FISHWAYS ON THE RIVER SIRE.

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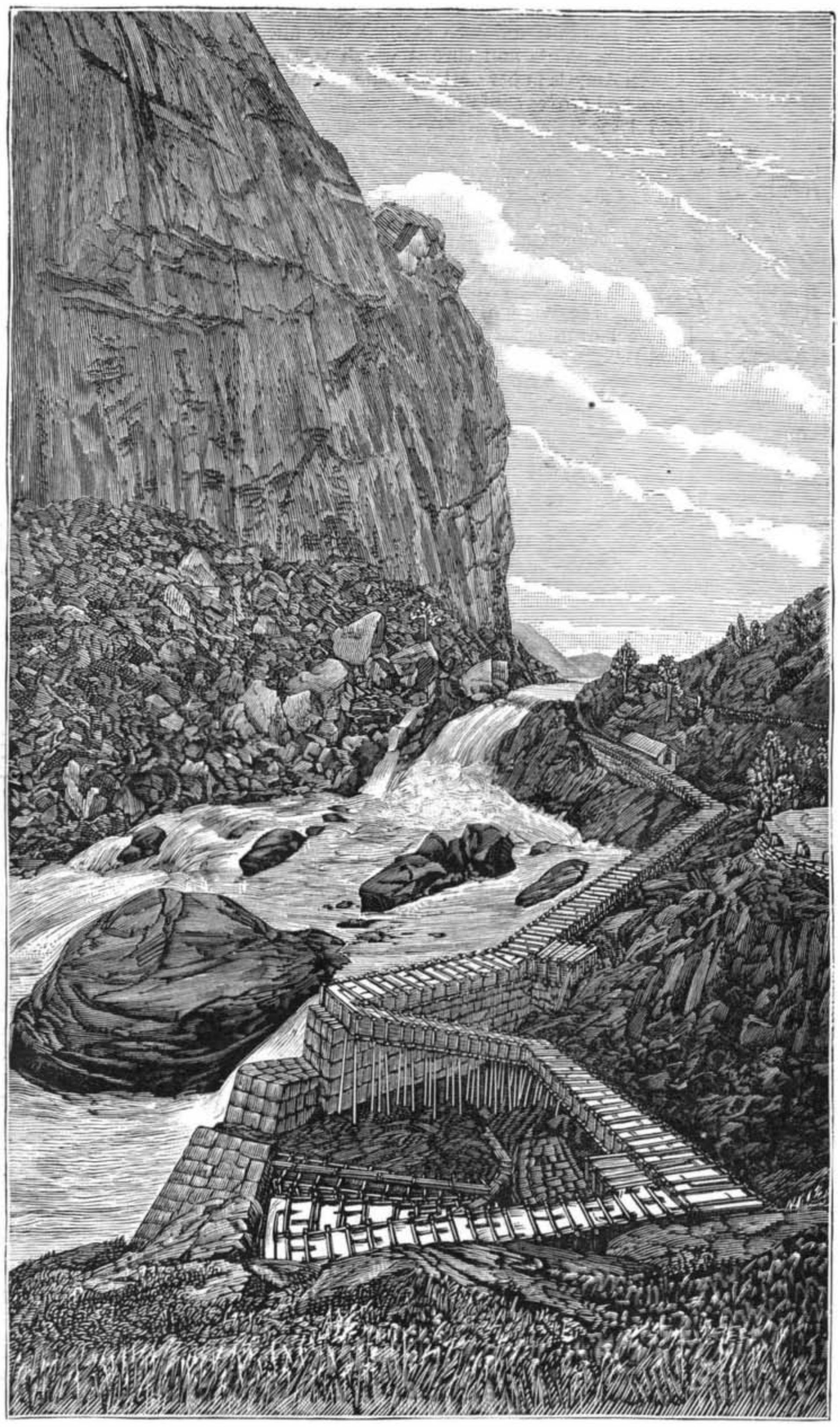
The salmon fishways at Sire, Norway, have attracted considerable attention in the last few years, being the greatest undertaking of this description ever completed in the world. We accompany this article with an illustration of the larger and more complicated of the two fishways of which we are to speak—the one at the so-called Rukanfos, or upper Logsfos.

