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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.

CABLES FOR THE NEW EAST RIVER BRIDGE.

Within a few days the preliminary work for stringing the great cables of the new East River Bridge will be in full swing, and such have been the improvements in this important and very special line of work since the construction of the Brooklyn Bridge twenty years ago, that it is likely all four cables will be in place before the close of the present year.

The four main cables will be 18¾ inches in diameter, and each will consist of thirty-seven strands, each strand being made up of 282 steel wires 1-6 of an inch in diameter. In each cable, therefore, there will be 10,434 wires, with an ultimate or breaking strength of about 20,000 tons, a total of 41,736 wires with a combined strength of 80,000 tons. This means that the four cables would be equal to lifting by a direct vertical pull a fleet of eight warships of the size of the armored cruiser "Brooklyn." That the cables should have such an enormous aggregate strength will be fully understood, when we remember that each square inch of section of the wire is required by contract to have an ultimate strength of 100 tons.

Preparatory to stringing the wires of the main cables four temporary footbridges will be erected for the construction of each cable. Each pair of footbridges will be thoroughly braced together, and also at intervals there will be transverse footways connecting the two pairs. The four footbridges will be double-decked, the lower deck being about 15 feet below the upper deck. The upper deck will be utilized for making the thirty-seven strands of which each cable is composed, and, as each strand is completed, it will be lowered several feet to the position which will be occupied by the finished cable.

The working platforms or footbridges, although they are merely temporary affairs, will require four cables, of an aggregate strength of 2,500 tons, to carry them, and the cost of constructing these platforms will be not less than $200,000. The stringing of the footbridge cables will be carried out in a novel manner, as follows: A lighter, on which will be placed the reels of cable, will be moored at the foot of the New York tower. A line will then be attached to one end of the cable, which will be hoisted to the top of the tower, carried over a temporary saddle, and down to the New York anchorage, where it will be made fast. The lighter will then be towed across the river and the cable being paid out as it advances, and allowed for the time being to lie upon the bottom of the river. The end of the cable will then be drawn up over the Brooklyn anchorage. When the four cables have been swung, floorbeams will be laid across them, and the planking and handrails will be put in place, thus affording a continuous footway or working platform from the anchorages up to the towers and across the whole wide span of the river. After the cables are completed they will be clamped with bands of steel to which will be attached the suspenders from which the stiffening trusses and floor will be hung. The cables will be filled in with a protecting substance composed of oil and pitch, etc., and then they will be completely inclosed with half-round steel plates which will overlap each other so as to completely shed the rain water and give a thorough protection against the weather.

THE RETIREMENT OF REAR-ADMIRAL HICHBORN.

The retirement of Rear-Admiral Philip Hichborn on account of age limit, which takes place on the fourth of this month, marks the close of an official life which has been most intimately associated with the history of the United States navy, not merely in connection with what might be known as the steam-and-steel period, but also with that of the wooden hull and sail-power. The retiring chief naval constructor forms a link between the old and the new schools of construction. His first practical experience in the navy consisted of five years of apprenticeship to the government as a shipwright in the Boston navy yard, where for a few years he acted as assistant secretary to Admiral F. H. Gregory. After a course of theoretical training in ship designing, Mr. Hichborn moved to the Pacific coast, where we find him at Mare Island as a journeyman shipwright, timber inspector, draftsman shipwright, and finally in 1862 as master shipwright, a responsible position for a young man but twenty-three years of age. In 1869, seven years later, he was appointed assistant naval constructor with the rank of lieutenant. The following year he was ordered to report to Portsmouth navy yard, where he supervised the building of the wooden steam vessel "Essex," which, by the way, was recently refitted at the New York navy yard and is now doing duty as a training ship. In 1875 he received his commission as Naval Constructor.

