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THE BERDAN TWIN TORPEDO.

The Berdan system of torpedoes, illustrated and described elsewhere in this number, is both novel and interesting. As will be seen, it consists of sending twin torpedoes against an enemy, and is especially devised for service where torpedo netting is used as a protection. Its inventor claims that it possesses the accuracy of the best models now in use, while, unlike them, it cannot be thwarted in its purpose of destruction.

If Gen. Berdan can make good this claim, the science of attack in naval warfare will have been materially advanced, and, where his system is in use, the biggest warship be compelled to keep to the high seas.

It is difficult, however, to see how he can sustain his assertion that his system embodies the virtues without the fatal defects of the systems now in use.

The successful operation of the two torpedoes—supposing them to be safe from shot fired from the vessel, by being submerged—depends upon the continuous and perfect working of several mutually dependent parts, the failure of any one of which would render the attack abortive. The system resembles a train of wheels—one imperfect tooth stops the whole.

Again, the torpedo netting can be made to protect the bilges as well as the sides of a vessel. It is arranged at present to stop the ordinary torpedo, but it could readily be made to swing off from both sides of the anchor chains, encircle the ship, and be lashed to a floating bit swinging to a bridle in tow astern. In fact, the general use of such a torpedo would compel a remodeling of the torpedo netting. That seems to be all.

The nature of the twin torpedo, that is to say, a pilot torpedo towing another at the end of a line, would positively forbid an attack being made by means of it from any direction save with or against the current. For it will be readily seen that however straight a course the pilot may steer, the second torpedo must make leeway when towed athwart the tideway. This would, of course, serve to make its aim uncertain when close aboard the enemy, and there is reason to believe that it would be more likely under such circumstances to fetch up broadside on rather than nose on. But, if it can only attack with or against the current, it can only hope to strike the bow or stern of the enemy, for vessels invariably swing to the tide or current, and consequently it can only attack the two smallest surfaces, those most easily defended, and where the chances of miscarriage in its aim would be the greatest.

To attack at slack water would be too nice a calculation to offer any promise of success. The weight and dimensions of this torpedo would also seem to be against it when working in a heavy seaway, for there would be times when the pilot would be caught in the roll, and made to stand on end and constantly lose its course, while, were it made larger, it would offer a greater surface to attract the aim of the gunners, and consequently have less chance of bringing its convoy up to the enemy.

AMERICA TO KEEP THE CUP.

The great International Yacht Race between the Puritan and Genesta has finally been accomplished, and the victory of the sloop at both trials leaves the cup still in America's possession. The greatest interest has been manifested on both sides of the water over the result of this contest, and when it became known that on two occasions the Puritan had proved herself the faster boat, the general enthusiasm seemed to reach all classes of people, and on this side of the water at least to cause great rejoicing.

As most of our readers know, the race was to be awarded to the yacht making the best record twice out of three times; and as both trials gave the victory to the Puritan, the third or 40 mile triangular race was not deemed necessary.

After four ineffectual attempts to sail a race, the first came off on Monday, the 14th, over the inside course of the New York Yacht Club, from Owl's Head in the Narrows between Staten and Long Islands to the Sandy Hook Light Ship, and return to the buoy off Fort Tompkins, on Staten Island, a total distance of 38 miles. The wind was light until Sandy Hook had been passed, and the conditions generally were regarded as slightly favoring the Puritan, as the Genesta is thought to sail under greater advantage when the sea and wind are somewhat heavy. The Puritan kept ahead from the start, making the course in 6 hours 6 minutes and 5 seconds, thus beating her rival 16 minutes and 19 seconds corrected time.

As the Genesta cracked her masthead cap in the first race, the second trial did not take place until Wednesday, the 16th. This was over the outside course from Scotland Lightship to the turning buoy, 20 miles to the southeast. There was a lumpy sea and strong lower sail breeze that made the friends of the Puritan who had never seen her in heavy weather somewhat doubtful about the result.

