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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.

OUR NEW NAVY.

It is likely that but few, even among those of our readers who take a special interest in naval matters, realize what a large addition has been made to the United States Navy since the conclusion of the Spanish war. The great popularity of the Special Naval edition which this journal brought out during the war, coupled with frequently-recurring requests from our subscribers for a similar work bringing the development of our Navy up to date, has satisfied us that a special number describing our naval growth during the past three years would meet with public favor, and would answer a large number of inquiries, written and unwritten, regarding the exact present strength of the United States Navy. In preparing this Special Number, we have thought that we could not do better than be guided by the great popularity achieved by its predecessor, and the issue will, therefore, contain a photographic illustration of every type of ship authorized, building or completed since the Spanish war, with a complete description of its construction, armor, armament and general fighting qualities.

A special chapter will be devoted to the remarkable work accomplished by the Bureau of Ordnance in designing for our new warships entirely new guns of unprecedented power, the pieces ranging from the 40-caliber, 12-inch rifle down to the 50-caliber, 3-inch piece which will enter so largely into the make-up of our modern batteries. The naval lists, which were a popular feature in the former number, will be brought up to date, and we shall present a comparative table showing our present fighting strength compared with that of other navies of the world.

By way of marking the great stride made by our navy in the brief three years since the war, we may mention that the aggregate displacement of battleships, monitors and cruisers in commission during the war, omitting the hastily improvised auxiliary fleet, was a little over 153,000 tons, whereas the double-page drawing showing all the new ships put in commission since the war, and all the ships at present authorized and under construction, represents an aggregate displacement of over 313,200 tons.

In other words, the addition now being made to our navy is over twice as great, measured in displacement, as the actual fleet that won the Spanish war. To this must be added the fact that in range, power, and accuracy the new guns of this modern navy are at least 100 per cent superior to the low-velocity, smoke-producing weapons of Santiago and Manila Bay.

A COMPOUND CONDENSING STEAM CARRIAGE.

We do not know of a more promising subject of investigation for the practical mechanic than that of the production of a suitable condenser for the steam-driven automobile. Manufacturers of the steam carriage have made wonderful progress in the development of the type, and considering the inherent difficulties of the problem, the steam carriage to-day exhibits an ingenuity and skill in its design not excelled by that of any of its competitors. There are few prettier pieces of mechanism to be found than the compact, powerful little two-cylinder, Stephenson link-motion engines which are almost universally used on the steam automobile of to-day. The boiler and various regulating appliances, automatic or otherwise, are the result of most careful thought and reflect the greatest credit upon the makers. Type for type, and considering the limitations under which each type labors, the steam carriage of to-day, as a piece of mechanical design and construction, is fully abreast of its electric or gasoline-driven competitors.

The radius of action, as far as it is governed by fuel capacity, is much greater than that of the electric and not far short of the internal-combustion-motor machines; but when we come to the question of water capacity, we find that the steam-driven type, while about on a par with the electric, is still far short of that of the gasoline type. It has long been recognized by the makers that as soon as a satisfactory condenser can be devised, the radius may be increased to almost any extent desired, and this for the reason that the water instead of being thrown away in the form of exhaust steam, will be pumped back to the boiler, and perform a continuous cycle through boiler, engine, and condenser, the replenishing of the water tank taking place at long intervals, the loss being only such as is due to leakage and evaporation. In addition to the advantage of increased radius of action, the provision of a condenser would, of course, result in great fuel economy, a large portion of the heat being returned to the boiler.