It is commonly believed that the main object of salmon fishways is to enable the greatest possible number of persons to share the profits of the salmon fisheries, by affording the owners whose property is situated above the obstacles to be overcome by the fishway an opportunity to participate in the salmon fishery. This belief, however, is far from being correct. If in building fishways this was the only object, it would not only be an unnecessary waste of time and money, but simply an injustice to the present owners of the salmon fisheries, as their legally attained rights, self-evidently, would suffer, when being compelled to share them with others. The true object in building salmon fishways is, much more, to increase the salmon by improving the conditions on which the reproduction of the fish is dependent. The salmon can only increase in rivers, where it can spawn late in the fall or early in the winter, in places where the river bottom is made up of fine gravel and where there is an even, somewhat swift, but not violent current. In many salmon rivers, places of this description are rare, especially near the mouth of the river, where the bottom usually consists of clay, mud, or fine sand, and the water is impure. When the salmon is confined to short stretches of river of this nature, it is forced to spawn in places which, if not altogether injurious to the development of the fry, are, at all events, in great measure unfavorable, and the inevitable result is that disproportionately great quantities of spawn are destroyed. Good fishways, then, constructed in the proper places, will greatly improve the productiveness of a salmon river by augmenting the number of favorable spawning places.

The great results attained in this manner can be seen in other countries. In the Ballisodare River, on the northwestern coast of Ireland, where formerly no salmon was found, on account of an insurmountable waterfall at the very mouth of the river, they have succeeded, by using three fishways, in establishing a salmon fishery, valued at 50,000 kroner a year, considerably more than the value of salmon fishing in any Norwegian river. By far greater profits have been realized in other rivers of Great Britain and Ireland by building fishways and demolishing mill dams.

The fishway at the Rukanfos, represented in our engraving, surpasses every work of its kind, both on account of the fall and the obstacles to be overcome. The total height of the fall is, as stated, no less than 27·2 meters (89 feet), and the steep, wild cliffs that surround it on all sides leave but little space for building a fishway. Further, the floods which occasionally occur are exceedingly violent, often causing the water to rise 6·6 meters (21·6 feet) both at the foot and the head of the fall. Extraordinary measures have been necessary in order to procure the necessary room to protect the works against the flood and make them useful at low water. The engraving gives a general view of the work, at the same time conveying an idea of the huge, very nearly perpendicular, mountain side that towers above the fall at its left. It will be seen how the lower part of the fishway is guarded by two immense stone walls, and, partly resting on one of them, winds up through the narrow ravine, until reaching a point from which it is continued in a more horizontal direction. The fishway, which is built of wood, except at the very top, where it is blasted into the stone, has a grade of 1 in 7 and 1 in 8, and is principally arranged according to an American system (E. A. Brackett's), with a few minor alterations. The total length of this fishway is 285 meters (935 feet), while the passage to be made by the salmon is 785 meters (about one-half mile); it is 2·82 meters in width, with a depth of 1·18 meters, depth of water about one meter. The punctuated cross lines in the outline show the current breakers, fixed in the bottom of the channel to check the swiftness of the current. The greatest peculiarity about the fishway is the construction of the lowest part, nearest to the mouth of the channel. To make the fishway more attractive to the salmon, a side channel, which lies nearly horizontally on top of the lower part of the way, has been constructed to increase the water; to keep the water from overflowing during a flood the walls are made considerably higher at the mouth, where they are no no less than 4·2 meters high. The upper course has also some peculiarities of its own, consisting of a number of cross dams, whose level is 0·4 meter lower than those opposite, and in each there is an opening at the bottom 0·89 meter square. The principal dam at the top is fitted out with a trap door which can be opened and closed at pleasure. It has been seen that the salmon can now pass the fishway without any difficulty, notwithstanding that some improvements, to make the fishway more useful at very low water, still remain uncompleted. As the number of salmon in this river, owing to the lack of spawing places which are accessible to the salmon, was small when the fishways were constructed, some years must pass before the results of the labor can be seen. Only few salmon have so far passed up the fishway. When the remaining improvements have been completed, the undertaking will undoubtedly pay largely. At the upper part of the fishway a house for the artificial hatching of salmon has been constructed. We are indebted to the Fish Commission of State of Massachusetts for the loan of the cut.