Though the sloop was not as well sailed as the English cutter, she made the course of forty miles, beating half the time against a heavy sea, in 5 hours 3 minutes and 14 seconds. When the turning buoy was reached, the Puritan was decidedly behind,

but she made up the intervening distance on the home stretch, coming in 1 minute and 38 seconds ahead of the Genesta, and making the closest race, over so long a course, that has ever been sailed. The opinion prevails in Boston that though we don't build many boats, we build them pretty well. The Genesta has won in the race for the Commodore Cup, but the future of the Puritan is undecided, as she is to be sold shortly at auction.

Though the race is ours, its principal object—to determine which boat is the better model—does not seem to have been gained, for one cannot call a forty mile race conclusive where the rival yachts cross the line within two minutes of each other, even making all due allowance for the reported bad handling of the winner. Another trial over the triangular course would have left impartial judges better satisfied.

EXAMINATIONS OF BEER.

The New York State Board of Health recently sent to the brewers in this vicinity for samples of their beer for purposes of analysis. These analyses are complete, and the Board finds that the beer sold hereabout is of excellent quality. What the Board really means must be that the beer brewed hereabout to stand analysis by State boards of health is of excellent quality. The brewers, we are told, are well satisfied with the fair manner in which the Board has conducted the examination.

This is not at all astonishing. It would be very surprising, indeed, if they were not satisfied, for they could scarcely attain better results had they made the examinations themselves.

The only people that will be dissatisfied with the way the Board has conducted their examinations will be the general public, or at least that portion of it which drinks beer and ale. These will be apt to regard the Board's efforts to discover bad beer as being more novel than effective.

Yet much was to have been expected from the act of last winter. This act was, in reality, an amendment to the already existing law relating to the adulteration of food and drugs. It was made to include spirituous, fermented, and malt liquors, and was deemed necessary by reason of the discovery of a very general adulteration of the articles specified. So far as beer is concerned, it was found that the existing rivalry among the brewers was leading to a cheapening, not only of processes of manufacture, which is not necessarily unlawful, but also to the use of inferior and even unhealthful ingredients. Lager beer, as its name implies, is beer that has been kept in store or lager, and is really quite unfit to drink immediately after being brewed. Nevertheless, it is very generally sold to the public in this condition; the brewers saving themselves the expense of from three to six months' storage by means of a process which they have discovered of artificially aging or maturing their beer.

When hops were dear, they substituted glucose, and though glucose is an entirely healthful ingredient, it may scarcely be regarded as a proper or natural constituent of lager beer; and now that hops, which fetched \$1.25 per pound but a year ago, are a drug in the market at 15 cents, there would seem to be no excuse for using a substitute. Private analyses which have been made of lager beer sold hereabout show a very general use of grape sugar and glucose where the ash, and especially the phosphoric acid, is low as compared to the extract; and the excess of carbonates which they contain are said by the authorities to indicate the use of bicarbonates. The extract of catechu, used in some cases as a substitute for hops, though not necessarily injurious, may, under certain conditions, really prove so.

It may be set down as a rule that to secure a really good beer there should enter into the composition good water, good malt for body, good, sound hops for flavor, good yeast for fermentation, and plenty of time should be given it to age and mature.

In order to learn what was being done in this matter by the New York City Board of Health, the writer called at its office at Police Headquarters. Dr. Cyrus Edson, a careful and experienced man, said that so far he had devoted himself to the mode of drawing beer in the saloons and beer halls, for in this there was even more danger to the public health than was likely to be found in the adulteration of the beer. Lead pipes, he said, were generally used in drawing the beer from the cellar to the tap, a pernicious practice that often led to making really good beer injurious to health. He showed the writer a long copper spigot or tap similar to those in general use, and which he had taken out of a beer saloon. He had had it cut through lengthwise, in order to exhibit the corrosion that had taken place from the constant presence of beer. Its interior was a mass of corrosion, green and spongy. Beer, he said, which passes through such a spigot must always be more or less injuriously affected, that which remains the longest being, of course, the most contaminated. The first person who calls for beer in the morning, where such a spigot is used, would get beer which has stood all night in these poisonous surroundings. In other words, he would

get beer that is absolutely poisonous. Asked why the brewers continued to use glucose when hops are so cheap, Dr. Edson replied that it was because they had become used to it, and to use hops would compel them to change their processes, which might entail considerable trouble and expense. The fact seems to be that the demand for beer has grown at such a pace—it was 6,000,000 gallons last year—that at from \$8 to \$9 a barrel the brewers can readily dispose of all they make and no questions asked as to how long it has lain in store or lager. A few weeks' keeping and an application of the process of artificial maturing, and it is distributed and ready for the consumer; while in the Old World both the law and the taste of the beer drinker would compel the brewer to keep his beer in cellar for from four to eight months.

