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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1026.

For the Week Ending August 31, 1895.

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

It is now forty-five years since this important association held its first meeting, under the presidency of Professor Edward Hitchcock. That was in Philadelphia, where the next meeting also was held. Annual meetings have been held ever since, in Boston, New Haven, Cincinnati, Albany, Cleveland, Washington, Montreal, Indianapolis, Toronto, Rochester, New York, Brooklyn, and other cities, mostly in the Northern States, although it was originally intended to alternate between the North and the South. One reason for the preference for the cooler latitudes is that it has been found necessary to hold the meetings during the summer vacation in order to accommodate the members connected with colleges and schools.

There are now 2,000 members enrolled, including nearly every eminent scientist in America, besides many persons who would claim only to be friends of scientific aims and pursuits. The attendance on the annual meetings varies from 200 to 1,000 members, besides the large number of casual visitors attracted to the public lectures and social entertainments. It is eminently a popular organization, aiming at the "advancement of science" by influencing the minds of the multitude, and seeking to stimulate scientific research far beyond the bounds of its limited membership.

It is now fifteen years since the A. A. A. S. has met in New England, although its official home is at Salem, Mass., and it was incorporated by a special act of the legislature of Massachusetts. It seems appropriate, therefore, that this year its anniversary should be held in the charming city of Springfield, where it convenes from August 28 to September 5, with excursions to follow and with affiliated societies meeting both before and after. At first the discussions and papers were all in general session. But as the work broadened it was found necessary to divide into nine sections, representing Mathematics and Astronomy, Physics, Chemistry, Mechanical Science and Engineering, Geology and Geography, Zoology, Botany, Anthropology, and Economic Science and Statistics. Even this subdivision was found to be insufficient, and the affiliated societies referred to were formed, namely, the Geological Society of America; the Society for Promotion of Agriculture; the Entomological Society; the Society of Engineers: the American Chemical Society; the American Forestry Association; the Association of State Weather Service, and the Botanical and other clubs, all of which usually meet during the association week.

Yet daily general meetings are held, for the election of officers, hearing of reports, and transaction of general business. Two or more free evening lectures are also given complimentary to the citizens of the locality, and there is free admission to the public addresses made by the president and the vice presidents.

The citizens of Springfield have made ample preparations for welcoming the large body of scientific guests who are expected this week, and many plans have been laid for their entertainment. The general sessions are held in the Y. M. C. A. building; the presidential address will be given in the Court Square Theater; and the general reception will be in the City Hall. The hotel headquarters are at the Worthy Hotel. Various neighboring cities have extended invitations and arranged for excursions enabling the guests to visit many points of scenic, historic, or scientific interest.

THE LESSONS OF THE BATTLE OF THE YALU.

The current number of the Century contains a graphic account of this battle, written by an eyewitness and active participant, Philo N. McGiffen, who was in command of the battle ship Chen Yuen on that memorable occasion. He disclaims all intention of giving a technical account of the action, and wishes his readers to regard the description as a series of vivid impressions, received in the midst of five hours of the most terrific artillery duel the world had ever seen. Whatever may have been the writer's intention, he has certainly given us a series of war pictures that are not merely fraught with tragic interest to the lay reader, but are also full of valuable lessons for the future guidance of the professional naval designer.

For the past forty years, or ever since armor was first placed upon a warship's sides, the science of warship design has been almost entirely theoretical. The nations of the earth have poured their wealth like water into the naval treasury, and the naval boards have spent it faster than it came to hand. Huge navies have been created on purely theoretical lines, and just how far these theories were correct and just what was the relative value of the many and diversified types of ships, guns and armor, no one, not even the experts, could tell.

It is true there had been a naval fight at Lissa, in which the ram, that classic weapon of Greece and Rome, had demonstrated its deadly power; it is true that the Chile-Peru war has produced one memorable sea fight in which gun contended with armor; and again, in the sinking of the Blanco Encalada, the torpedo, under modifying circumstances, showed that theory had proceeded along the right lines and had produced a weapon of appalling destructive power; but yet, taken for all in all, the experience gained had been very meager, in comparison to the thousand and one questions that were awaiting solution.