FISHWAYS ON THE RIVER SIRE.

A CAMEL will work seven or eight days without drinking. In this he differs from some men, who drink seven or eight days without working.

Converting Sawdust into Manure.

A correspondent in the *Country Gentleman* states the chemical process sawdust should undergo to render it suitable for fertilizing, and how to use it on the land after the sweating process has been accomplished. Sawdust is a conductor of heat; to change its condition, heat, air, and moisture are necessary.

To secure the vegetable mould so important in rendering a soil (sand and clay) fertile, sawdust presents a desirable compound for the purpose when properly treated. The difference between humus, ulmine, vegetable mould, etc., consists in their containing more carbon than wood. To obtain these compounds, a slow burning or decay (*eremacausis*) must take place. To produce this chemical action, heat is necessary—at least 80° to 90° Fah., with a small supply of air—a kind of smouldering process. The first element of the wood to unite with oxygen is the hydrogen, and quickly the excess of carbon shows itself by the dark or charcoal color, as is the case when the decay takes place in the soil; as the oxidation of the hydrogen continues, the humus, ulmine, vegetable mould, comes in view. Too much heat must be avoided, or the carbon will also take oxygen, and all will pass to the air as carbonic acid and water, and nothing but the mineral matter be left.

In all manure piles this heat must be controlled, or you will have the so-called fire-fanged mass, free of humus and its allied combinations.

Vegetable matters in a green state possess a self-destructive power within themselves, having the gluten and chlorophyl in a moist state. These compounds are much more sensitive than ternary ones. I will compare them to flesh and fat in the animal kingdom. The carbon, hydrogen, and oxygen of the fat will hold together for a while, but with flesh the case is different. Four [illegible] not company, and they hate each other, *i. e.*, have no chemical affinity. The restless negative nitrogen will slip away the moment the cohesive power of life is lost; hence the rapid resolution of flesh in the presence of that all-important heat.

With this explanation, I purpose suggesting a plan for utilizing sawdust or any carbonaceous matter to reduce to humus. First have a bed of the dust, and on this a thin bed of green matter—weeds of any kind will answer the purpose—then a thin sprinkle of fine road dust of clay, followed by a bed of sawdust, and alternate, until your pile reaches some feet. Soon the unfixed nitrogen will unite with the hydrogen, and seek its old home in the air in the form of ammonia, which, when freed, will be trapped by the clay. The resolution of this vegetable matter sets free the locked up sun-heat it contained, and the heat induces the hydrogen of the wood to seize oxygen and pass to its old condition (water), and the desired combination of humus and vegetable mould comes in full view; and this is the great restorer of life to a worn out body of sand and clay. When applied from a pile of sawdust, or the turning under of a growth of vegetable matter, the result is the same. Life and motion commence, ammonia, carbonic acid, and moisture from the air are all drawn to it and held, and the roots soon find and transform water, carbonic acid, and ammonia into living organic matter, and life again comes out of the inorganic kingdom without the use of flesh and blood.

The First Patent.

The first patent granted to an inventor in the United States is mentioned in a speech of Ex-Senator Wadleigh, of New Hampshire, in the Forty-fifth Congress. The Senator said: "An intelligent gentleman of my own State has referred me to an act of the general court of Massachusetts Bay passed in 1646, granting to one of his ancestors, Joseph Jenks, the exclusive right of making and selling his improved scythe for the term of fourteen years. That, I think, was the first patent granted to an inventor in America. The improvement referred to changed the short, thick, straight English scythe into the longer, thinner, curved implement with stiffened back now in use."