Mr. Hichborn's connection with the new navy dates from the year 1880, when he was selected to serve as a member of the first Naval Advisory Board. In 1884 he made a tour of investigation of the navy yards of Europe and on his return published a report on European dockyards, the demand for which was so great that Congress authorized the printing of two editions. On his return from Europe he was ordered to the Navy Department at Washington as Assistant Chief of the Bureau of Construction and Repair, and on July 12, 1893, he was appointed chief of the same bureau, a position to which he was reappointed four years later and from which, by virtue of age limit, he now retires. For a more detailed account of Rear-Admiral Hichborn's life and work, we refer our readers to an article in the current issue of the SUPPLEMENT.

AERONAUTICAL CONGRESS.

REPORTED BY THE SPECIAL CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The Congress of Aerostatics has been one of the most interesting of the series held at Paris during the Exposition. It was presided over by M. Janssen, Director of the Observatory of Meudon, in which the meetings were held. The different governments sent official delegates; those of the United States were Messrs. Chanute, Gallice, Langley, Marvin, Rotch, Poëy, and Zahm. The list of delegates included a great number of names prominent in aeronautic and scientific work, such as Aimé, Bereau, Bonaparte (Prince Roland), Bruce, Saint Victor, De Dion, Giampetro, De Fonvielle, Lieut. Hinterstoesser, Hammer, Count de la Valette, Morani, Richard, Santos-Dumont, Tissandier, Tzerseleff (Prince Dimitry), etc. The French army and marine were represented by a number of delegates. The principal address was delivered by M. Janssen, in which he reviews the progress already made in aerostatics and the results hoped for in the future. Since the last Congress, held at Paris in 1889, a considerable progress has been made in the different branches. In France and the leading nations the governments have taken up the subject, and its importance in military operations is becoming more clearly recognized. If it is considered that the armies are constantly increasing, as well as the range of the arms of artillery and infantry, a like extension of the theater of combat is to be predicted, and in consequence the use of balloons will become indispensable, and these will be provided with more powerful optical appliances. It must not be forgotten that balloons play an important part in indicating to the artillery the efficacy of its fire and the corrections to be given. If, on one hand, it is pleasing to record the progress which military aerostatics has accomplished in the hands of the skilled officers charged by their governments with the establishment and operation of these services, it must be acknowledged that great desiderata still exist. In fact, if it is possible to leave a besieged place almost with impunity, it is not the same for re-entering; it is to this second phase of the question that the subject of the direction of balloons is attached. Since 1889 the great problem of the dirigibility of balloons has occupied many workers, but it should be said that in spite of the very interesting attempts, the question has not made a decisive step. The experimenters are, however, still at work. M. Santos-Dumont is preparing for the competition for the Deutsche prize of $20,000, and Count Zeppelin is making a great effort with his balloon of 360 feet on Lake Constance. Although the question of dirigibility is the most important, it is also of the greatest interest to improve the aeronautic conditions, either as to remaining as long as possible in the air or to rise to a great height. In this order of facts may be cited the remarkable voyage of Count de Castillon de Saint-Victor from Paris to Sweden, where the balloon covered more than 800 miles, and that of Count de la Vaulx, who kept his balloon in the air for more than 30 hours without landing. M. Mallet has made with the same balloon a tour of France lasting eight days, landing in different places. As regards the altitude reached, the record has been made by M. Berson, of the Meteorological Institute of Berlin, who has risen several times to a height of 28,000 feet, exceeding the highest summits of the Himalayas; it is by the use of oxygen that M. Berson was able to support the rarefaction of the air at this great height. Scientific ascensions have made great progress in Germany owing to the initiative of the Society of Aerial Navigation of Berlin, which is sustained by the liberality of the Emperor. During the last five years the number of these ascensions has reached no less than seventy-five, and the results obtained have lately been discussed in the extensive treatise of Assmann, Berson, and Gross. But the heights attained by these balloons carrying observers are necessarily limited. Even with the use of oxygen, the observer must contend with the depression which surrounds him, and from which results an expansion of all the gases contained in the system, which, in spite of the respiratory reparation due to oxygen, may lead to death. M. Janssen then speaks of the scientists and aeronauts whose loss is to be regretted, among others Eugene Godard, originator of siege balloons, and from whom the author obtained excellent counsels at the time of leaving Paris the 2nd of December, 1870, during the siege with the balloon "Volta;" Hureau de Villeneuve, one of the founders of the Society of Aerial Navigation; Gaston Tissandier, Coxwell, and others. M. Janssen closes his address by a review of the advantages which would result from the mastery of the air and the effects this would have upon civilization.