Jumbo's Tragic Death.

After a career quite unparalleled in elephantine animals, Jumbo, the greatest of his family, has departed. The immense animal, the largest in captivity, had just been exhibited at St. Thomas, Ontario, on the 15th, and was being led along the railway track with Tom Thumb, the baby elephant, to be loaded into their respective cars, when a heavy freight train, running at the rate of forty miles an hour, bore down upon them. As soon as Jumbo saw the train, he made a rush for Tom Thumb, and grasping him in his trunk, threw him away across the tracks as easily as if he had been a kitten. Jumbo then tried to save himself, but it was too late, and he was crushed to death between the engine and the cars on the siding. The poor beast's devotion was unfortunately wasted, for Tom Thumb's leg was broken, and he had to be shot the following day. The engine and several cars of the colliding train were thrown from the track.

Jumbo was about twenty-five years old. His earliest appearance in polite society was as a baby elephant, at the Jardin des Plantes in Paris, but, when three years old, he was given in exchange to the London Zoological Garden, where, for almost nineteen years, he was the children's most favored pet. In 1882, Mr. P. T. Barnum purchased him for \$10,000, but various lawsuits increased the cost to \$80,000 before the animal could be brought from England. The news of the sale caused great consternation among the little people of the metropolis, and even some of the older Britons, Ruskin included, entered a protest against the transfer. Jumbo's huge body weighed 7½ tons, and he stood 11½ feet high. His skeleton will be preserved at the Smithsonian Institution and his hide at Tufts College. Jumbo's name was known all over the country, and during his three years in America he made many friends, who will mourn with his disconsolate keeper over his untimely fate.

Opening of the Novelties Exhibition, Philadelphia.

The Novelties Exhibition, under the management of the Franklin Institute, was formally opened on Tuesday the 15th, at the building situated at the corner of 32d Street and Lancaster Avenue, in West Philadelphia, where the Electrical Exhibition was held last year. The managers tried very hard to have all the exhibits in place at the time of opening, but this attempt of what in itself would have been a great novelty was not successful.

The exhibition will not be of so much importance scientifically as the electrical display of last year, but it promises to be of much greater popular interest. The Institute has carefully excluded everything that is not novel, and has limited that term to inventions made since 1876. The display covers a wide range in science and technology, since the admittance was limited by only the one consideration, that the exhibit should be unique. One of the most striking exhibits will be that of the De la Vergne Refrigerating Company, of New York, who will show a large iceberg in the center of the building, where the fountain stood last year. It is proposed to freeze the fountain just as it would appear if flowing at ordinary temperatures. To accomplish this, coils of pipe are introduced into the water, and a powerful freezing mixture made to circulate through them, in order to generate and maintain the necessary cold. This part of the exhibition was delayed several days on account of an accident to the "pickle tank," which inconveniently sprung a leak. When the ice mountain is complete, and illuminated by electric lights of various colors, the effect cannot fail to be very beautiful. The value of such spectacular attractions was demonstrated by last year's experience. The real wonders of the Electrical Exhibition were appreciated by very few of the many visitors whose attendance made the enterprise successful, yet the general effect of the whole affair, and the party-colored illumination of the fountain and shrubbery, served to attract a large crowd of people.

The display of the Women's Silk Culture Association will also be attractive. It will show a number of modern looms in operation, and will weave ribbons, embroideries, and other souvenirs.

The large and popular field of photography is also well represented, together with its kindred art of chemical engraving. There will be a good collection of iso-

chromatic photographs, illustrating the correct reproduction of colored images.