Ancient and Modern Engineering and Architecture.*

The remark, "There is nothing new under the sun," is more axiomatic than the casual reader believes. We think that this is a very progressive age, and that our generation stands pre-eminent in civilization—is the highest known. This is so, but to state that we, in this age, are immeasurably superior to the ancients is, we think, incorrect. Our aim is not to prove our century inferior to the past ones, rather it is to present historical facts which will indicate that modern architectural and engineering works are merely reproductions of those of the ancients, though sometimes larger and more speedily erected, owing to better facilities.

The works of long ago compare very favorably with those of the present, and in some instances excel anything of our own time. Hardening copper for tools is one of the lost arts; we cannot manufacture the Damascus blade, nor do we know by what means the pyramids were erected. There are very few (if any) streets like one in Cordova, founded 152 B. C. It was perfectly straight, ten miles long, and illuminated by public lamps. Paris, which is said to be the best lighted city in the world, cannot surpass this wonderful street. Cordova was not without rivals. Granada, founded before Augustus; Seville, in its prime 590 B. C.; Toledo, taken by Maximus Flavius 193 B. C., vied with Cordova with its 200,000 houses and 1,000,000 inhabitants. This city of Cordova may not be a fair comparison, as its decay commenced when conquered by Ferdinand III., of Castile in A. D. 1236. Modern cities surpass the ancient in number rather than in magnificence.

A slight acquaintance with archæology is sufficient to show us that the Statue of Liberty Enlightening the World is a duplicate in principle of the Colossus of Rhodes. The former is to be erected upon Bedloe's Island in New York Harbor, in honor of fraternity between France and the United States. It is of copper, and the ascent to the head is made by inner staircases. The right arm is extended, grasping a torch, which will illuminate the harbor by electricity. The total height is 328 feet 11 inches; pedestal 177 feet 9 inches, leaving 151 feet 2 inches for the statue. This work of art was fabricated in France under the supervision of its projector, Bartholdi, who in all probability took his idea from the Colossus of Rhodes, which was also erected upon an island, the Rhodus, in the Mediterranean Sea, twenty miles from Lycia on the south coast of Asia. This colossus was of brass, and erected 300 B. C. in honor of Apollo. Historians tell us that the height was 125 feet, "with legs distended on two moles which formed the entrance of the harbor," said moles supposed to have been twenty feet apart, and ships sailed under the body on entering the port. The statue was hollow, and the legs were lined with large stones to counterbalance the weight. This colossus was the workmanship of Chares, a pupil of Lysippus, a celebrated sculptor of Greece. The Colossus of Rhodes was thrown down by an earthquake sixty years after erection. The brass made 900 camel loads, or 720,000 pounds. The Washington Monument is considered a grand work, but the work of putting a new foundation under the old one was far more wonderful than the building of the obelisk itself. This monument presents a smooth exterior, and is 555 feet in height; was commenced more than thirty-six years ago, and finished under Colonel Thomas Lincoln Casey, chief engineer and architect, December 6, 1884. This pile of stone is hollow, and capped by marble with a conical apex of aluminum. The Pharos of Alexandria was 450 feet high, and built upon an island. Alexander the Great gave his order for this structure 332 B. C. to a Macedonian architect, Dinocrates by name, who also connected the island with the mainland by an earth wall. This lighthouse differed from the Washington Monument in being highly ornamented, the stone was finely carved, columns and balustrades worked in the finest marble embellished the exterior. It was built in several stories, tapering toward the top. The ground floor and the two next were hexagonal; the next square, with towers at each corner; the fifth to the top was round, with an external winding staircase. The extreme top was open, so that sailors could see its night beacons. The Pharos at Alexandria was a work of art, a credit to Alexander, who commenced, and to Ptolemy Philadelphus, who finished it. The Americans have built the highest structure known to man, but it is barren of all art. There is quite a difference between building a lighthouse with carved marble on an island, and erecting huge stones perfectly smooth by machinery, inland, even to the height of 555 feet.