The Congress was divided into four sections, and in each a number of interesting papers were read. The following is a list of the sections and some of the communications for each: Section 1. Aerostatics. Aimé; dirigible thermosphere. Angelot; new system of balloons. Dibos; signals from balloons at great distances. Giampetro; use of sails in direction of aerostats. Jaguaribe, new apparatus (velo-aerian). Regnard; ascensional propeller. Zahm; theory of balloon direction, etc. Section 2. Aviation. Ader; military aviation. Alexander; force of helices. Bretonnière; study of flying and aeroplanes. Canovetti; experiments on the resistance of air. Herard; new propeller. Mortureux; aerocycle with four wings. Rotch; use of kites at Blue Hill, United States. Roux; study of the flight of birds. Santi; aeroplanes, etc. Section 3. Instruments. Assmann; scientific aerial voyages. Batut; aerial photography from kites. Bouquet de la Grye; aerial telegraphy from balloons. Bruce; luminous balloons for military signals and exploration. Dibos; project of exploring voyage in Central Africa. Rotch; kite apparatus. Triboulet; method of triangulation by panoramic apparatus, etc. Section 4. Legislation. Formation of a scientific commission for the study of aerostatic patents. De Villiers; role of military aeronauts in the Egyptian campaign. Pesce; aeronautic and maritime rights, etc. A number of these papers, which are of great interest, will be reproduced in full or in abstract.

LOTUS POISON.

Messrs. Dunstan and Henry have recently read a paper before the Royal Society, treating of the nature and origin of the poison of the Lotus Arabicus. This is a small leguminous plant, indigenous in Egypt and the north of Africa. It grows abundantly in Nubia and especially along the borders of the Nile, from Luxor to Wadi-Halfa. It is known to the inhabitants under the name of "Khuther;" the plants whose grains are ripe serve as fodder, but at certain epochs of its growth the plant is quite poisonous for horses, sheep and goats, the poisonous properties are most strongly marked in the young plant and continue up to the time that the grains appear. As this plant has caused considerable trouble to the civil and military authorities of Egypt, a complete study of it has been made at the Royal Institute of London, after the material collected by Mr. E. A. Flayer, Director of Egyptian Telegraphs. The dry plant is of a brilliant green color and has the odor of freshly-cut hay. When wet with water and ground, the leaves of the plant give off a considerable quantity of hydrocyanic acid. This quantity is a maximum in the plant just before or just after flowering. It is found that the prussic acid comes from a crystalline yellow glucoside, having the formula O_{22} H_{19} NO_{10}, which is called *lotusine* by the experimenters. Under the influence of an enzyme, also contained in the plant, the lotusine is transformed into prussic acid, sugar, and a new yellow coloring matter, called *lotoflavine*. The action takes place also under the action of acids, but is produced only slowly with emulsine and not at all with diastase. The experimenters propose to call the new enzyme *lotase*: it seems to be distinct from all the others known. Its activity is nullified by the action of alcohol, and it has but little action upon amygdaline. The old plants contain lotase, but not lotusine. The sugar formed by the action is identical with ordinary dextrose. The lotoflavine has a composition which corresponds to the formula $C_{15}H_{10}O_6$. It belongs to the class of pheno-y-pyrones; it is a dihydroxychrysine, isomeric with luteoline, the yellow coloring matter of the Reseda luteola. The decomposition which is produced when the lotase is put in contact with the lotusine, this taking place when the plant is ground with water, is represented by the following reaction: $C_{22}H_{19}NO_{10}$ (lotusine) + $2H_2O = C_{15} + H_{10}O_6$ (lotoflavine) + HCN + $C_6H_{12}O_6$ (dextrose). Hydrocyanic acid is found in small quantities in many plants, and according to Treub and Greshoff it is often present in the atmosphere. The only glucoside well known at present which produces this acid is the amygdaline of bitter almonds, which, under the influence of emulsine, also contained in the almonds, forms dextrose, benzaldehyde and prussic acid. This new glucoside presents, therefore, a great scientific interest.