From the partial lists which have already been published, there will be apparently few lines in modern technology in which the visitor will not find something of interest. There is some talk of making the display a permanent one, and of establishing, in connection with it, an industrial exchange for the sale of new devices.

It is too soon to comment upon the wisdom of such a proposition, but as a rule crystallized exhibitions have not proved successful.

Apparent Resistance of a Body of Air to a Change of Form under Sudden Compression.

COMDR. THEO. F. JEWELL, U.S.N.

In some recent experiments on the explosion of gun-cotton at the U. S. Torpedo Station a phenomenon has been observed which, it seems to me, can only be explained by supposing that atmospheric air, when subjected to sudden and violent compression, acts like a rigid body.

The gun-cotton employed in these experiments has been first converted into pulp by the ordinary processes of making paper pulp, and then compressed into cylindrical cakes or disks, 3½ inches in diameter and 2 inches thick, in a hydraulic press, with a pressure of about 12,000 pounds to the square inch. In the press each disk has imprinted upon one of its faces the letters U.S.N. and figures 1885. These letters and figures are one centimeter in length. They are not in relief, like the markings on a coin, but are depressions in the disk, about one millimeter deep. Through the axis of each disk is a hole, into which is introduced the charge of fulminate of mercury which is used to detonate the gun-cotton.

When such a disk is placed upon a wrought iron plate, with the marked face in contact with the plate, and detonated, there is left upon the iron a depression somewhat greater in diameter than the disk and deeper toward the center than on the edge. Within this depression are found clearly and deeply stamped upon the iron, as though by a punch, the letters and figures of the disk, while the position of the hole in the disk is marked by a still deeper depression.

In view of the fact that since my arrival at the meeting I have found, in conversation, that the true technical distinction between an ordinary explosion and a detonating explosion, such as takes place with gun-cotton, seems not to be clearly recognized, I want to point out that detonation differs from an ordinary explosion in that it is a chemical change that takes place, if not simultaneously, certainly with immeasurable rapidity, throughout the whole mass. In the explosion of gun-powder the chemical action goes on with comparative slowness; but in the explosion of nitro-glycerin, gun-cotton, and their derivatives, the explosion is an upsetting of all the molecules of the mass at the same instant. It is of even a higher order of rapidity than the transmission of a blow through a set of ivory balls, with which we are all familiar.

The products of the explosion of gun-cotton are all gases, and these gases are heated to a very high temperature by the chemical action which takes place. The change from the solid to the gaseous state taking place simultaneously throughout the whole mass, the resulting pressure is enormous. I venture to suggest that when this enormous pressure is applied instantaneously to the air inclosed within the markings on the gun-cotton disk, the air acts like a hard body, and is driven into the iron. As is well known, in the use of the high explosive no "tamping" is necessary, the atmosphere acting as an envelope to the charge. I believe the fact that gases do resist a change of form under suddenly applied pressure has been demonstrated heretofore, and this phenomenon has been investigated by Stokes, Maxwell, and others, but it has never occurred to me that this resistance to a change of form could be as great as seems to be the case here. At any rate, the results which I offer will doubtless be interesting and suggestive. [From a paper recently read before the American Association, Ann Arbor, Mich.]

Superstitions Concerning Eclipses.

From time immemorial, and to the present day, most peculiar ideas have been entertained in different parts of the world about eclipses and their cause. The Hindoos believe that a black demon seizes the moon with its claws, and as long as darkness prevails, the air is filled with lamentations, men, women, and children entering the rivers, where they remain up to their neck in water until the return of light.

The Siamese priests (talapoints) believe that when the moon is eclipsed a great dragon is devouring it, and in order to oblige him to let go his prey they make all sorts of abominable noises.

The Chinese, like the Laplanders, are convinced that an eclipse is the work of demons, and make a great hubbub to frighten them away.

The Romans believed the eclipses to be the work of magicians, and that a great noise could prevent them from hurting the moon. Plutarch says that Aglaonice, during an eclipse of the moon which she had predicted,

persuaded the women of Thessalica that by her magic songs she had not only the power to darken the moon, but to oblige it to descend upon the earth.

