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 Edition (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, corner Franklin Street, New York.

NEW YORK, SATURDAY, JULY 1, 1899.

A PERTINENT QUESTION.

It is generally understood that the main object of Congress in authorizing the President to appoint a new canal commission was to secure an impartial investigation of the relative advantages of the Nicaragua and Panama routes. The many commissions which have examined and reported on the feasibility of these two locations include the names of four Americans of more or less professional reputation, two of whom, Admiral Walker and Prof. Haupt, have pronounced themselves as being heartily in favor of the construction of the Nicaragua Canal, while the other two, General Abbot and Mr. Fteley, have indorsed the Panama route. In making up the new and presumably non-partisan commission, the President has included Admiral Walker and Prof. Haupt and ignored General Abbot and Mr. Fteley, who are, by the way, two of the most distinguished hydraulic engineers in America, and pre-eminently qualified to serve on a purely technical commission such as this. Why has this partisan selection been made?

If the Executive is desirous of learning the exact truth regarding the Panama scheme, why has there been omitted from the Commission the very experts who alone are able to give the fullest and most reliable information? The work of General Abbot in connection with the army engineers has won for him a world-wide reputation, and Mr. Fteley, who is a past president of the American Society of Civil Engineers, is now engaged in the construction of the great Croton dam, the most formidable undertaking of its kind in the world. These two gentlemen are so obviously fitted to take a prominent part in the work of the new Commission that their exclusion is liable to arouse serious doubts and misgivings in the minds of that portion of the public which is familiar with the isthmian canal situation, as to the bona fide nature of the investigation.

SPEED AND AIR RESISTANCE IN CYCLING.

It is pretty well understood among those wheelmen who have given any thought to the subject that the chief element of resistance in riding the bicycle on level roads is due to the atmosphere. The simplest proof of this is to be found on a windy day, when the difference between riding against and riding before the wind has only to be felt to be appreciated. The remarkable feat of the professional cyclist Murphy, who on June 21 rode a mile behind a locomotive in one minute and five seconds, proves what an extraordinarily large proportion of the effort of the rider is expended in overcoming air resistance. The shortest time in which a mile has ever been covered with a flying start, unpaced, is one minute, fifty-five and four-fifths seconds. This was done by the rider Hamilton at Denver, June 18, 1898. With human pacing, where the rider is partially protected from the rush of air, the fastest time has been made by Taylor, who covered the mile in one minute and thirty-one and four-fifths seconds. In the recent trial provision was made for inclosing the rider in front, above, and on both sides by a wind shield, and making this protection so complete that he was riding practically in still air. The result shows that complete protection from the wind enables a rider to increase his speed by about 100 per cent. Comparing their records, it is questionable whether Murphy could ride a mile unpaced in as short a time as Hamilton; or to put it in other words, it is probable that Hamilton could ride a mile under the Murphy conditions in less than one minute.

From a scientific standpoint this extraordinary feat will have a value as attracting further attention to the serious nature of air resistance, for it raises the question as to whether the form of all vehicles that move at high speed should not be modified so as to present the least possible resistance to the wind. This is particularly true of locomotives and cars, and it is conceivable that some light form of sheathing extending from the cars nearly to the rails, and from car to car, might materially aid in reducing the air resistance.

A FALSE ALARM.