Both ancient and modern engineers and architects considered height as a great objective point. The Great Pyramid is 478 feet. Cologne Cathedral is 510 feet. Rouen Cathedral, 490 feet. The statue of San Carlo Borromeo, at Arona, erected in 1697, was 66 feet high, and the pedestal 40 feet. A marble statue of Nero was said to be 120 feet high. The walls of Babylon were 378 feet high, also 93 feet 4 inches thick, and in compass 60 miles. Herodotus, who was at Babylon, gives these figures; others give the height 50 feet, as they were after the time of Darius Hystaspes, who pulled them down to that height, that he might conquer the city again more easily, if necessary. The Chinese wall was much longer, being 1,250 miles, but very much inferior in width and height; only 20 feet high, 25 feet wide at the base, and 15 feet at the top; about one-third of the wall of China is dirt and rubbish, the rest being masonry, and it dates back to 220 B. C.

The Hanging Gardens of Babylon were built by Nebuchadnezzar to gratify his wife Amytis. The gardens were over 400 feet square, built terrace above terrace until they were 27 feet higher than the walls, or 400 feet. The top was sustained by a series of arches one above the other, and each terrace was bound by a solid wall 22 feet thick. On the top arches were first laid flat stones 16 feet by 4, over these weeds and bitumen; then two rows of cemented brick covered by sheet lead, upon which was laid earth sufficiently thick to nourish large trees. The gardens were filled with the blooming plants and shrubs which were admired by Queen Amytis in her native Media. The different terraces and groves contained fountains, parterres, seats, and banqueting rooms; in fact, all the splendor and magnificence of Eastern art seem to have been lavished upon these gardens by King Nebuchadnezzar in order that his Median bride should be happy in her new home. Pen cannot picture the grandeur of the conception or the perfection of the execution of these gardens, which have been and are the wonder of all ages. The greatest hanging structure now in existence is the Brooklyn suspension bridge, costing $15,000,000. The whole length is 3,475 feet, and it connects New York and Brooklyn by a clear span of 1,595 feet. It is 135 feet above low water mark and 85 feet broad, it has also two platforms, one above the other. The piers are stone masonry, hollow, and sunk below the surface by means of caissons. As the details of this work are formidable, it is sufficent to say that it is the greatest engineering feat known. John Roebling was the engineer.

One of the mysteries handed down to us is the manner in which the ancients manipulated those immense stones. Take the obelisk of Luxor, which stands sentinel over the Place de la Concorde, in Paris, 73 feet in length. Long continued manual labor could quarry it, but by what means it was conveyed to Luxor is still hypothetical; and the stones of the Pyramids, not one of which is less than thirty feet long by five thick, how could they be hoisted up 478 feet, or, rather, how were they, and by what means were these great blocks of granite transported from the quarry at Syene to the delta of the Nile, a land journey of six hundred or a voyage of seven hundred miles? Egyptologists have surmised many ways by which the Pyramids were built, but none of them seem satisfactory. No representations of derricks or hoisting machines have been bequeathed to us. Some writers say that the stones were raised by machines from step to step, others tell us that skids were used, still others that the external covering was laid from the top to the bottom. The great Pyramid Cheops covers at base about 555,000 square feet, and rears itself 478 feet. The first step is nearly four feet eight inches high; the top one, one foot eight inches. Mathematics were known in that day, as its angle was perfect at all sides, 51° 50', also each stone was accurately fitted to another. Notwithstanding the difficulty in finishing granite, the stones of this royal tomb were finely polished. Chronologists differ as to the date of the reign of Cheops, the latest date given being 2123 B. C. Herodotus says that he "was informed by the priests of Memphis that the great Pyramid was built by Cheops, that 100,000 men were twenty years in building it, and that the body of the king was placed in a room in the bottom of the Pyramid." No king ever had a mausoleum so beautifully magnificent; beautiful in its simplicity, magnificent in its proportions. The Pyramid of Cephren is 684 feet square and 456 feet high. The Pyramid of Mycerinus is 330 feet at base and 174 feet high. There were many other pyramids built, but to all of them we can only say, "The eternal pyramids—the mystery of the past, the enigma of the present, and the enduring problem for the future ages of the world."

