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NEW YORK, SATURDAY, DECEMBER 8, 1906.

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.

BRIDGING THE HUDSON RIVER.

Since the failure of the Pennsylvania Railroad and other companies, that have their terminals in Jersey City, to build the great Hudson River bridge, of which so much was heard and written in the early nineties, the subject of bridging this river has dropped entirely out of sight. During the past year, however, the question of building a highway bridge across the Hudson has been the subject of consideration by a joint commission of the States of New York and New Jersey. This committee has recently completed its investigations, and will shortly present its report.

The original proposition for bridging the Hudson contemplated the construction of a colossal railroad bridge with a capacity for fourteen railroad tracks on two decks; and had this structure been built as originally planned, and at the original date proposed, it would have solved at a single stroke the problem of direct railroad communication between Manhattan Island and the West, and it would have done so for about one-fourth of what it will now cost to construct the same number of tracks in separate tunnels beneath the Hudson River.

It has never been generally understood how near this great enterprise came to being actually put through. Had it not been for the parsimony shown by the lesser railroads when it came to the final question of distribution of cost, the bridge would have been built. It was the endeavor of these roads to force the Pennsylvania Company to carry the burden of construction practically alone, that led the president to abandon at the last minute the scheme for the construction of a bridge and order the construction of tunnels exclusively for the use of the company. At that time real estate did not command the high prices which it does to-day; there was not so great a demand for structural steel; nor was labor so scarce or so highly paid. The combined railroads would have secured fourteen tracks into New York city for a cost, including terminals, which was estimated at $60,000,000, and certainly would not have exceeded $100,000,000. Two years from to-day, the Pennsylvania Railroad, after spending $100,000,000, will find itself limited to two tracks for communication with Manhattan and Long Island; and the other railroads will have no connecting tracks whatever.

Because of the great increase in the value of real estate, and in view of the very proper prejudice of the citizens of New York against the construction of viaducts and elevated railways within the city, it would be impossible either to secure the necessary permission for such a bridge, or interest the enormous capital that would be required for its construction. The city has wisely made up its mind to place all future railways and terminal stations as far as possible below ground, at least in the lower and business sections of Manhattan. On the other hand, if the site for a railroad bridge were found at the upper end of the island, where real estate would be cheaper and the objections to a great terminal station would not be so many, the station would be too far removed from the business centers to serve as a satisfactory city terminal.

The objections against a bridge over the Hudson designed for railway purposes disappear when the structure is designed simply as a connecting link between the highway systems of New York and New Jersey. The objections on the score of the excessive cost of the structure itself; of the enormous outlay for downtown real estate; and of the disfigurement of the city by the construction of elevated railways and terminal buildings, are no longer formidable. If the bridge were built primarily as a link between the public roads systems of the two States, there would be no necessity to locate it in the downtown district; and its Manhattan approach could very conveniently be made at street grade from the high level of the Washington Heights district. Here the bridge could be made to serve as a part of the fine system of boulevards and driveways which extends from Riverside Park into the Bronx and Westchester County; while on the New Jersey side connection would be easily made with that splendid system of roads for which New Jersey is justly famous.

The chairman of the joint commission of New York and New Jersey announced that they will not attempt definitely to fix any particular site for a bridge; but will merely suggest that it be built somewhere between 14th and 72d Streets. We are of the opinion that if the site of the first bridge is selected in the vicinity of 72d Street, its convenience and popularity would be such that there would be an early demand for a second bridge to accommodate the general vehicular traffic in the lower business section of the city.

SAFEGUARDS FOR THE PANAMA CANAL LOCKS.

The engineers of the Isthmian Canal Commission have recognized that the absolute safeguarding of the locks of the Panama Canal against destruction by steamship collision is one of the most vital problems in the whole of the canal enterprise. When the Commission announced its decision in favor of constructing a lock canal, in which the summit level was to consist of an inland sea held at an elevation of 85 feet and entered by three stupendous locks in flight, a storm of criticism was aroused against the plans on the ground that an accident might result in the carrying away of the locks, the emptying of the large high-level lake, and the wrecking of the whole enterprise. The most weighty criticism came from Mr. Hunter, the Chief Engineer of the Manchester Ship Canal, and a member of the consulting board, who drew attention to the fact that there had been several accidents on his own canal by collisions of steamships with lock gates which, for the time being, had tied up traffic on the whole canal.