There are, however, well-understood difficulties attending the design of a suitable condenser. There is the increased weight; there is the difficulty of separating the oil which will necessarily be carried over from the cylinders; and there are the well-known difficulties attending the pumping of hot water, that is approximately at the boiling point, into the boiler. Judging from an experimental condenser which a member of our staff fitted to his steam-driven machine, merely for the purpose of reducing the clouds of exhaust steam in cold weather, it should be quite practicable, by making use of aluminium piping and a suitable system of flange or pin-cooling devices, to secure sufficient surface to condense all of the steam. While an air-cooling condenser would, of course, add appreciably to the weight, the increase would be by no means prohibitive, nor would it even begin to offset the gain in economy and in radius of action that would be secured. Of course, the chief difficulty, if air-cooling were used, would arise when the machine is doing its maximum work in hill-climbing. At such a time it might be necessary to increase the air current by means of a rotary fan; but even supposing that condensation during hill-climbing were only partial, the worst that could happen would be the loss of a portion of the water in the form of uncondensed steam. Furthermore, the provision of a successful condenser for the steam carriage would open the way for other important improvements tending to increase the power and efficiency of the motor. The water-tube boiler, higher steam pressures of from 250 to 300 pounds to the square inch, and the use of multi-cylinder engines, compound or even triple-expansion, would be improvements which would tend to bring the performance of the engine and boilers nearer to the economy which is realized in marine practice.

Having said this much, however, we must bear in mind that there is one radical difficulty which would immediately present itself if the exhaust were turned into condenser. At present the large steam-raising capacity of the steam-carriage boiler is due in considerable measure to the fact that the exhaust is used to induce a strong draft through the burner and tubes, and if the exhaust were directed to the condenser, some other means of increasing the draft, or some other form of boiler, would have to be resorted to. Of course, sufficient draft might be secured by a rotary fan; but as our proposed condenser already calls for a cooling fan, it can be seen that the accessories of the new design would be beginning to multiply beyond the point of working practicability. However, after all is said and done, it must be admitted that the problem is a very live one, full of interest and promise to the inventor who can work it out to a practical solution.

M. SANTOS-DUMONT'S PLANS TO CROSS FROM NICE TO CORSICA.

INTERVIEW BY OUR PARIS CORRESPONDENT SPECIALLY FOR THE SCIENTIFIC AMERICAN.

The Paris correspondent of the Scientific American had the opportunity of meeting M. Santos-Dumont shortly before his departure from Paris, and made a visit to the balloon shed at the Aerostatic Park in company with the aeronaut. The famous "No. 6" is being dismounted and made ready to be taken to Nice, where the experiments are to be carried on during the winter under more favorable conditions than at Paris. Speaking of his present balloon, which has a double silk envelope, M. Santos-Dumont says that he had considerable difficulty in preventing it from folding together during certain maneuvers, owing to the insufficience of the ventilator which sends air into the small interior balloon. In fact, when the balloon is afloat it is submitted to differences of temperature according to the layers of air which it traverses; and in consequence of the endosmose which takes place in spite of all precautions, the gas leaks and a balloon of elongated form is always in danger of folding in the middle. This he knew from past experience, and accordingly provided the No. 6 with an interior air-bag which is more or less filled by a ventilating fan attached to the motor, and keeps the main balloon expanded out. The ventilator, however, did not prove all that was desired, and so he had hard work to keep the balloon in proper shape. The Buchet petroleum motor which he uses has also caused him considerable trouble. It has four cylinders mounted on the top of a long crank-box in aluminium. Once in the air, as a general rule, only two out of four cylinders worked, and this left him naturally at a great disadvantage. With this motor he counts upon 18 horse power, but as this is often cut down one-half he cannot make the balloon go through the evolutions he wishes. The Longuemare carbureter has always worked very well in spite of the considerable inclinations which it takes due to the varying position of the balloon. The carbureter is regulated by a wire which passes to the car. It will be remembered that the motor is at one end of the frame and the car at the other; the aeronaut is thus at a considerable distance from the apparatus, and uses a number of wires to carry out the maneuvers. A small pilot-wheel thus carries two wires which pass upward and then back to the rudder. In place of taking sand as ballast he now uses water, and this is contained in two long pointed cylinders mounted in front. Each cylinder, which contains 6 gallons, may be emptied gradually by a valve from which a wire passes to the car. The aeronaut is obliged to use a guide rope weighing 110 pounds and 150 feet long, which hangs down from the front end of the frame. This often causes difficulties by dragging upon the ground or catching upon the roofs of houses.