ESTIMATION OF TUNGSTIC ACID IN ITS ORES.

Carrying out the method recommended by Blair in his "Chemical Analysis of Iron," page 264, Mr. Herbert M. Shilstone made a large number of tungstic acid determinations in wolfram and scheelite ore concentrates for the American Tungsten Mining and Milling Company, of Long Hill, Conn., a few months ago, and found the following methods very satisfactory, accurate results having been obtained without excessive care or unusual precaution.

For the analysis of wolfram he proceeds as follows: The ore concentrate is very finely pulverized and passed through a No. 13 bolting cloth. From 0.3 to 1.00 gramme is weighed and brushed into a small beaker, nitric acid is added, the beaker covered, and the whole digested or heated on the water bath for one-half hour. Hydrochloric acid is now added, and the digestion continues until the ore concentrate is thoroughly decomposed. It is generally left on the water bath all day. It is necessary to replenish the nitric and hydrochloric acids during the digestion, retaining about 25 cubic centimeters of solution in the beaker all the time.

When the ore concentrate appears to be perfectly decomposed it is evaporated to dryness on the water bath (a higher temperature is not desirable), is then redissolved with hydrochloric acid and evaporated down again, redissolved again with hydrochloric acid, diluted with water, filtered, washed thoroughly with acidulated water and then with alcohol. The tungstic acid now remains on the filter along with the undecomposed silica, etc.

It is treated on the filter with ammonia, the filtrate allowed to run into a platinum dish, then evaporated to small bulk, and excess of ammonia added, filtered again if necessary into a platinum crucible, evaporated carefully to dryness, heated gently to drive off the ammonia and finally ignited at a high heat. Cooled and weighed as tungstic acid.

If the ore concentrate is not thoroughly decomposed in the first case, the residue from the first filter must be redigested with acids, treated as before and the result added to the first.

For scheelite he uses a fusion method (as per Fresenius' Zeitschrift, 29, pages 104, 105), which he finds gives results as accurate and is more rapid in operation.

From 0.3 to 1.00 gramme of the finely powdered ore concentrate is mixed with about 10 grammes of equal parts of soda and potash carbonates and fused in a 2-ounce crucible for two hours; the crucible is now given a circular motion so as to coat the inside with the melt, and then chilled by immersing in a beaker of cold water, without letting the water in the top of the crucible. When cool the melt probably will crack away from the sides of the crucible; if not, the crucible must be laid on its side in a small beaker just covered with water and digested on the water bath until the melt is dissolved. The crucible is washed thoroughly and the washings run into the same beaker; it is better to rinse the crucible finally with a dilute solution of hydrochloric acid which must be kept for further use. Continue the digestion of the melt until it is thoroughly decomposed and the soluble tungstate of soda dissolved in the hot water, filter off the undissolved residue and wash thoroughly with hot water.

The acid washings of the crucible are now added to about 200 cubic centimeters of a 25 per cent solution of hydrochloric acid and brought to a boil, the filtrate containing the tungstate of soda is added slowly and constantly stirred, and the beaker is kept covered to avoid loss by spitting as much as possible. A precipitate of tungstic acid will be thrown down if there is an excess of acid; if not a further addition of boiling hydrochloric acid must be added until it gives an acid reaction with litmus paper; the boiling is continued for one-half hour, the beaker removed from the fire and allowed to stand twelve hours in the cold. Filter off as much of the supernatant liquid as possible, never filling the paper more than half full, add a little water and a few drops of nitric acid to the precipitate and transfer as carefully as possible to [illegible]r, taking all precautions. For a very fine pr[illegible] mop out beaker and wash precipitate unti[illegible]ashings are no longer acid, dry in the air bath at 110 deg. C., remove the precipitate from the filter and ignite the filter paper, moisten the ash with a few drops of ammonium nitrate and ignite again, add the precipitate of tungstic acid, ignite first at a low heat and finally at a high temperature, cool and weigh as tungstic acid.