During the past six months, or since the plans for a high-level lock canal were adopted, the Isthmian Canal Engineers have been giving very careful study to the question of safeguarding the locks, both against collision and against the disastrous effects which would ordinarily follow if one or more of the lock gates were carried away. Among the devices for preventing collision, which have been made the subject of study, the most promising is that calling for the provision in front of each pair of lock gates, and about 50 feet therefrom, of a pair of safety gates, which a vessel, entering the lock too quickly, would have to carry away before she could collide with the lock gates proper. The protection afforded by these gates would be twofold. In the first place, a vessel would exercise as great care to avoid hitting them, as if they were the actual gates that held the water in the lock, since collision with them would in any case result in serious damage to the ship itself. In the second place, these gates, because of their enormous structural strength and the great resistance which they would offer to an end-on blow, would suffice, even though they were carried away, to absorb the remaining momentum of the ship.

In addition to the gates, a system of control by means of powerful warping and snubbing devices is being developed, these latter being installed upon the massive concrete masonry which forms the side walls both of the entrances and the locks themselves. One method under consideration contemplates the use of powerful friction drums, working on the same principle as the friction drums used to ease the strain in towing during heavy weather at sea. Cables led from these drums, which would be securely held in the masonry, would be made fast to the ship, and as they unwound, each cable would exert a retarding pull on the ship of from five to ten tons. This control would be positive, and sufficient cables could be made fast aboard to give absolute control of the largest vessel.

The carrying away of a lock gate would be a calamity, not because of the value of the gate itself, but because its destruction would cause a rush of water that might sweep out the whole flight of locks and result in the loss of the whole 37 miles of summit level. Consequently, in addition to making provision, in the way of safety gates and elaborate braking devices, to prevent collisions with the gates, the Commission engineers are making a careful study of various devices by which, should the gates be broken down, a barrier could be interposed back of the gates at the entrance to the locks, which would close the entrance and hold back the water. There are three principal methods under consideration. First, the use of huge caisson cylinders, which could be floated across the lock entrance and close it in much the same way as the caisson gate closes a drydock; second, the use of an emergency swing bridge carrying vertical gates; and third, the use of a special type of hinged swinging gates.

If cylindrical caissons were used, they would be placed either horizontally or vertically. In the horizontal system a cylinder 46 feet in diameter, which is the depth of the water in the lock entrance, and slightly longer through its axis than the width of the entrance, would normally lie in a transverse sunken pocket, built transversely to the axis of the lock, and sufficiently deep to allow the cylinder to lie submerged below the 45-foot level. Should a lock gate be carried away, this cylinder would be rolled up out of its pocket on an inclined plane, until it rested upon the bottom, with its ends bearing against suitable shoulders built for this purpose in the side walls of the entrance. As the cylinder would be built with a diameter slightly greater than the depth of water in the entrance, it would serve to effectually close the channel and hold up the lake level until repairs had been effected. The rolling of the cylinder, which would be water-ballasted sufficiently to give it a slight margin of submergence weight, would be done by means of heavy cables passed around the ends of the drum and operated by powerful winches suitably placed on the shore. Another plan under consideration contemplates the use of two vertical cylinders which normally would stand in vertical pockets formed in the side walls of the entrance. Each cylinder would be slightly smaller in diameter than the width of the entrance so as to secure a slight resultant horizontal pressure when they close, and provision is made for swinging them out of their pockets until they meet at the center of the entrance channel, where they would form a barrier to the flow of water.

Another method contemplates the use of two vertical sectors of cylinders, hung on heavy pintles at the side walls of the entrance and normally swung back into pockets out of the way of the traffic. Should a vessel collide with a gate and be sunk in the channel, these gates would be swung shut until they met or closed against the sides of the sunken vessel. The advantage of this type of gate is that, as the resulting thrust is normal to the curved upstream faces of the gates there would be no destructive impact as they swung together in the face of the rush of water.

Another most effective method of holding back the lake would be the provision of a swinging bridge, mounted on a turntable, and corresponding, in its construction and operation, to the ordinary swing bridge over a navigable waterway. In case of accident, one arm of the bridge would be swung across the 100-foot opening of the entrance, until it brought up against an abutment formed in the opposite side wall. From the bottom of the arm, which would be a steel truss of great strength and rigidity, would project a series of vertical steel guide pockets, reaching down the full 45-foot depth of the entrance, and bearing on a bottom sill. In case of accident this arm would be swung across the entrance, and a series of steel curtains would be lowered until the flow of water was entirely shut off.

It will be seen from this outline of the studies which have been made of this problem, that the destruction of the lock gates would not necessarily involve the washing away of the whole flight of locks and the emptying of the summit level lake. The devices which we have above described are, it is true, of gigantic size, and would involve some careful planning both as to their construction and subsequent operation; but with the modern materials and appliances which the engineer has at his disposal, there is no inherent difficulty in these plans to prevent the satisfactory realization of one or other of them in practice.