M. Santos-Dumont is now preparing to carry out a series of experiments on a much larger scale upon the Mediterranean, and will soon be ready to go to Nice. At present he is making great preparations for his new experiments, and is to have a large balloon house constructed upon a piece of property which has been offered to him for the purpose on the coast near Monaco. The shed will be 150 feet long and 80 high, much larger than that at the Aerostatic Park, and near it will be installed a hydrogen generating plant. The present balloon, No. 6, has already been emptied of gas and packed up and the framework will be transported as it is upon two flat cars. The aeronaut has already commenced the construction of a new balloon, the No. 7, which will be 30 feet longer than the No. 6 and built especially with a view of obtaining high speed. It is a much more powerful air-ship than the former in every way, and measures 120 feet long and 18 feet middle diameter. The same general shape is preserved, but the new balloon will be of a more elongated form than the other. The framework will be also 30 feet longer, making 85 feet, and will weigh about 140 pounds. The series of balloons has thus been gradually growing larger; the first balloon of 1898 gaged only 225 cubic yards. Since this he has made five others, increasing in size, and the present balloon is again an increase of 250 cubic yards over the precedent, or 1,030 cubic yards. Two screws are to be used, one at each end. They are 15 feet in diameter and driven independently by 45 horse power motors, thus giving 90 horse power in all, and a very high speed may be expected. This time he will use gasoline for ballast, and it will be used to feed the motors and thus be consumed instead of thrown overboard. Hence he expects to be able to stay in the air longer and cover long distances. The car, instead of being near one end, will be placed in the middle of the framework and the motors mounted one at each end, near the helices. In this way a much better balance will be obtained. The frame will hang as before from the balloon by steel piano-wires, and owing to the better equalizing of the strain there will be much less danger of tearing the balloon at the points of attachment to the silk. M. Santos-Dumont expects to occupy the next three months in making experiments in the bay of Monaco, and will then try to cross the Mediterranean from Nice to Corsica. This trip he is confident of being able to carry out, and he expects to make the passage in one-half the time taken by the steamers. He expects to be ready to carry out this project about the end of February. If it is successful the next step will naturally be to cross to Africa.

FURTHER TESTS AT SEA OF THE BELLEVILLE BOILER.

Following the test between the two cruisers, "Hyacinth" and "Minerva," of the British navy, from Gibraltar to Portsmouth, to ascertain the respective advantages and disadvantages of the Belleville and cylindrical boilers, the results of which we published in the Scientific American of October 5, another contest has been carried out between these two ships, and again the Belleville has been defeated. The course was from Cape Finisterre in Spain to Berehaven in the southwest of Ireland. Both vessels started level, but the "Hyacinth," equipped with Belleville boilers, at first forged ahead. After two hours' steaming the "Hyacinth" was traveling so well that she soon left the remaining vessels of the Channel Squadron, which was accompanying the test, far in the rear. It was considered in view of the speed at which the "Hyacinth" was traveling that she would establish a steaming record. The cylindrical boiler vessel, "Minerva," however, although she was at first left behind, when once she had got full steam up rapidly drew level with the "Hyacinth," and easily contrived to keep up with her, even with her engines eased down. The "Minerva" then put on full steam once more and fairly raced away from the "Hyacinth," reaching Berehaven long before her rival. The test of the Belleville boiler on the "Hyacinth" on this occasion was unusually severe. Every ounce of steam was requisitioned, and extra men were sent down to the stokehold to assist in the trimming of the fires and the working of the bunkers. One of the after group of boilers primed to such an extent during the run as to render it necessary to draw the fires. Again there was the excessive and unaccountable loss of feed water which characterized the run from Gibraltar to Portsmouth. The loss of water on the comparatively short run between Cape Finisterre and Berehaven was over 50 tons.