Several of the New York dailies recently published a rather lurid description of the danger which attends our recently purchased cruiser, the "New Orleans," whenever she goes to sea. The public was gravely informed that this vessel and her sister ship, the "Albany," which is now completing at the Elswick Works, England, have so little natural stability that under certain conditions of loading they are liable to "turn turtle" and disappear from the active list of the United States navy. As a matter of fact, there is not a word of truth in the rumor, and the "New Orleans" merits all the words of commendation which have been bestowed upon her by the officers who were in charge of this crack vessel during the operations of the Spanish war. The origin of the rumor is to be traced to the misunderstanding of a report which was recently made by Naval Constructor Bowles on the inclining experiments lately carried out upon this vessel. Every ship that is built for the United States navy, or acquired by purchase, is put through a series of tests to determine her stability under widely varying conditions of loading. Although the elements of stability are carefully calculated when a ship is designed, there is always a possibility of subsequent changes in the armament or construction of the vessel causing slight variations from the intended stability, and hence it is the practice in our navy to ascertain the actual stability by inclining tests made after the ship is afloat. In the case of the "New Orleans" this was done at the earliest convenient opportunity after the war, and the results were tabulated and forwarded in a report to Washington. It was a misconstruction of the meaning of the report which led to the ridiculous statements which have been referred to above.

To determine the stability when she is absolutely light, the "New Orleans" was emptied of all coal, ammunition and stores, a condition, of course, in which she would never be found when in commission. It was discovered that when absolutely empty, she has what is known as a negative metacentric height, and in this condition she inclines to port or starboard a few degrees until she assumes a position of stability. There is in this nothing unexpected or unprovided for in her design. Indeed, it is a fact that all the great transatlantic liners have a negative metacentric height when empty of coal and stores, and provision is made in them, as it is in the "New Orleans," for taking a sufficient amount of water as ballast into the double bottom to restore the vessel to an even keel.

It is true that as compared with the majority of our home-built warships the "New Orleans" has, when light, less stability. This results from the fact that more attention is paid in our ships to certain elements which are neglected in the Armstrong vessels in favor of coal capacity, speed, stores and armament. In our own ships, and in those of the British navy, liberal provision is made for the comfortable berthing of the crew. More space is given up to their accommodation than is allowed in the ships of foreign navies. The Armstrong Company, which built the "New Orleans," has a reputation for turning out warships of high speed, great coal capacity and unusually heavy armament, and there is no denying the fact that their ships are particularly showy in this respect. In the elements which do not appear upon paper, however, but which are of equal importance, their vessels will be found in many cases to be lamentably lacking. As a rule, the crew and officers are the chief sufferers, as, for instance, on the "New Orleans," where a large part of the space on the berth deck, which in American ships would be utilized completely as living and sleeping quarters for the crew, is taken up by coal bunkers, something which would never be allowed for a moment by our Bureau of Construction and Repair. Then, again, the number of rounds of ammunition carried per gun is small in these ships; there is a scarcity of small boats; ventilation is not so thoroughly worked out, and in various respects weight is saved in order that it may be put into guns and motive power. Now, when a vessel of this type begins to be emptied of her coal, stores and ammunition—weights which are carried low down in the hull of a ship—it will be seen that she quickly loses her stability and the metacentric height is liable to change from the positive to the negative.

The "New Orleans" incident is of considerable interest as showing how easily we may fall into error in judging of the value of one particular warship as against another. There has been a continual outcry raised in England against the latest ships designed for the British navy by Dr. White, Chief Naval Constructor, because these vessels as compared with the Armstrong vessels have shown ton for ton of displacement a great inferiority in certain elements of fighting power. They are not nearly so heavily armed; they are not so fast; they are not even so well protected; yet, as a matter of fact, we have no doubt that Dr. White, who is responsible for their design, could show that they have compensating advantages in the way of roominess, sea-worthiness, large supplies of ammunition and ample stores which make them fully the equal of the Armstrong ships.

Without saying anything derogatory of the splendid vessels which are turned out from the Elswick yards, the matter may be expressed in a nutshell by saying that Armstrong builds for the trade and with an eye to the grandstand, and while such phenomenal vessels as the "O'Higgins" and "Esmeralda" are vastly more powerful in armament and speed than other vessels of a like displacement, it is not likely that in the test of actual warfare they would be found to be either better or worse than the best of other navies.

SCIENCE AND SPIRITUALISM.