This solution was expected to come in the breaking out of the long-expected European war. To the surprise of every one, it was in the East, and not in the West, that the test was made. It was the semi-civilized races of the East that taught the Western nations the true value of their modern guns, ships and armor.

It has been contended that the test is not conclusive; that on the part of one, at least, of the combatants there was too much cowardice, irresolution and general incompetency, to render the results of much technical value. But we think that any one who reads this account by an eye-witness of the cool, dogged bravery of the Chinese gunners above deck and the Chinese engineers below deck; the one decimated by a murderous tempest of quick-fire shell, and the other slowly roasted in an engine room temperature of 200° (see description), we think that any reader must admit that the two Chinese ironclads were fought for all there was in them, and that the results of the fight furnish us with reliable data for future designs.

The chief interest of the battle centers in the two Chinese ironclads and the principal squadron of the Japanese. They fought out the fight all to themselves; the flying squadron of the Japanese, consisting of the lighter and swifter cruisers, directing their attention to the lighter armed Chinese ships. It was just such a test as the naval world had been looking for—swift, unarmored or lightly armored ships against slower but heavily armored battle ships. The four ships constituting the principal squadron were armed with one 12½ inch gun placed forward, amidships, in an armored barbette, and a secondary battery of lighter quick-fire guns. This 12½ inch gun is, in some respects, the most formidable gun afloat. Built by Canet, in France, it has extreme length, great velocity, and has a theoretical penetration at the muzzle of 50 inches of iron! Theoretically, the shot from this gun should have ripped the Chinese ships from end to end, and have pierced their 10 inch and 14 inch armor like so much cardboard. What are the facts? Says Commander McGiffen: "We were struck both on the 14 inch belt and 10 inch conning tower by the 12½ inch shells," but "no shot penetrated more than four inches." So that, if this be true (and the authority, surely, places it beyond question), the comparatively light and somewhat out of date armor of the Chen Yuen had about 70 per cent of resisting power to spare against the most powerful penetration of modern ordnance!

This proves to us what the writer has long believed, viz., that penetration as shown at the proving grounds will always be vastly in excess of the actual penetration in time of battle. The test shot is always fired normal to the plate, but in action not one shot in one hundred will strike normal to the plates on the curved, oblique, or spherical armored portions of a battle ship. With every degree of deviation from the normal at the point of impact, the shot has to travel that much further to pass in a diagonal line through the plate; and there is an extreme angle at which it will refuse to "bite" at all, and will glance away, inflicting comparatively little damage. Unquestionably this is what happened in the majority of cases where the shots struck the armored portions of the Chinese ships.

Another lesson of the fight is that a heavily armored barbette, placed high above the water line, and resting upon a light unarmored substructure, is a mistake. The opponents of this system of construction, which is to be found in the Admiral class of Great Britain's navy, and in the turrets of the 8 inch guns in our own battle ships Indiana and Oregon, have claimed that a well-directed shell, placed beneath the floor of these barbettes, would wreck the whole gun and mountings, and disable the gunners. This is precisely what happened when the Chinese Chen Yuen, by a well-directed shot at 1,700 meters from her 12 inch gun, killed 49 and wounded 50 men on the Japanese Matsushima, and totally disabled her 12½ inch gun, which was mounted as above described.

Though the heavy guns fell so far below their theoretical effectiveness, the larger class of quick-fire guns, the 4·7 inch and 6 inch, proved to be fully as terrible in their destructive effect as was anticipated. At distances varying from 1,000 to 3,000 meters they poured in a perfect tempest of armor-piercing shells, against which the light 1 inch and 2 inch shields of the Chinese were worse than useless. It seems that these light shields are a positive source of danger to the gun crews they are supposed to protect. Too weak to keep out the quick-fire shells, they are yet stout enough to give the percussion necessary to explode the shells that pass through them. These shields thus became, in the words of Commander McGiffen, "veritable man-traps." They simply inclosed the flying fragments of the bursting shells, and concentrated their destructive effect. So fully alive to this danger were the Chinese