THE NATIONAL ACADEMY OF SCIENCES.

BY MARCUS BENJAMIN, PH.D.

The scientific session of the National Academy, which is held in the autumn, began its meetings at the University of Pennsylvania, in Philadelphia, on the morning of November 13. Alexander Agassiz, the President of the Academy, and Asaph Hall, its Vice-President, were unavoidably absent, in consequence of which the Foreign Secretary, Ira Remsen, President of the Johns Hopkins University, presided over the sessions.

It is not customary to open the meeting with an introductory address, but to proceed immediately to business, in consequence of which the reading of the papers was promptly taken up.

These included a paper by George F. Barker, of the University of Pennsylvania, on "The Monatomic Gases." He explained the difference between diatomic and monatomic molecules, and of the positive and negative elements. He described the history of the discovery of helion, neon, argon, krypton, and xenon, and the fulfillment of William Ramsay's remarkable prediction made in his address before the Chemical Section of the British Association for the Advancement of Science, at Toronto, a few years ago, as to the existence of the gas called Neon, and its exact relationship to the others in the same series. These gases are all monatomic, having only one molecular motion, and are incapable of combination with any other elements. He said that they were the equivalents of zero, or of nothingness. In mathematics one may go from the negative to the positive, or the opposite, by passing through zero. This series of elements was placed equidistant between the negative series, in which were hydrogen and the haloids and the positive series, in which were lithium, sodium, and the other alkalies.

The "Transmission of Heat Through Vapor of Water at Small Pressures" was the title of a joint paper by Edward W. Morley, of Adalbert College, Cleveland, with Charles F. Brush, the well-known electrical expert. It gave a series of results of experiments made by the authors. Prof. Morley also presented a second paper descriptive of "Two Forms of Gage for the Recording of Small Pressures of Gas," which were especially devised in order to measure the pressure of aqueous vapor. With these gages it is possible to make measurements in which the mean error of a single reading is not much greater than a ten-thousandth of a millimeter. The description of the apparatus as given by Prof. Morley was highly technical, and was illustrated by means of drawings, which he presented before the Academy.

Charles S. Pierce, of Milford, Pa., presented a paper on "The Logic of Research into Ancient History." He contended that the logical procedure on which students of ancient history had worked was as bad as logic could be. No new truth ever came from induction or deduction, but can come only from abduction. The correct method, he said, is that our hypothesis ought to explain all the related facts. It is not sufficient to say that testimony is not true. It is our business to find out how it came to be such as it is. After testing our hypotheses, they should not be abandoned until conclusively refuted. There is no practice more wasteful than that of abandoning any hypothesis once taken up, until it becomes evident that it is quite untenable. A hypothesis being accepted on probation, the process of testing it should consist in examining such of the consequences of the hypothesis as will be capable of direct verification rather than in examining the facts to see how well they accord with the hypothesis. Mr. Pierce illustrated his propositions by a number of false hypotheses, which he took from the published lives of Aristotle and Pythagoras.

Henry F. Osborn, Professor of Biology in Columbia University, presented a paper on "Dolichocephaly and Brachychephaly as the Dominant Factors in Cranial Evolution." Prof. Osborn announced that after studying the fossils of the rhinoceros found in this country and abroad, he found the grouping of the rhinoceros fossils to be largely false, and reached the conclusion that the length of limb and the proportions of skull of the fossilized rhinoceros were correlated. His recent study on American fossils led him to apply this principle, and he found it exceedingly useful in studying any heterogeneous group, the inter-relationship of which is not at once entirely clear. His deductions were that there was but very little doubt that the first step in the production of long skulls is connected with the elongation of the limbs and feet, which is caused by the moving about of the animal over a large extent of country in search of food. Then the lengthening of the skull follows, especially in grazing animals, by reason of the necessity of bringing the front teeth nearer to the ground. His conclusion was that it might be laid down as a fundamental principle, unless there be some compensating cause producing a different outcome, that, giving these conditions, the result as announced by him would always be brought about. Prof. Osborn also presented brief papers on the "Cranial Evolution of Titanotherium, II," and on "Latent and Potential Homology," which were the results of his recent studies in vertebrate paleontology.