We have recently been entertained by the daily press with accounts of a spiritualistic investigation of the immortality of the soul, which is remarkable, not so much for the novelty of the results obtained, as for the prominent position occupied by the chief inquisitor as a professor in one of our foremost institutions of learning.

That Prof. Hyslop believes that he has found in spiritualism additional and complete proofs of the soul's immortality can hardly be questioned. He states that he has arrived at his conclusions only after a most thorough and painstaking examination, in which all possibility of fraud was carefully excluded. Indeed, it is the very method of investigation employed which Prof. Hyslop so strongly emphasizes; for he lays great stress upon the scientific methods, the care, and exhaustiveness which characterize his inquiry and distinguish it from previous work in this direction.

Prof. Hyslop has asked the public to withhold its judgment until he has published a full account of his experiments and submitted the facts which he has gathered to the scientific world. As a matter of mere courtesy and justice we should wait. But in the meantime we cannot help remarking how puerile and fruitless have been the results of previous attempts, how disproportionate the time and effort expended. Such men as Marsh, Kebble, Dr. Hodgson and Prof. James have also attempted a scientific investigation of spiritualistic phenomena. Mr. Marsh, we are told, talked with Adam and Eve, with Methusaleh and other biblical personages. Mr. Kebble conversed with Washington, Bonaparte, Byron and a host of equally distinguished men, and both Hodgson and James have brought all the undoubted critical acumen of their minds to bear upon the case of Mrs. Piper. The actual results, judged from a dispassionate, scientific standpoint, are very disappointing. Even in the case of Hodgson and James, they are vague, trivial and inconclusive.

The many newspaper articles which have appeared on Prof. Hyslop's experiments give us (chiefly because of his reticence) no coherent account of what he has actually accomplished. From the little that can be gleaned, however, we are not very sanguine that anything new has been added to what is already known of spiritualism.

In his spiritualistic experiments, Prof. Hyslop has been associated with some of the most distinguished psychologists and alienists, men who have become well known through the value of their contributions to mental science. For this reason we have a right to expect something more than the vagueness and ambiguity which have ever been characteristic of spiritualism, something which will at least prove amenable to the ordinary laws of evidence, and afford us that sensible proof of immortality, the desire for which is coeval with the existence of the human race. Although the publication of the results of his examination into spiritualism may not be accompanied by "such a wave of excitement as the world has never seen before," we trust Prof. Hyslop will keep his promise, and if he presents us with results in the way of spirit communication, we hope they will be marked by that dignity and practical utility which have been so invariably and conspicuously wanting in all previous communications.

THE TRANSPLANTATION OF NERVES.

In a certain proportion of injuries to nerves, the ends cannot be brought together, and a portion of the nerve obtained from one of the lower animals or from an amputated limb can be implanted. Dr. R. Peterson has contributed an important article to The American Journal of Medical Sciences on the transplantation of nerves. It gives some interesting instances. In one case a man was severely injured in the right wrist by a circular saw; he lost sensibility in the hand. Five months after the injury the transplantation of a nerve was decided upon. Four centimeters of the sciatic nerve of a young bloodhound was sutured between the ends of the median nerve with kangaroo tendon. A similar operation was performed on the ulnar nerve. On the following day a distinct return of sensibility in the thumb was found; three months after the operation, sensibility was almost complete. There are twenty recorded cases of transplantation of nerves. There were eight primary and twelve secondary operations. The time from the injury to the operation varied from forty-eight hours to one and a quarter years. Eight out of twelve cases of the secondary operation showed improvement in sensibility or motion, while only four out of eight cases of primary operation im-

proved. The interval between the ends of the divided nerves varied from three to ten centimeters; but the distance did not seem to affect the result.

In nine cases the transplanted parts were from the sciatic nerves of dogs, three from rabbits, one from a kitten, and one from the spinal cord of a rabbit, and in five from recently amputated limbs. In one case a sciatic nerve which had been excised was itself transplanted. In nine cases catgut was used to unite the implanted segments of divided ends; in three, silk; and in one, kangaroo tendon. No case recovered entirely, but generally the cases were very much improved. The average time in which sensibility appeared after the operation was about ten days, and motion returned in two and half months.

