. The sowing machine or seed drill is doubtfully credited by Beckmann to Theophrastus; at all events, it is plainly described by Pliny, who also mentions the Rhaetian (Swiss) wheel plow. His measure of a fair day's work for a yoke of oxen for the first plowing, nine inches deep, is an acre, and for the second plowing, an acre and a half; with the wheel plow, about two acres. The machine reaper was another Roman invention. With the scythe, an acre of grass was a fair day's work; with the scythe-chariot, or reaping-machine, four times as much. The grain harvester was a Frankish invention. "In the vast domains of Gaul, a large hollow frame, armed with teeth and supported on two wheels, is driven through the standing corn, the beasts being yoked behind it; the result being that the ears are cut off and fall within the frame." The wine press, which anciently was worked by levers, was much improved by the Greeks during the Augustan period, by adopting the screw. About A. D. 50 this press was still further improved by the Romans, who used thicker plank, reduced the size of the press boards and the height of the screw, and gave the latter more threads.

The city of Rome was supplied with no less than fourteen aqueducts, not necessarily for drinking purposes, because it always had the river, which afforded a copious flood of fresh water, but for the sake of convenience, and especially to supply the baths and drive the water mills, most of which were located under Mount Janiculum. It was these water mills which made Rome a great manufacturing city. They were employed in innumerable arts, and gave rise to endless mechanical inventions and improvements. When, in the sixth century, the Goths laid siege to Rome and cut off the aqueduct water, Belisarius established a series of floating boat-mills on the Tiber, which, being driven by the current, enabled the accustomed industries to be resumed. Grist mills driven by streams, or the wind, were common in the rural districts; the more ancient ones pounding the corn in gigantic mortars, the improved ones grinding it between revolving stones. Not only was flour produced in these mills, but also various cereal preparations, like our breakfast foods of the present day. Among these was one that yet remains to be reinvented. This was alica, a preparation of spelt, which the Roman writers allude to as a great delicacy.

It is not many years since the yeast cake was introduced into America as a novelty; yet it is an invention at least two thousand years old. Here are the words of the Roman encyclopedist on the subject: "Millet is more especially employed to make yeast. If kneaded with must (grape-juice) it will keep a whole year. The same is done, too, with fine wheat bran of the best quality. It is kneaded with white must, three days old, and then dried in the sun, after which it is made into small cakes."

The cultivation of alfalfa, which has made the fortunes of some of our far western farmers, is another "antiquity." It was brought from Media into Persia in the time of Darius, and afterward into Greece and Italy. Medica was its Persian, lucerne its Italian, and alfalfa its Arabian name. Amphilocus, an agricultural writer of Athens, devoted almost an entire work to the culture of this valuable grass; and the Roman writers were scarcely less enthusiastic on the subject.

The silo, for preserving grain in the earth, is evidently an Oriental invention, which, before the Augustan age, made its way westward through Bactria, Pontus, and Thrace to Egypt, Greece, Italy, and Spain. The Pontic name was *siri*. Varro says that wheat, properly stored in dry soil, will keep for fifty years; and millet, a hundred. He mentions an actual instance of beans, which were preserved for a period of more than 220 years.

The same ingenuity that could preserve grain from rotting, protected wood from burning; and this also was a Pontine and perhaps an Oriental invention. Aulus Gellius relates that at a period about a century before the Christian era, Archelaus, one of the generals of Mithridates, painted a wooden tower with a preparation of alum, and thus rendered abortive Sylla's attempt to fire it. Another method of protecting wood from fire is mentioned by the Greek tactician, Æneas, about 360 B. C. The Greeks also invented our roof gardens, and have left us very explicit directions how to construct them. The idea was doubtless taken from the hanging gardens of Babylon, while these again probably came from the Orient. But few things are entirely new. Roof gardens are as much an evolution as steam engines. They both saw the light in halcyon ages; were neglected or forgotten in times of retrogression; and were resurrected, with improvements, in more propitious days.

If now we turn from mechanical inventions to the agricultural products of the Roman period, especially those which are believed to be of modern introduction, we will find among the number esparto, silk, cotton, glucose, champagne, lard, and possibly tobacco. There will probably be no question about the first half dozen of these commodities; the disputable subject is tobacco.

Esparto, which is still largely used in Southern Europe for making sandals, mats, baskets, ropes, nets, sacks, etc., and which for similar purposes might be profitably cultivated in the United States, was known to the Romans as spartum. It was brought from Asia by the Carthaginians, and introduced by them into Spain during the fourth century B. C. At about the same time it was also cultivated in Greece, and employed in making the rigging of their light sailing craft. From these countries it spread to all the intervening ones. The story that the silkworm and the manufacture of silk were introduced into Europe by two monks, in the reign of Justinian, is unworthy of credit. Silkworms were cultivated in the Greek island of Cos nearly a thousand years before Justinian; and a tissue was made from their silk, which was then, as now, known as bombazine. The fact is mentioned by Aristotle and corroborated by Pliny, who remarked that the clinging garments made of it, disclosed almost as much as they concealed. The gossypium, or cotton plant, and manufacture, are fully described by the same author, who, after alluding to the culture of the plant in Egypt, says: "There is no tissue known that is superior to this thread, either for whiteness, softness, or dressing; the most valuable vestments worn by the Egyptian priests being made from it." To confirm his account, abundance of cotton tissues have been found in Egyptian tombs of the Alexandrian age. Glucose, known to the Greeks by nearly the same name, *ai gleucos*, or Always Sweet, and to the Narbonenses as *dulce*, or sweet, was gathered from raisins. "In order to make it," says Pliny, "they keep the grape hanging on the vine for a considerable time, taking care to twist the stalk." In many parts of Europe it is still made in the same way.