One thing the ancients did not attempt; at least there is no record of their building self-supporting domes prior to the church of St. Sophia, in Constantinople, originally built by Constantine, destroyed by fire, and rebuilt by Justinian. The dome is 175 feet high. St. Paul's, London, commenced in 1675 and finished in 1710, has a dome 145 feet in diameter and 365 feet from the ground. St. Peter's has the largest and highest dome known. This beautiful pile was commenced in A. D. 1450, and finished three and a half centuries after. The dome is 405 feet from the pavement, and 193 feet in diameter. The domes of the churches of St. Genevieve and Invalides, Paris, are also self-supporting.

Not even Dinocrates, who built Alexandria and the Pharos, also the Temple of Diana, attempted the difficult engineering feat of self-supporting domes. In constructing the Pyramids mathematics were known, consequently it was not ignorance which prevented the ancients from worshiping under a self-supporting vault.

The sewers of Paris are great works of skill, large enough to float inspection boats, but they do not surpass very much the Maxima Cloaca of Rome, thirteen feet broad and thirteen feet high, built by Tarquinius Priscus, 616 B. C. Athens had sewers which drained into the Saronica Gulf. Babylonian sewers drained its marshes into the Euphrates. Modern age has simply copied from the ancient. The principle is the same now as when the Alexandrian architect wished to build a temple to Arsinoe, in which he intended to suspend her statue by means of a loadstone. The only thing modern sanitation can claim over the ancient is sewers greater in length and number, owing to the greater needs.

Of aqueducts, the Croton of New York claims the honor of being the finest of our age. It is forty-two miles long, and thirty-three from Croton Lake to Harlem River. Lisbon aqueduct is twelve miles long; the one which carries the water to Paris, 110 miles. Ancient Rome had fourteen aqueducts. Three of these supply modern Rome—Aqua Virgo, about eleven and a half miles, built by Agrippa, to supply his baths; Aqua Claudia, forty-five miles long; and Aqua Trajana, twenty-three miles, built to supply inland basins for spectacular sea fights. Constantinople had its aqueduct of Pyrgos, fifteen miles long. The aqueduct supplying Athens had perpendicular pipes of clay or lead every 240 feet or so, leading up to the surface; by this contrivance light and air were admitted to the water. Eupalinus tunneled through a hill at Samos eight feet high, eight feet broad, and four thousand two hundred feet long, with an accurately reckoned declivity; also a channel at the bottom, three feet square, to carry the water, which was thereby aerated. Duplication of tunneling on a greater scale is found in Mt. Cenis, eight miles long, double tracks. It is twenty-five feet wide at the base, and twenty-four feet high. St. Gothard is nine and a half miles long. Hoosac is 25,040 feet, and Sutro 3·84 miles long. The last clearly parallels the Samos tunnel, being used to carry water from a mine. Some writers say that the Euphrates was tunneled under, but the statement is vague, and bears no authenticity.

The reservoirs of the ancients were not inferior to those of the present time. The expertness of the ancient engineers is attested by the remains extant; they certainly are not buried in the waters of the Lethe. The Pools of Solomon still continue to furnish water to Jerusalem. They are three in number. The upper is 160 feet above the middle one, the latter 248 feet above the lower. The first was supplied by pipes from springs, and, when full, emptied into the second, and that into the lower one. The water was used for irrigating Solomon's gardens and supplying his temple. The lower pool held about 31,442,425 gallons, the middle about 12,289,912, and the upper one contained 13,778,772—a grand total of 58,511,109 gallons, or nearly six times as much as the Kansas City reservoir, which is estimated at 10,000,000 gallons. These pools were solid rock and masonry, lined with cement, and had steps leading to the bottom. One historian says that Nebuchadnezzar, wishing to brick the bottom of the Euphrates, which flowed through the center of Babylon, caused a reservoir forty miles square to be dug, so as to allow his masons a dry river bed. Another historian writes that Nitocris, a daughter of Nebuchadnezzar, is said to have dug a reservoir 420 stadia in circumference, lined with stone, for the waters of the Euphrates, in order that the river bed at Babylon should be dry so that she could build piers for a bridge. A stadium being 625 feet, it would make this circumference forty miles. These two reservoirs may be the same, and this shows what discrepancies there are among writers.