PREVENTION OF COLLISIONS AT SEA.

The recent marine disasters on Long Island Sound and near Sandy Hook, New York harbor, where serious collisions in a dense fog occurred, forcibly bring to the attention of the traveling public the need of some simple method of determining with a reasonable degree of accuracy the relative positions of the respective vessels.

There is no doubt, now, in view of the practical development abroad of wireless telegraphy, an opportunity for the owners of several vessels in one line to equip each steamer with a set of wireless telegraph instruments arranged to communicate with each other.

That being the case it will only be necessary for each vessel to have an operator skilled in the use of the instrument, whose duty shall be, in the event of thick weather, to send out prearranged caution signals at certain regular intervals, and at the same time watch the receiving instrument for replies. When a return signal is received, then communications as to the location and course of the vessels can be easily made and a prospective collision avoided.

It has been shown by the experiments across the channel between France and England that the distance the electrical waves will travel varies with the height of the conducting terminal above the water level. According to W. H. Preece, a conductor 20 feet high will signal well to a distance of one mile, 40 feet to 4 miles, 60 feet to 9 miles, 100 feet to 25 miles. He also states that the electric waves travel over water with greater force than over land.

As the average height of a large steamer mast above this level is 100 feet, the electric waves should be effective for a probable distance of 25 miles.

Such an arrangement would be more certain than the usual fog siren, for the effectiveness of the latter is varied in certain instances by the force and direction of the wind. Wind or stormy weather do not interfere with the working of the electrical waves.

Taking the case of the collision of the steamers "C. H. Northam" and the "Richard Peck" on Long Island Sound a short time ago as an example, the captains of each vessel were brothers; they were on their night trips from New York to New Haven, and vice versa. After starting a dense fog quickly arose. They knew at about a certain time in the night they would pass each other. When that time arrived they were unable to determine each others' whereabouts definitely or to communicate as to the course each was taking, and it happened that the "Richard Peck," which was the stronger vessel, plowed transversely through the bow of the "Northam." She was barely saved from sinking. Had each vessel been supplied with the simple wireless electric instruments, and had they been put in operation as soon as the fog appeared, the vessels would have been able to have communicated with each other within a distance of say 15 miles, and thus easily have avoided a collision.

It seems to us that the interests of the great steamship and transportation lines demand that they should be quick to adopt every known scientific device that can effectually serve as a safeguard against the perils of dense fog or thick weather.

What line or combination of lines will be the first to adopt such safeguards?

METHOD OF TRANSFERRING PHOTOGRAPHIC FILMS.

Several years ago a special transferotype paper was made by which the developed film or picture could be removed and transferred to any desired object or onto glass or a gelatine film.

With the advent of the celluloid and other transparent films the manufacture of the transfer paper ceased.

The celluloid films and similar films are not wholly free from pits, miniature semitransparent dots, brush marks, etc., which magnify seriously when an enlargement is to be made or even when a lantern slide is made by contact with the film.

For the purpose of proving this and securing images of absolute clearness and perfectness, Mr. W. Jennings, of the Photographic Society of Philadelphia, discovered a plan of readily removing the picture gelatine film from the supporting celluloid or transparent support. His explanation of how it is done is as follows:

Dip the film for about half a minute in a 10 per cent solution of alum and water, then lay it on a plate of glass and at the upper corners proceed to roll back the gelatine film gently with the fingers. It readily separates from the support, and in this rolled-up condition it is washed in running water for about five minutes, to take out the wrinkles and eliminate the alum. Then place a clean plate in a tray containing a 10 per cent solution of glycerine and water.