"Observations on Tungsten" was the title of a paper by Edgar F. Smith, of the University of Pennsylvania, who has undertaken a careful study of the various tungsten-bearing minerals for the purpose of ascertaining precisely to what extent hitherto unobserved quantities of iron, manganese, vanadium and phosphorus are compounds of these minerals, as he believes that the various determinations of the atomic value of that element is due to the errors caused by failure to determine these unobserved elements in the minerals. His paper was largely of the nature of a preliminary announcement.

Dr. Horatio C. Wood, Jr., of the Medical Department of the University of Pennsylvania, read a paper on the "Vaso-Motor Supply of the Lungs." He said that while it had long been known that the general blood vessels of the body were controlled by nervous mechanism, still this had not been shown to be true of the blood vessels of the lungs, and this proposition he sought to establish, contending that the blood vessels of the lungs were in fact supplied with vaso-motor nerves, and that these were affected by the administration of drugs in a manner different to that in which any other blood vessels of the human body were affected. Dr. Wood expressed the opinion that the discovery regarding the vaso-motor nerves of the lungs would have a considerable value in practical medicine, and might influence particularly the treatment of pneumonia, a disease that temporarily affects the caliber of the blood vessels, which condition might be counteracted by the use of certain drugs.

Prof. Samuel L. Penfield, of the Sheffield Scientific School of Yale University, presented a paper "On the Use of Stereographic Projection in Making Accurate Maps; with Criticism of Some Recent Methods of Map Projection," which he illustrated with a series of photographs reflected upon a screen. He contended that for accuracy and ease of geographical and geodetic measurements it afforded very great advantage over the polyconic method and Mercator's projection. Known to scientists hundreds of years ago, the wonder was that the stereographic method had fallen into disuse. In its principles it was absolutely exact, and for the navigator made it possible to save considerable distances in laying a course, as compared with the ordinary marine charts. In all flat projection there must, of course, be greater or less distortion of dimensions and outlines; but the distortion under the stereographic system was insignificant in contrast with that under the system that prevailed in most modern atlases, where arbitrary circles instead of the true great circles of the earth were employed as parallels.

In addition to the foregoing, George F. Becker, of the United States Geological Survey, presented papers entitled "Note on Linear Force Exerted by Growing Crystals," and "Note on the Organic Theory of Tilted Blocks," but, as he was not present, his papers were read simply by title.

A joint paper by S. Weir Mitchell, the celebrated neurologist, and Simon Flexner, of the medical school of the University of Pennsylvania, bearing the title "Snake Venom in Relation to Hæmolysis, Bacteriolysis and Toxicity," as well as a paper "On the Nature of Double Halides," by Ira Remsen, of the Johns Hopkins University, and one "On the Pseudo-catalytic Action of Concentrated Drugs," by James M. Crafts, of the Massachusetts Institute of Technology, were presented by title only, or with a brief statement of their contents by the authors.

Two biographical memoirs of deceased members were presented before the Academy. The first of these was a memoir of Frederick Augustus Genth, by George F. Barker. Prof. Genth came to the United States as a young man, and after filling various professional chairs, was ultimately called to the charge of the Chemical Laboratory in the University of Pennsylvania. His skill in chemical analysis gained for him a high reputation, and he was analyst for several State geological surveys, acquiring a very high reputation as an expert in the domain of mineral chemistry.

The second biographical memoir presented was one on Gen. John Newton, by Cyrus B. Comstock. Gen. Newton was a distinguished army engineer, and held high rank during the civil war, commanding a corps at Gettysburg and in the later Virginia campaigns. He became chief of engineers, and during his administration had charge of the explosions at Hell Gate. Subsequent to his retirement, New York city became his home.