The Greeks, and the inhabitants of Asia Minor, stood in such awe of eclipses that, according to Herodotus, in the year 610 B. C., while a battle between the Lydians and the Medes was raging, an eclipse of the sun occurred, as predicted by Phales of Millet. It not only put an end to the fight, but the contending parties hastened to make peace, cementing the treaty by the marriage of Aryenis to Astyages.

If we now turn to America, we find that the Peruvians, Mexicans, and others stood in great awe of the phenomenon. The Peruvians particularly dreaded the eclipse of the moon; they imagined that Luna was suffering from one of the mysterious diseases to which she was supposed to be subject, and feared that the queen of night might burst open and fall upon them. To avoid such a terrible calamity, and awaken her from her lethargy, they would sound loud instruments, shout at the top of their voices, and beat the dogs to make them howl.

The Mexicans imagined that eclipses occurred in consequence of a family squabble between the sun and the moon, and that the moon was wounded in the fray. The frightened men observed rigorous fasts, the women inflicted corporal punishment on themselves, and young girls drew blood from their arms.

In Yucatan, the most interesting State of Mexico, the descendants of the Mayas are convinced that when Luna loses her brilliancy, she has sickened in consequence of being bitten by some large and very spiteful ants called *Julabs*, and that they will devour her if she is left without help. To frighten away her enemies they beat drums, blow shell trumpets, shout, beat their dogs, pinch the cats' tails, and fire rockets and guns toward the moon.

The American Institute Fair.

The entries for the fifty-fourth annual exhibition of the American Institute, which opens on Wednesday, September 30, are already exceptionally numerous, and indicate that many novelties will be shown. This is particularly the case in the machinery department, where electric, steam, and compressed air motors of novel construction are promised. Something new in the way of sewing machines and various other labor-saving devices will be exhibited. One of the prominent attractions will be a combination organ, which can be played automatically, or by the use of the ordinary key board, either separately or together, thus enabling the organist to play a given tune while improvising variations at the same time.

The flower show will be a special innovation, and will continue only during the opening day and the remainder of the week. Among the horticultural novelties will be a collection of "calladimus" of unusual size and foliage. Special medals of excellence are to be given in addition to the other prizes for the best seedling carnation and the best seedling dahlia.

Zinc in Plants.

The presence of zinc in plants has been repeatedly observed, and not only in such as grow near deposits of zinc ores, but also, though in minute quantities, in plants where no zinc could be traced in the soil. From a number of experiments the author found that the injurious action of zinc sulphate in solution was more considerable than it had been assumed. In solutions of 1 mg. zinc per liter all plants vegetated undisturbed, while with 5 mg. per liter all perished. Old plants of any kind died more rapidly than young plants. Insoluble compounds of zinc in the soil—such as zinc oxide, sulphide, and carbonate—have no perceptible action. The poisonous action of zinc on plants seems to depend on the destruction of the chlorophyl.—*Anton Baumann.*

BOXWOOD, which is almost exclusively used for wood engraving, is becoming more and more scarce. The largest wood comes from the countries bordering on the Black Sea. The quantity exported from Poti direct to England is immense; besides this, from 5,000 to 7,000 tons of the finest quality, brought from Southern Russia, annually pass through Constantinople. An inferior and smaller kind of wood, supplied from the neighborhood of Samsoun, is also shipped at Constantinople to the extent of about 1,500 tons annually. With regard to the boxwood forests of Turkey, the British Consul at Constantinople reports that they are nearly exhausted, and that very little really good wood can be obtained from them. In Russia, however, where some little government care has been bestowed upon forestry, a considerable quantity of choice wood still exists; but even there it can only be obtained at an ever-increasing cost, as the forests near the sea have been denuded of their best trees. The trade is now entirely in English hands, although formerly Greek merchants exclusively exported the wood. In the province of Trebizonde the wood is generally of an inferior quality; nevertheless, from 25,000 to 30,000 cwt. are annually shipped, chiefly to the United Kingdom.—*The Garden.*