commanders, that they actually removed the 30 foot circular one inch shields that covered the barbettes; claiming that they would only serve to intercept and explode shells which otherwise would pass harmlessly overhead. These shields were designed to keep out the smaller machine gun shot; but as the fight was carried out at long range, "the value of shot smaller than 3 lb." was "questionable" at least under such conditions. The value of superior speed was clearly established. The Japanese ships, with their 17½ knots speed, simply played with their slower antagonists, and appeared to have followed out their own plan of tactics at will. They came down diagonally on the Chinese fleet, in line ahead, at 12 knots speed; the forward half circling round the right flank of the Chinese line and returning along their rear. Thus they had the long-drawn-out Chinese line of battle between two fires. Their formation was soon broken; and the two Chinese ironclads, like lions at bay, were the center round which the Japanese principal squadron circled, sweeping them with a murderous fire at long range.

Superior speed is to the modern warship what the weather gage was to the frigate in the days of sail-driven ships—it gives the power of accepting or refusing battle. The faster ship can choose her position, and place herself at what range she pleases. The Japanese ships fought at long range, and thus neutralized the superior advantage afforded by the heavy armor of the enemy as compared with their own lighter protection.

It was also clearly shown in this engagement that the use of wood, or any combustible material, in the construction of a fighting ship, should be kept down to the lowest possible limit. Time and again the Chinese ships were set on fire by the quick-fire shells that came aboard; and the crews had to leave their guns and fight the flames that broke out continually from the wooden partitions and deck houses. Decks, cabins and passageways will in future be built of light plating—or at least such parts of them as lie above the water line. In the meetings of the Naval Institute of Great Britain it has often been urged that the first naval battle would show that the fight would be won by destroying the crew and not the ship. The event has proved the surmise to be nearly correct. Much of the so-called gun protection was no protection at all; and gun positions were rendered untenable by the fearful hail of fifty pound and ninety pound quick-fire shells that swept them. Much of the weight that is now devoted to guns might with advantage be devoted to the encircling of fewer guns with heavy six-inch shields and casements. Five guns with effective protection are better than ten with none, or next to none.

There was one cause of fatalities on the Chinese ships that was certainly unexpected and unprovided for. It appears that the conning tower was situated high up and between the barbettes. Many of the shot that rebounded from this tower fell into the barbettes; and more of the crew were disabled in this way than by the direct fire of the enemy.

In conclusion, summing up, we may say that the modifications to be looked for in future designs are:

1.—A more extended use of stout side armor, with a tendency to carry water line armor completely fore and aft; as in the French and Russian ships.

2.—In the case of armored barbettes or turrets, the extending of the armor down to a connection with the water line belt; so that the protection from axis of gun down to water line may be complete.

3.—Fewer guns with heavier shields.

4.—The elimination of all wood or combustible material from the construction.

5.—As far as compatible with the above desiderata, an increase in the speed. J. B. W.

Cycle Notes.

While the American manufacturers contemplate increasing the size of bicycle tires on the '96 models, the English firms intend to adopt the reverse style. An English manufacturer in speaking of the tire question says: "If anything, we shall reduce the size of our tires, and with very good reason, I think. On theory the larger sized tires ought to be more comfortable, but in practice I do not think they will generally be found so. Large tires mean added weight, and that, too, just where it will detract most from speed. For general road work during the past season we have used 1¾ inch tires mostly, and for light wheels 1⅝ inch. The indications are that next season will see 1⅝ inch tires used very freely and 1½ inch used for the light wheels."

In a Wisconsin village a funeral procession was very largely made up of men and women on bicycles, the deceased having been a member of the bicycle club.

The two advantages claimed for tandem bicycles are the absence of vibration when riding over a rough road and the ease with which two riders can propel the machine against a head wind.