Next take the separated film and spread it out (printing side up on the glass plate in the tray), then lift up the plate and place the film on the plate under slowly running water. This will drive out the bubbles. Use the finger or the tip of the tongue for a squeegee. The film will dry perfectly flat and free from grain. When dry it may be intensified, reduced or retouched as usual. This is an excellent way to save film negatives having joints in the celluloid. I have no trouble in transferring fifty 4 by 5 films in an hour in this way

Positive pictures can just as well be transferred from this supporting film onto other things than plates of glass as one's fancy may choose.

WATER-TUBE BOILERS FOR OUR WARSHIPS.

BY LIEUT. G. L. CARDEN, U.S N.

The Navy Department has decided to introduce in a number of new warships of this country the Niclausse type of water-tube boiler. It was this form of boiler which was employed on the late Spanish warship "Cristobal Colon," and from what can be learned of its workings, good results are expected. The main objection heard against the boiler by engineer experts is the feature of the horizontal tubes. Whether this objection will prove a valid one, experience alone can tell, but in the opinion of the naval officials in Washington, the reports from abroad are all in favor of the new generator.

The Niclausse boiler is of French design. Various types of French water-tube boilers have proved eminently successful, particularly the Belleville and Normand types, and within late years the British Admiralty have made liberal use of these French designs. The British cruisers "Powerful" and "Terrible," the largest protected cruisers in the world, each carry forty-eight Belleville boilers, arranged twenty-four on a side.

In this country recourse has been had both to foreign and domestic designs of water-tube generators, and American warships are now using in a number of instances the Yarrow, Thornycroft, Ward, Du Temple, and other types.

It is the expressed view of leading engineer officials that the troubles experienced from time to time with water-tube boilers have been largely due rather to unfamiliarity with the type in general than to any inherent or ineradicable defects in their design or construction.

In the hands of experienced and alert engineers, water-tube boilers have thoroughly demonstrated their fitness for deep-sea work. It has only been necessary to prove that water-tube boilers are reliable for general cruising purposes to insure their adoption in place of the Scotch marine types. It is the saving in weight afforded by the tubular boiler that so strongly appeals to the naval architect, and in the case of warships the economy thus secured is of more importance than it is in the merchant marine.

The new warship "Maine," building at the yards of the Cramps, will be the first of the new battleships to carry Niclausse boilers. Her sisters, the "Missouri" and "Ohio," will each carry, it is understood, Thornycroft boilers. The design of the "Maine," as finally settled upon, calls for twenty-four Niclausse boilers, arranged in three groups of eight boilers each. Each group will be subdivided by the center line bulkhead, and each boiler will have fifteen elements of twenty-four tubes, the whole number of elements being 360 and the number of tubes 8,640. The "Maine's" boilers are designed to carry steam at a working pressure of 250 pounds per square inch above the atmosphere.

The announcement is now made by naval officials that the water-tube boiler will hereafter be exclusively used in United States warships. In the case of the "Maine" and her sisters the particular type of boiler to be selected was left to the contractors, subject to the approval of the Navy Department. The Cramps selected the Niclausse, and the Union Iron Works and Newport News establishments the Thornycroft. Rear Admiral Melville, chief of the Engineering Bureau, is the authority for saying that it has been definitely decided to adopt water-tube boilers for all our new warships. It is known that Admiral Melville was anxious to incorporate water-tube boilers in the battleships authorized prior to the last group, but it was impossible, it was found, to do so at the last moment, since no hull changes would be permitted.

In the British navy the Belleville water-tube boiler has been adopted for all vessels larger than torpedo craft.

According to the statements of leading British officials, the charges brought against the Belleville boiler have narrowed down to a low efficiency in fuel consumption. The official reports of the engineering departments do not, however, bear out the indictment. The big armored cruiser "Terrible," on her trial trip, recorded a consumption of 1·71 pounds of coal for each horse power exerted for an hour. On the trial of the British cruiser "Diadem," which trial lasted for thirty hours, the coal consumption per indicated horse power per hour was 1·59 pounds. This consumption was the equivalent of 13·9 pounds of coal per hour per square foot of grate surface. On the eight hours full-power trial of the "Diadem," when the coal burnt was increased to 20·8 pounds per hour per square foot of grate surface, the coal was only increased to 1·76 pounds per indicated horse power per hour. Steam was maintained at the engines during the thirty hours and eight hours runs, respectively, at 245 and 249 pounds per square inch.