The melting snows from the Armenian Mountains sometimes caused an overflow of the Euphrates, whereby the city of Babylon and the country surrounding suffered from inundations. It was therefore necessary to drain the country, and to prevent any future trouble two canals were cut west from Borsippa to the river Tigris, which makes these canals about seventy-five miles long. Ancient Greek authors attribute this work to the ruler who made the greatest city of ancient times, and one never excelled in any age—Nebuchadnezzar. There are many canals now of modern engineering, but few, if any, constructed to drain and to receive waters from overflowing rivers. The longest canal is the Erie, in New York State, 350½ miles long and 70 feet wide, finished in 1862. The largest canal is the Suez, authorized by Said Pasha in 1854, built by M. Ferdinand de Lesseps, and finished, or rather officially opened, in 1871. It is 100 miles long, of which 25 miles are lakes. Its width varies from 325 to 197 feet at the top, and is about 70 feet wide at the bottom; the depth varies from 30 to 85 feet. The Erie Canal entire cost nearly $46,000,000, while the capital stock of the Suez Company was $60,000,000. The United States leads all other nations in number of canals—forty-four altogether.

The length of this paper forbids our writing further, although the archæological fields are blooming with undescribed beauties of art. Many more comparisons could be made which would place the modern age in an unenviable position. Readers who have been our

* Extracts from a paper by Dr. R. Wood Brown, in the February number of the *Kansas City Review*.

companions so far will notice many so-called errors, but when it is borne in mind the large number of historians and archæologists, also the difficulty of deciphering the writings of those whose sarcophagi have been violated, it will be apparent that dates and measurements, at the best, are merely approximate.

Sources of Electricity.

Professor Tyndall recently delivered the first of a course of Christmas lectures adapted to a juvenile auditory on "The Sources of Electricity," to a body of listeners which filled the theater of the Royal Institution.

The speaker stated that nine years ago he had lectured there on the subject of frictional electricity, but on the present occasion he intended to give a connected story of the whole subject, to show how the knowledge of electrical science grew up. No doubt all present were aware that the word "electricity" was derived from the Greek word "*electron*," meaning "amber," for the Greeks knew that amber when rubbed would attract light particles, such as small fragments of paper. Amber is found in Europe on the seashore of the Baltic, particularly after storms, and the people gather it among the seaweed; there are also fossil trees which once yielded amber; in fact, just as gum oozes out of the cherry tree at the present day, so did gum in those early times ooze from the amber tree. The two mouthpieces of pipes stuck together, which he held in his hand, had been in the Royal Institution he did not know how long, and when he rubbed them on a catskin, they saw that the amber attracted light particles of bran. The mind of man was never contented with mere facts, so the real question was, "Why does the amber attract the bran?" A great philosopher of those early days, Thales by name, supposed amber to possess a soul, and because of its soul it attracted bodies, and for the next two thousand years nothing more was known about electricity. In the year 1600, Dr. Gilbert, who lived in the time of Queen Elizabeth, remarked that amber was nothing but gum because it contained insects, so that other bodies might possess the same electrical power; he discovered many such, including glass.