The various trade papers devoted to cycling have a total circulation of over 100.000. Among them are the following: Bearings, Cycling Life, the L. A. W. Bulletin, and the Referee; these are all published in Chicago. In New York City we have the Bowling and Cycling Gazette, the Wheel and Cycling Trade Review, and the American Wheelman and Cycle Trade Gazette. The Wheeling American is published at Nunda, N. Y. In Philadelphia are published American Cycling and the Cycle Guide. The Bicycling World is published in Boston, and the American Cycle in Hartford, Conn. The Wheelmen's Gazette is published in Indianapolis, Ind. The Michigan Cycle at Grand Rapids, Michigan. The Western Sportsman and Bicycle Reporter, Kansas City, Loose Spokes is published at Moorestown, N. J. The Pneumatic is published at Milwaukee, Wis., and the L. A. W. Pointer at Oshkosh. Farther West we have the Cycling and Sportsman, which is published at Dallas, Tex., the Cycling West, Denver, Col., and the Northwest Sportsman and Cyclist, Portland, Ore. In Canada there is the Canadian Wheelman, published at Simcoe, Ont., and Cycling, which is published at Toronto, Canada. The Wheelwoman, which is conducted by Mary Sargent Hopkins, is published at Boston, Mass., and is one of the latest additions to cycling periodical literature. It is a very handsomely gotten up monthly.

Belgium wheelmen are not only taxed, but they must at all times carry with them their tax receipt, so that they may be able to show the same to any inquiring official.

A new tire has been invented, called the ball-bearing bicycle tire. The objection to the ordinary tube tires is that a puncture in one place destroys the usefulness of the whole tire until the puncture is repaired. The new tire consists of a closed rubber tube, filled with hollow elastic balls of the same diameter as the internal diameter of the tube. These balls are vulcanized and inserted in the tube during the process of manufacture. The tube may first be vulcanized, however, and the balls inserted through an opening which is afterward closed. It is said that additional elasticity and rigidity is imparted to the tire by the insertion of these hermetically sealed elastic balls, and, as each ball is an independent cushion, it would require puncture of several balls to make the tire useless. Another curious pneumatic ball tire has been patented in England, substituting for the continuous tubular tire a series of rubber balls, set in cups at the outer end of the spokes; the balls are so arranged that they may be simultaneously inflated. Several advantages are claimed for this device, one of them being that no serious inconvenience will follow the puncturing of one or two of the balls. It is also claimed that there is a great saving of ground cohesion, and this will increase the ease and speed of propulsion.

Atlanta Exposition Notes.

The electric fountain will compare with that of the Chicago Exposition. The water will rise 180 feet and will flow at the rate of 150,000 gallons a minute.

The forestry exhibit promises to be the most complete and instructive ever made by the government, exceeding in excellence, though not in size, the exhibit at Chicago in 1893. The wide range in the use of wood in all phases of human life will be shown. Large panels are already hung on the pillars of the building, each representing one particular line of use; as, for instance, wood in the kitchen, wood in the laundry, in sports, in the garden, in tools, etc.

The lumber exhibit will be so complete that any one may trace the growth of the tree through various stages, learn its adaptability to various commercial uses, its value, durability, comparative worth for special uses, etc.

Remarkable Railway Speed in Great Britain.

LONDON, August 23.—The London and Northwestern Railway Company's new fast train between London and Aberdeen, which left London at 8 o'clock p. m., August 22, arrived at Aberdeen at 4:32 o'clock a. m., August 23. Part of the journey of 540 miles was covered at the rate of seventy-five miles an hour.

This eclipses anything before recorded. To make this time, the average speed maintained must have been 63·47 miles an hour, including all stops.

No American railroad can show anything like this for long runs, although on short runs better time has been made.

On the New York Central the best time has been 436½ miles in 439½ minutes, including stops.

St. Louis' Speed Test.

The speed made by the St. Louis, August 20, on her official speed trial in the English Channel for acceptance as an auxiliary cruiser in the United States navy resulted in her showing a sustained speed of 22·3 knots per hour.

When she went into the dock at Southampton, prior to this trial, it was found that the bottom was in a very foul condition, being covered with grass a foot long. The St. Louis by her present performance wins a mail-carrying contract for ten years, at the rate of $4 per mile of a weekly service between New York and Southampton. The contract to take effect October 12.

Fascination by Snakes.