When we speak of champagne, it is neither cider, mead, nor perry that is meant, all of which were manufactured by the Romans, and are fully described in the works left to us; but of a wine made from grapes, and rendered sparkling and effervescent by artificial means. "As to wines which have been treated with marble, gypsum, or lime, where is the man, however robust he may be, who has not stood in dread of them?" inquires a Roman moralist. What is this but champagne? Strange as it may seem, this too appears to have been an Oriental invention; for previous to the Roman imperial era, both the Greeks and Egyptians had it. In Africa, says Pliny, it was prepared with gypsum or lime, and in Greece with powdered marble, precisely as is done in many countries at the present day.

Hog lard is invariably referred to by the Greek and Roman writers as *axungia*, or axle grease, that probably being its principal use in countries blessed with an abundance of pure olive oil. It was also largely used for ointments, unguents, and pomades.

It will not be disputed that the culture of tobacco was brought into Europe from America in the sixteenth century; what is contended is that the smoking of pipes is of great antiquity, and was practised in India, China, and Egypt, long before the discovery of America. Pliny mentions the smoking of colt's-foot, "inhaled through a reed," as a cure for a chronic cough. Apollodorus, a writer of the Ptolemaic age, says that: "The barbarians, by inhaling the fumes of the cypiros plant, diminish the size of the spleen. They never go out of the house," he adds, "till they have inhaled these fumes, through the agency of which they acquire strength and vigor." Pliny calls cypiros an Indian weed; says it resembles the ginger plant; that some people chew it; and that it tastes like saffron. All of which certainly suggests tobacco. If the Indian traders of Ptolemy could introduce it no farther west than Egypt, and Oviedo first introduced it from America into Spain, it took nearly two thousand years to carry it from one to the other of these distant frontiers of the empire. It would be a curious subject to inquire what pantascopic changes its soothing influences might have brought about, had the Romans encouraged its use during the interval!

SCIENCE NOTES.

Action of Liquid Air on the Activity of Seeds.—In a memoir read before the Académie des Sciences, M. Paul Becquerel publishes the results of his investigations on the action of cold on seeds, making use of liquid air. The interesting conclusion is reached that the resistance of seeds at low temperatures depends on the quantity of water and gas contained. If the quantity is sufficient, the cold disorganizes the protoplasm and nucleus and renders all return of life impossible. But if the protoplasm has already reached by desiccation its maximum of concentration, or maximum of activity, it escapes the influence of low temperatures, and the seed preserves its germinating power.

Within comparatively recent years, that is, since aniline dyes have almost completely supplanted the mineral and vegetable dyes formerly used in coloring cotton textiles, an extensive demand for castor oil has sprung up in the industry of dyeing and printing cotton goods. Without presuming to invade the intricacies of the dyer's art wherein secret recipes for the composition of colors and their application to cloth are the property of each individual dyer, it may be said that the general principle underlying the utility of this oil in coloring processes is that the aniline and alizarine dyes are soluble in sulphurated castor oil; in other neutral fats and oils these dyes, with few exceptions, are in general insoluble. In certain processes of dyeing and printing, therefore, castor oil enjoys a practical monopoly over all other oils.

The sphere of hygiene may be divided, as it often is, into the two hemispheres, public hygiene and personal hygiene, or it may be cut into one portion dealing chiefly with the human mechanism and its operation (personal hygiene), and another portion dealing chiefly with the environment of that mechanism (sanitation). The time has gone by when any one person can safely undertake to deal with the whole sphere of hygiene. The physiologist and the physician must in the future leave to the architect and the sanitary engineer such subjects as housing, heating and ventilation, water supply and sewerage, precisely as the sanitary engineer has never presumed to deal with foods and feeding, vaccines and antitoxins, exercise, sleep and rest. The former subjects deal chiefly with the control of the environment, the latter subjects chiefly with the control of the individual, and sanitation and hygiene must henceforward be regarded as separate hemispheres of the science of health.

A new apparatus, the "aquameter," has been devised for assisting in the compilation of weather forecasts. In such work it is pointed out that a very important factor is not taken sufficiently into consideration. This is the exactitude of the percentage of aqueous vapor in the approaching winds. The barometer gives some such indication, but the height of the barometer depends on wind pressure and temperature as well as on moisture. The wet and dry-bulb thermometers constitute an antiquated instrument and are not sufficiently reliable, as their variation depends on erratic circumstances and their indications are not represented in actual percentages of aqueous vapor. Rain results when an atmosphere nearly saturated with aqueous vapor becomes lowered in temperature. The nearness or otherwise of a wind to its saturation point, is, therefore, a most important question. It has had to be determined hitherto by recourse to elaborate apparatus, including a chemical balance, and, therefore, out of the usual province of a meteorologist. By using the aquameter, however, which is a simple instrument, the exact percentage of aqueous vapor can be obtained. By the opening and shutting of two taps and the raising and lowering of a mercury reservoir, a measured quantity of air is drawn into a glass vessel, and placed in contact with anhydrous phosphoric acid which is a rapid water absorbent. The rise of mercury in the narrow glass stem of the vessel then gives the exact percentage of the aqueous vapor in the air.