THE HEAVENS IN MARCH, 1901.

BY HENRY NORRIS RUSSELL, PH.D.

This is another uneventful month from an astronomical standpoint. Of all the planets only Mars is visible in the evening sky; and so we may well devote part of our time to the consideration of the strange markings on his surface, as was promised a month ago.

These objects, the so-called "canals," were discovered by the Italian astronomer, Schiaparelli, about fifteen years ago, and have since been seen so frequently, and by so many observers, that there is now no doubt of their reality. They appear, under favorable conditions, as fine straight dark lines running across the ruddy parts of the planet's surface—the so-called continents—in all directions. Their actual width must be 40 or 50 miles at least, since a narrower line would hardly be visible at so great a distance. Many of them reach the "seas" just at the head of some bay and frequently three or more converge accurately to a single point. Most remarkable of all, a large number of them have, at certain times, been seen "doubled," the single line being replaced by a pair of parallels, two or three hundred miles apart, and this duplication seems to follow the course of the Martian seasons. When the air is unsteady, the canals appear as faint, ill-defined streaks; and some of the ablest observers have never seen them otherwise.

They are very difficult objects to observe, but nevertheless, the facts of observation have accumulated far more rapidly than satisfactory explanations for them. They can hardly be rivers, because they are quite straight, and frequently run from one sea to another. It has been suggested that they are cracks in the planet's surface, but though this accounts for their straightness, it hardly explains the regularity of their arrangement, and much less their duplication.

A mere glance at one of the recent drawings of Mars suggests with great force another hypothesis—namely, that the canals are artificial structures of some sort. But here again we meet with serious difficulties. Why should an artificial waterway be fifty miles wide? And how can their doubling be accounted for?

Perhaps the best of existing theories, and certainly the most stimulating to the imagination, is that proposed by Mr. Lowell and his fellow-workers at his observatory in Arizona, who have devoted a great deal of attention to the subject. He regards the dark greenish portions of Mars' surface as areas covered, not with water, but with vegetation, while he believes the ruddy areas to be deserts. The planet's surface is evidently pretty flat, as mountain ranges, if present, would be conspicuous, just as they are on the moon. According to Mr. Lowell, there is much less water on Mars, in proportion to his surface, than on the earth, and much of it is frozen up in the polar ice-caps during the Martian winter. As the ice melts in the spring, the water floods the lower lying regions of the surface—the "seas"—and keeps them green and flourishing. The canals are artificial watercourses, built to carry off the water where it is needed. On each side of them is a strip of irrigated land, bearing the same relation to them that Egypt does to the Nile, and it is this belt which is wide enough to be visible from the earth. The duplication of the canals is accounted for by the ingenious idea that, for some reason, the Martians cut the water off from the central part of this strip first, so that it dries up while the edges are still green.

Mr. Lowell has a good many other facts to back up his theory. One of the most important is that he has seen a number of the canals prolonged upon the "seas." It is hard to see on the old theory how a canal could be dug in the ocean, but there is nothing very remarkable in a belt of dense vegetation near an irrigating canal in a sparsely grown tract. There are also many instances of seasonal change among the canals, and certain parts of the seas, which bear out his theory.

There is, however, something to be said on the other side. The regularity of the arrangement of the canals may be more apparent than real. When several faint lines near the limit of visibility are *nearly* straight, and intersect *near* the same point, the figure which they present, seen as it is only by glimpses when the air is steadiest, is very likely to be drawn by even the most careful observer as composed of *straight* lines, intersecting exactly in one point, so that too much stress must not be laid on the published drawings.

There is also a controversy in the astronomical world as to the reality of the doubling of the canals. Prof. W. H. Pickering has pointed out that lines a little out of focus are often seen double. Any one may verify this by following his directions. Draw a few fine dark lines on a piece of paper; place them three or four feet from the eyes, close one eye, and look with the other at the finger held a foot or less from the face. The lines will appear distinctly double. Of course he does not deny that observers have focused their telescopes properly; but the eye when tired with long or careful gazing may, and often does, alter its focus suddenly and almost arbitrarily. This explanation is, however, strenuously opposed by many observers and the question is by no means settled.