BY HAROLD S. FERGUSON, F.L.S.

No error is apparently more rooted in the human mind than that which attributes to snakes a peculiar power called "fascination," which they are believed to be capable of voluntarily exercising. By this power they are said to be able so to paralyze their victims that they are rendered utterly incapable of movement, and wait for the attack of a snake, or even go forward to meet it, in fear and trembling, but without any power of retaliation. Now any one who watches the behavior of small animals placed alive as food in the cages in which snakes are kept in captivity, in the hope of seeing this marvelous power in operation, will be grievously disappointed; chickens, rats, guinea pigs, rabbits, all move about with an utter absence of fear of the snakes. It may be said that all these are more or less domesticated animals, and have no hereditary dread of their natural enemy; but wild rats, placed in the cage of their particular pursuer, the rat snake of India (Zamenis mucosus), exhibit an absence of fear.

How, then, is it possible to account for the existence of the belief in the possession by snakes of the so-called power of fascination? It may have arisen from several causes. An observer may come on the scene and find a number of birds mobbing a snake just as they will mob an owl or kite. The dashes of the birds toward the snake and their fluttering round it may easily be put down to the effect of the snake's glance, while they are, in reality, merely the attempts of the birds to drive off the intruder. A mother bird whose young are attacked will almost certainly behave in this way, and may herself fall a victim, not to the power of fascination in the snake, but to the force of her maternal feelings. Then again it has been noticed that a hen placed in a snake's cage will often go toward it and make a determined peck at the snake's tongue. Dr. Stradling has also seen a frog doing the same thing.

Were this seen to occur in a wild bird, it might easily be put down to fascination. With regard to snakes that kill their prey by the injection of poison, it is even more easy to account for the appearance of the power, for they bite once and once only. The poison does not kill at once; the victim flutters on to a branch, it may be, or runs a short distance and stops, the snake watches it, the poison does its deadly work, and the bird falls. Any one who comes up not having seen the attack might in this way be readily deceived into imagining that it was the glance of the snake and not the poison that caused the victim to fall. It may be then the approach of an insectivorous bird or mammal who, taking the movements of the snake's tongue for those of a worm or insect, hopes to secure a meal. It may be the mobbing of the snake by the companions of a victim that has been seized, or of a mother whose nest has been robbed; it may be simply the effect of poison already injected before the observer has come upon the scene, or it may be simple curiosity.

These explanations should suffice to satisfy all those whose minds are not so filled with the love of mystery as to make them prefer to believe in the possession of this power, simply because it is mysterious, and, therefore, to refuse a common sense explanation.

In ninety-nine cases out of a hundred one or other of the above causes has been at work. What, then, of the hundredth case, and what about the fascination exercised on man, cases of which have undoubtly been recorded? The explanation lies in the probability that it is a case of hypnotism; it may be said, however, this is giving up the whole argument and admitting that a snake can fascinate, only it is calling the power by another name and saying that it can hypnotize. But this is not so. The snake does not hypnotize, the person is self-mesmerized; the action is purely subjective. Every one knows the school boy trick of holding a cock with its beak pressed against a table and drawing a chalk line from the tip of the beak along the table. The bird will remain in the position it has been placed in, though perfectly free to move. Now the snake no more exercises the power voluntarily than does the chalk line; position and tactile impression here produce hypnotism, and visual impression can produce it likewise. It is an error to suppose will power has anything to do with the effect. The matter has been taken up scientifically by the medical profession, especially in France, and it has been found that the hypnotic state of sleep or trance, or whatever it may be termed, can be produced by looking fixedly at the operator or at a coin or at the tip of one's own nose; it is not necessary to go into the question of how the result is brought about, but there is a physiological explanation. What happens then in the hundredth case is that the man or the animal may be self-hypnotized by gazing fixedly at the snake, the subject, being thus thrown into a sort of a trance, making no attempt to move out of danger, unless roused by some exterior influence.

We may conclude, then, that the attribution to snakes of the power of fascination is due to faulty observation and the drawing of conclusions from incorrect premises.—Science-Gossip.