AIRSHIPS IN THE FRENCH ARMY.

The French army seems to have taken the lead in the way of practical use of airships for military work, and will soon have two airships in actual service. It will be remembered that the first one of these, the "Lebaudy 1905," which made such a fine run from Moisson to Chalons, and a set of maneuvers at Toul, was turned over to the government by Messrs. Lebaudy, and the Minister of War had it stationed first at the Toul fortress and afterward at the Meudon establishment near Paris. It is proposed to use it especially in order to train the aerostatic personnel, and it will remain there for the instruction of the officers and men who are to form the first crews of the airships. Commandant Bouttieaux and Capts. Voyer and Bois, who followed last year's tests, are charged with the instruction of the men. The personnel will thus be well trained by the time the second airship "Lebaudy 1906" is delivered to the army. The new airship presents a great interest. M. Etienne, the Minister of War, having seen the value of the former airship during last year's maneuvers, decided to have a new balloon of the same kind built by Messrs. Lebaudy, and the new "Lebaudy 1906" is the development of the principles already applied with success by Engineer Julliot. Modifications over the type we have already described are made in some of the details. The envelope, still of rubber-treated canvas, measures nearly 200 feet long with a large diameter of 35 feet as before, and a volume of 4,000 cubic yards. A Panhard-Levassor 70-horse-power petrol motor is used now, and it gives much better results than the 20-horse-power form used on the first airship. All the mechanical parts are calculated accordingly, and a higher speed is looked for. Some changes have been made in the planes and the steering apparatus. As it is somewhat longer and thus has a greater volume, and the arrangements for ballast are improved, with a higher power, it should give even a better performance than the first, with a greater range of action. Most of the maneuvers are worked by automobile steering wheels placed near the pilot. The floor of the nacelle is of steel plate. While building at Moisson the construction has been kept secret for the most part. The most recent reports state that the new airship is now entirely finished, and it is filled up with gas by a corps of military aeronauts commanded by an officer. Then the first trials will be made on all the different parts so as to show what modifications may be needed. After these are made the final tests will take place, probably near the first of December. Then the Minister of War will take possession of the airship, as has been agreed upon, when it will have been put in perfect shape by Messrs. Lebaudy. It is to be known as the "Patrie," while the other will keep the name of "Lebaudy," and will be allotted to the fortified post of Verdun. Here will be established a well-fitted airship park which will be much more complete than the temporary one first set up at the Toul fortress. A third airship will no doubt be built, and will be called the "Republique."

NATIONAL ACADEMY OF SCIENCES.

BOSTON MEETING.

BY WILLIAM H. HALE.

The meeting of the National Academy of Sciences at Boston, November 20 to 22, was notable in several respects. A majority of all the members of the Academy were present; forty-three papers were presented, so that both in attendance and number of papers all previous records were broken; and also a new and interesting feature was added in the conversazione, which means, as they use the word here, not merely a social gathering, such as the conversazione to which the British Association for the Advancement of Science has long been accustomed, but a collection of most interesting and instructive exhibits showing the latest phases of scientific research in many departments. Boston may well claim to be the best place in the world to hold a scientific meeting, and the sessions were held in the most delightful environment possible—the new group of marble palaces just opened for the Harvard Medical College.

With so much of interest to describe and report, no exhaustive account is practicable. The topics presented cover a wide range, from the evolution of the universe to the measurement of waves of electrical energy of the wireless telegraph, of but one or two millionths of a second duration. A very curious and novel theory as to the extent and nature of the stellar system was advanced by Prof. George C. Comstock, to the effect that there is something which quenches light coming from the regions outside the milky way than from the milky way itself; hence, that the bright stars in the latter may not really be larger than the faint ones outside; the small apparent motion of these stars is due to the fact that they are drifting in the same general direction as our sun; and there is reason to believe that the universe is infinite.

Dr. George E. Hale exhibited photographs of the sun taken at the Carnegie Institution in California, and discussed solar spectra and their bearing on stellar evolution. Photographs taken by the incandescent calcium vapor at different heights surrounding sun spots show that the atmosphere is hotter in its lower and cooler in its higher strata. It is also found that the temperature of sun spots is so much cooler than that of the surrounding atmosphere as to allow elements elsewhere dissociated to combine, notably oxygen and titanium, as the spectrum shows the presence of oxide of titanium in the sun spots. A similar evolution has taken place in the stars.