Another objection of a different kind raised against the vegetation theory is that Mars receives much less heat from the sun than the earth does, and, unless he has much more internal heat, it is hard to see how his ice-caps can be so much smaller relatively than the earth's. Other substances might freeze and melt in the same way; the polar caps might be of frozen carbon dioxide, or even frozen in as far as their telescopic appearance is concerned.

So at present we can only say that no completely satisfactory theory of the condition of Mars' surface has been advanced, much less demonstrated, although those which assume the presence of intelligent life on the planet will always remain the most attractive to the imagination.

THE HEAVENS.

The western sky still contains the familiar winter constellations. Along the Milky Way lie Cassiopeia, Perseus, Auriga, Gemini, Canis Minor and Canis Major; and west of it the most conspicuous groups are Orion and Taurus.

At our chosen hour of 9 P. M. on the 15th Ursa Major is well above the pole. Besides the Dipper one can easily recognize the group of stars nearer Capella which form the animal's head, and the three pairs of small stars, almost in a straight line, which lie to the southward above Leo, and mark its paws. In the northeast are Bootes and Corona Borealis, and farther south is Virgo. Leo, identified by the conspicuous "sickle," with Regulus at the end of its handle, is approaching the zenith. Between Regulus and Procyon, a small group forms the head of Hydra, whose body is marked by a long line of rather inconspicuous stars extending eastward beyond the horizon.

THE PLANETS.

Mercury is evening star till the 7th when he passes between us and the sun and becomes a morning star once more. He will not be visible to the naked eye till near the end of the month, when he rises over an hour before the sun. On the afternoon of the 12th he is in conjunction with Venus. Venus is still morning star, but is now so nearly behind the sun, that she rises but forty minutes earlier on the 1st and only twenty minutes before him at the month's end. Mars is conspicuous in the east in the early evening, and passes the meridian about 10 o'clock in the middle of the month. He is beginning to recede from the earth, but is still very bright. Jupiter rises about 2:30 A. M. on the 15th, Saturn about 3 o'clock, and Uranus a little before one. Neptune is still in Taurus, setting about midnight.

THE MOON.

Full moon occurs early on the morning of the 5th, last quarter on the forenoon of the 13th, new moon on that of the 20th, and first quarter on the night of the 26th. The moon is nearest the earth on the 20th, and farthest away on the 8th.

She is in conjunction with Mars on the morning of the 4th, Uranus on the evening of the 12th, Jupiter on the afternoon of the 14th, Saturn the next morning, Mercury on the night of the 18th, Venus on the afternoon of the 19th, Neptune on the morning of the 26th and Mars once more on the evening of the 30th.

On the night of the 20th the sun enters the sign of Aries, and spring begins.

Oyster Bay, January 21, 1901.

MUSICAL SOUNDS FROM THE ELECTRIC ARC.

Mr. W. Duddell, an electrician of London, has discovered a method of producing musical sounds from the electric arc, and recently gave a lecture upon these investigations before the London Institution of Electrical Engineers. It is only the solid carbon, that which is homogeneous in its nature, that is capable of producing these unusual sounds. The cored carbons are absolutely silent. Not only is it possible to obtain musical sounds, but they may be varied so as to produce a tune, and to exemplify his thesis, the inventor played a popular air. The variations in the sounds are accomplished by a by-pass or shunt placed across the carbons, and which have the same effect as the fingers and keys upon a flute. Mr. Duddell, in the course of his lecture, arranged four arcs in series to increase the intensity of the sound, and by varying the self-induction and capacity in the shunt circuit by means of a keyboard, of two octaves, produced his tune. The keyboard may be placed at any distance from the lamps without depreciating the musical effects emitted by the arcs. The inventor has also requisitioned the electric-light arc for receiving telephonic messages transmitted from another point of the building.