The social features of the meeting included a reception by Provost Harrison and Mrs. Harrison, of the University of Pennsylvania, at the Free Museum of Science and Arts, and a dinner given at the Hotel Bellevue, by Dr. S. Weir Mitchell, at which more than thirty of the members were present.

The meeting was remarkably well attended, nearly half the members of the Academy being present at the sessions, which were adjourned at the conclusion of the reading of the papers on Thursday.

The next stated meeting of the Academy will take place in Washington, in April, 1902.

DR. STEIN'S TRAVELS IN CHINESE TURKESTAN.

Dr. M. A. Stein, the well-known explorer who recently returned from Chinese Turkestan and his researches among the buried cities of Asia, has discovered much valuable unknown information regarding the culture and daily life of those cities which for two thousand years have been immersed in the sand, and about the history of which comparatively nothing is known. The expedition was productive in the discovery of a large quantity of sculpture, fresco paintings, objects of industrial art, seals and so forth, dug out of the buried temples and houses, which afford a valuable link in the history of ancient China, India, and the West. A very comprehensive idea has also been gained regarding the extent of the advancement of the Turkestan desert. Some of the settlements excavated by Dr. Stein were found to be as much as 100 miles beyond the edge of the present cultivated area. From the results of his investigation the explorer opines that the inhabitants of these places were in possession of a culture mainly derived from India, and that they were Buddhists. The excavations prove that their culture was highly advanced, and that the art influence of Greece and Rome was felt even at that great distance from the classical centers. The most striking excavations were made in the heart of the desert north of Niya. There one settlement was exposed, covering with its scattered dwellings and shrines an area of about twenty-four square miles. Until digging began all that was visible were weird-looking rows of bleached timber pieces, projecting in various places like the framework of a wrecked ship from between the sand dunes.

The refuse-heaps which were unearthed near some ruined houses were specially interesting. These domiciles were apparently tenanted by village officials. The refuse heaps contained hundreds of documents, beautifully written on wooden tablets and carefully tied and sealed. Owing to the preservative nature of the sand, many of these were in splendid condition—the ink as black, and the seals and string as perfect, as if they were only a few weeks old. As these documents are in a known Indian script, their decipherment can be expected to reveal in a fascinating manner many of the details of the ancient village life. But it will be a task requiring years of close study, as in India itself the materials available of this early script have so far been very scanty.

Round most of the sand-buried houses were discovered carefully-planned little gardens, with avenues of trees, fenced lanes, orchards, and so forth. On clearing away the sand under the shriveled hedges were brought to light heaps of dried leaves, just as they had fallen in ages gone by. The gardens were much the same character as those found in Turkestan to-day. The trees were mostly poplars, peach, mulberry, and apricot. There is no evidence that these settlements were abandoned owing to any sudden catastrophe, but that their gradual desertion was due to the impossibility of continued irrigation, causing an advance of the sand.

GERMAN PORT OF EMDEN.

Mr. Jackson, secretary of the embassy at Berlin, under date of September 25, 1901, reports that the new port of Emden has been opened. The Reichsanzeiger says that this port can accommodate the largest seagoing ships. The inner harbor has everywhere a depth of more than 6 meters (19.6 feet), while the depth of the outer harbor at mean high water is more than 11 meters (36 feet), so that it can accommodate ships drawing 8.2 meters (26.8 feet) at all times. The harbor will be kept open in winter, and the channel of the Ems from Emden to the sea is to be made 10 meters (32.8 feet) deep. Quays have been built in the outer harbor; electric cranes, coaling chutes, etc., have been provided. The outer harbor is a free harbor, and provision has been made for the loading and unloading of goods and for storage, with comparatively little supervision by the customs authorities.

As between pneumatic riveting and hand work, an English engineer says that with the former men drive 500 rivets per working day, while with the latter only 250 rivets can be driven, but the size of the rivets is not given.