Prof. William H. Pickering demonstrated by a gyroscope the solution of a problem which has long perplexed astronomers—why the tenth satellite of Saturn has a retrograde revolution. This is really the original direction of revolution, but the other satellites and all but one of the planets of the solar system have been caused to change the original direction by the friction of the annual tide which in the course of ages has caused the axis of our earth, as well as of the other planets and satellites to turn clear around, causing the rotation to be opposite to its original direction. By imitating this tidal friction—producing an artificial tide on the gyroscope—Prof. Pickering caused a similar inversion of the gyroscope.

Prof. Bailey Willis discussed heterogeneous elements of the North American continent, indicating that this continent has had five elevations and four submergences.

Prof. Henry F. Osborn spoke of the American tertiaries, pointing out seven different successive changes of fauna due to the making or severing connections with different continents, so that North America has in turn been stocked from South America, Africa, again South America, and finally Europe, giving us from the last the types now prevalent.

Prof. Charles S. Van Hise gave an explanation of the origin of the ores of the cobalt-silver district of Ontario—the Nipissing mine, etc. This is the first discovery of cobalt of any extent in America; the only other important cobalt mines are in Saxony. The wonderful richness of the Ontario mines of cobalt and silver is attributed to the fact that the veins were filled as a result of two and in some cases of three successive concentrations.

It was well worth a journey to Boston to hear Dr. Charles S. Minot discourse on the nature and causes of old age. He began by saying that a German philosopher who told a visitor in the course of a short visit all the system of philosophy which it had taken him a lifetime to work out was angry that his guest could not master in so short a time what it had taken him a lifetime to acquire. Dr. Minot expressed much the same feeling at being expected to explain in a few minutes what it had taken him as many years to discover. Senescence, as he explained it, begins even before birth. The percentage of growth of an infant in comparison with its whole body rapidly diminishes. Guinea pigs as soon as they recover from the shock of being born, grow at the rate of 5 per cent a day, but at the end of the first month this rate has fallen to 1 per cent a day. Rabbits are born in a less fully developed condition, and they grow 17 per cent for the male and 16 per cent for the female at birth, which decreases to 5 per cent after one month and to 1 per cent after two months. But the rate in growth is many fold greater before birth. On the ninth day, immediately after the segmentation of the ovum is complete, the fœtus increases in weight 1,000 per cent, but this rate rapidly decreases. On the eighteenth day, the cells have differentiated in the different organs, and they are seen to have a thin coating of protoplasm. The differentiation of the cells continues to progress and the amount of enveloping protoplasm to increase. These two kinds of change are all that Dr. Minot has been able to discover; in other words, they are all that we know as to the changes which accompany increasing age. It is these changes in cell structure, then, that continue to progress as age increases and which constitute growing old or senescence, so far as we know anything about it. The only period of rejuvenation is the brief time occupied by the segmentation of the ovum immediately after impregnation. Senescence, therefore, begins long before birth.

The Alpha and Omega of the programme was Alexander Graham Bell on aerodromics, his name occupying both the first and the last place. He read only one of the papers, however, in which he gave an historical account of the development of aerial navigation, and described the form of apparatus on which he is now experimenting in Nova Scotia. He said that the problem was really solved by Langley in 1896, when he constructed a machine which actually did fly, for Bell saw it. Langley's later and more elaborate machine was unduly discredited because it never was actually launched, and so it never had a fair chance.

The discouraging factor of aerodromics is the well-known mathematical formula that the sustaining surface of a machine increases only as the square of its dimension, whereas its weight increases as the cube. If, then, you build your large machine in the same form as a small and successful model, it soon becomes too heavy to rise at all. To meet this difficulty, Dr. Bell decided to fasten together many small supporting surfaces. By this means he could increase the supporting surface at just the same rate as the weight. The best units are tetrahedra, with two faces covered and one face and the base open. These are made about double the size of samples which he passed around; probably about eight inches long on each edge. His first thought was to connect a set of these by their corners and to alternate this construction with open spaces; but he found that it was practicable to build up large masses of these units compactly, giving a great supporting power, combined with strength and lightness. The edges are of aluminium. The structure constitutes a sort of kite, using that word as a suitably descriptive one, but of course not at all in the nature of the old-fashioned simple flying toy.

In order to avoid needless risk of life, he uses his structures on water or at slight elevations, and kept captive. He finds it practicable to go at as low a rate as ten miles an hour, instead of the kilometer a minute, nearly thirty-seven miles an hour, at which the Wright brothers operated their machine in Dayton, Ohio. Apparently this high rate of speed was necessary to keep the machine in the air. He found also very recently that he could move his machine against a rather brisk breeze for the reason that it is heavier than the air, and momentum is the combined product of weight and velocity.