The announcement of the official adoption of water-tube boilers for the vessels of the United States navy is regarded in engineering circles as a most important one. Briefly summarized the resulting advantages are lightness, ability to raise steam quickly and accessibility for repairs. No trouble is experienced in raising steam to 250 pounds pressure from cold water in much less than an hour's time, instances being recorded of 23 minutes only being consumed. In the case of the cylindrical boiler from six to twelve hours are required. The danger formerly apprehended of tubular boilers breaking down is no longer seriously entertained. Tube boilers like cylindrical boilers must be cared for, and good judgment must be shown in handling them. If this is done there is no reason, in the opinion of naval engineers, why they should not always respond when called on for hard service.

MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The Forty-eighth Annual Meeting of the American Association for the Advancement of Science will be held at Columbus, Ohio, August 19 to 26, 1899. The Association headquarters will be located in Room 10, University Hall, Ohio State University, and the hotel headquarters of the Council of the Association will be at the Chittenden Hotel. A meeting of the Council will be held at noon on Saturday, August 19, at the hotel headquarters.

The opening session of the Association will be held at 10 o'clock A. M., on Monday, August 21, in the Chapel, University Hall.

The officers of the Columbus meeting are as follows: President, Edward Orton, Ohio State University, Columbus, Ohio. Vice Presidents: Mathematics and Astronomy, Alexander Macfarlane, Lehigh University, South Bethlehem, Pa.; Physics, Elihu Thomson, Lynn, Mass.; Chemistry, F. P. Venable, University of North Carolina, Chapel Hill, N. C.; Mechanical Science and Engineering, Storm Bull, University of Wisconsin, Madison, Wis.; Geology and Geography, J. F. Whiteaves, Geological Survey of Canada, Ottawa, Canada; Zoology, S. H. Gage, Cornell University, Ithaca, N. Y.; Botany, Charles R. Barnes, University of Chicago, Chicago, Ill.; Anthropology, Thomas Wilson, Smithsonian Institution, Washington, D. C.; Social and Economic Science, Marcus Benjamin, United States National Museum, Washington, D. C. Permanent Secretary, Dr. L. O. Howard, Cosmos Club, Washington, D. C. General Secretary, Frederick Bedell, Cornell University, Ithaca, N. Y. Secretary of the Council, Charles Baskerville, University of North Carolina, Chapel Hill, N. C.

The affiliated societies which will meet with the American Association are the American Forestry Association, the Geological Society of America, the American Chemical Society, the Society for the Promotion of Agricultural Science, the Association of Economic Entomologists, the American Mathematical Society, the Society for the Promotion of Engineering Education, the American Folk-Lore Society of America, the Botanical Society of America, and the American Microscopical Society.

It is expected that the Columbus meeting will be of great importance and interest, and attractive excursions will be arranged, and the usual receptions will be held.

ARMOR PLATE FOR BANK VAULTS.

A Pittsburg trust company has lately erected a vault, composed of steel armor plates, which possesses some novel features. It is 19½ feet by 16½ feet by 9½ feet. The entire front of the vault is of a single plate of armor 8 inches thick. This is reinforced by a nickel-steel plate of the same size, only 6½ inches thick. Therefore the total thickness is 14½ inches. The door is in the front, and the bolt-work of the door radiates from the center, like spokes from a hub. The armor plates are dovetailed together, and clamped from the inside. If desired, plates 22 inches thick can be used, thus avoiding the use of bolts. It is thought that armor plate vaults possess remarkable advantages over the old laminated plates. Other banks are about to adopt the new system.