On archeology, Prof. Charles P. Bowditch gave an extremely interesting account of the temples of the cross, of the foliated cross and of the sun at Palenque, Mexico, which showed a high degree of accuracy of knowledge as to periods of revolution of the earth and the planets Mars and Venus.

Ellsworth Huntington, who has recently returned from a tour of three thousand miles in Central Asia, presented evidence to prove that the climate of Chinese Turkestan has greatly increased in aridity in recent times. He showed photographs of villages inhabited from fifteen hundred to two thousand years ago, and necessarily requiring abundant supply of water, which were now in ruins, and very remote from water, in some cases as far as sixty miles.

Prof. Joseph Barrell showed how a comparison of sedimentary rocks over a continental area may enable us to discover what were climatic conditions in geologic ages. Periods of great rainfall were characterized by large areas of fresh-water sedimentation, and those of small rainfall by a greater proportion of marine deposits. The inclosed fossils indicate whether they were organisms of marine or of fresh-water life. He stated also that about one-tenth of the earth's present land surface is desert.

Dr. R. S. Woodward exhibited and explained a double suspension pendulum, devised especially in order to determine the rate of acceleration of the speed of a falling body. He avoids defects of previous pendulums, especially the knife-edge. His invention vibrates more steadily than the pendulums of the best astronomical clocks.

POINTS ABOUT NEEDLES.

BY H. R. CHRISTY.

One needle is a pretty small item, but the daily consumption of something like 3,000,000 needles all over the world makes a pretty big total. Every year the women of the United States break, lose, and use about 300,000,000 of these little instruments.

Our needles are the finished products of American ingenuity, skill and workmanship, and yet how many people, threading a needle or taking a stitch, have ever given a thought to the various processes through which the wire must pass ere it comes out a needle? The manufacture of a single needle includes some twenty-one or twenty-two different processes, as follows: Cutting the wire into lengths; straightening, by rubbing while heated; pointing the ends on grindstones; stamping impression for the eyes; grooving; eying, the eye being pierced by screw presses; splitting, threading the double needle by the eyes on short lengths of fine wire; filing, removing the "cheek" left on each side of the eye by stamping; breaking, separating the two needles on the one length of wire; heading, heads filed and smoothed to remove the burr left by stamping and breaking; hardening in oil, the needle is thus made brittle; tempering; picking, separating those crooked in hardening; straightening the crooked ones; scouring and polishing; bluing, softening the eyes by heat; drilling or cleaning out the sides of the eye; head-grinding; point-setting, or the final sharpening; final polishing; then papering, and finally, labeling. For wrapping, purple paper is used, because it prevents rusting.

There are many sorts and kinds of needles: First, there is the surgeon's grewsome outfit—the probing needle, made for tracking bullets or hidden cavities of pus; the hairlip needle, the long pins for pinning open wounds, the post-mortem needle of curious pattern. Some of these little instruments are thin, some are thick; others are long and straight; others, again, curve once, twice or three times. The veterinary surgeon has his special outfit also. The cook's needles are wonderfully, fearfully made. His larding needle is used to sew large pieces of meat together. The trussing needle is made on purpose to insert melted butter or sauce right into the vitals of a Christmas turkey. It is hollow, and has a large opening into which the sauce is poured. Nor less interesting are the needles which the upholsterer uses. Some are half curved, and some have round points. He has needles with curious eyes—long, round, egg, and counter-sunk eyes; the same kinds of needles are used by collar-makers. Then there are the delicate needles used by wig makers, glove makers, and weavers; these are often as fine as a hair. The glove needles are splendid specimens of skillful workmanship; the finest of them have three-cornered points. The great sail needle, which has to be pushed with a steel palm, would puzzle most people; so, too, the broom-maker's needle, which must also be pushed with a steel palm. The curious knitting-machine needle, with its latchet; the arrasene and crewel needles, and the needle for shirring machines; the weaver's pin for picking up broken threads, with an open eye in the hook. The long instrument used by milliners, the needle of the rag-baler, the knife-point ham needle used in the stock yards, the astrakhan needle—these and other varieties do not call for special notice.

The needle, as we see it to-day, is the evolved product of centuries of invention. In its primitive form it was made of bone, ivory, or wood. The making of Spanish needles was introduced into England during the reign of Queen Elizabeth. Point by point the manufacture has improved, until the little instrument is one of the highly-finished products of nineteenth century machinery and skill.