The lecturer then balanced a lath, perhaps about four feet long by two inches wide, upon a pivot; he said that a watch glass would do as well, and that if a boy could not afford a watch glass, he could balance it on an egg in an egg cup. He then showed that a rubbed glass rod would attract one end of the lath, and would also attract a small broad rimmed paper wheel so as to make it run along the lecture table, following the tube as a carriage follows the horses. But a carriage was drawn by visible threads, while the paper wheel before them appeared to be drawn by invisible threads, as if it were harnessed therewith to the rod. Why was this? Sir Isaac Newton considered the problem in relation to the action of the sun upon the planets; he thought that there was something there, but was cautious not to say what it was. That same question was now before them; it was one of the most important which occupied the attention of scientific men, and perhaps they would not solve it in our day and generation.

The inventor of the air pump, a burgomaster of Magdeburg, made further discoveries in electricity. He found out that when a feather suspended by a silk fiber was touched by an excited glass rod, the feather was afterward repelled by that rod, but attracted by a rubbed rod of gutta percha. [Professor Tyndall no doubt meant sealing wax, as gutta percha was not known in Europe at that time.] Other rubbed resins also attracted the feather repelled by glass; hence arose the idea of two kinds of electricity. The lecturer then balanced a lath on a stem insulated by a cake of shellac and placed himself upon a stool insulated with glass legs; he next asked his assistant, Mr. Cottrell, to strike him several times upon the back with a cat skin, which amused the boys present, especially when he said, "Strike me again, if you please, Cottrell." By the friction of this mild flagellation, enough electricity was developed on the surface of the lecturer's body to enable his knuckles to attract one end of the balanced lath. Newton, he said, found his dressing gown to act better than other rubbers, and noticed that in obtaining frictional electricity much depends upon the character of the rubber. Professor Tyndall then suspended a stick of excited sealing wax by its center to a silk string, and showed that it was repelled by another excited stick of wax; two rods of gutta percha similarly repelled each other, and he said that the same effect could be produced by means of two paraffine candles. He excited an ebonite comb by drawing it several times through his hair, and showed that it would then repel a suspended comb; it was necessary that the hair should be dry. Resinous bodies, he added, repel each other electrically, but attract vitreous bodies; the conclusion, therefore, was that similar electricities repel each other, and opposite electricities attract each other. These electricities were once called "resinous" and "vitreous," but now "positive" and "negative," but they must bear in mind that there is no intrinsic reason why one of the electricities should be named positive or negative more than the other. The electricity from glass is called positive, and that from resins negative. He then showed the repelling force between bodies similarly electrified, by holding two pieces of silk ribbon at one end, and rubbing them down with the catskin; they then repelled each other, standing out in Λ-form. He next warmed a board, and warmed a sheet of foolscap paper, then applied friction to the latter upon the former with a piece of India rubber. The electrified paper adhered somewhat firmly to the board, and when, with a penknife, he cut out two strips of paper, and raised them from the surface of the board, they repelled each other. He also exhibited a great paper tassel, the ribbons of which repelled each other when electrified.

On two long, dry, narrow glasses he placed two brass balls, one on each glass, then electrified one of the balls with an excited glass rod; afterward, by means of a discharging rod, he momentarily connected one ball with the other, which thus, it was shown, acquired the power of attracting the balanced lath. The fact, he said, that electricity can thus be conveyed from one object to another first gave the idea of an electric current. The gold leaf electroscope was next brought under notice, and the method of using it. Professor Tyndall showed that frictional electricity would travel along a string, and cause the leaves of the electroscope to diverge, when the string contained but the moisture it had taken up from the air of the theater, but that when it was dried it could no longer conduct electricity. He passed a current also through a silk cord which had just been dipped in water; by these experiments showing the effect of moisture. He warmed most of the things used in the lecture, he said, merely to get rid of moisture, otherwise heat or cold would not interfere with his experiments. Placing two apples upon the two tall glasses, he said that in the eyes of scientific men positive and negative electricities were mixed together in those apples, but that this speculation should not fetter the minds of the listeners; nevertheless, it enabled experimentalists to predict results before they were obtained. He then held an excited glass tube near one of the two apples, which were touching each other, saying that the tube was supposed to attract the one electricity and to repel the other; he next separated the apples, and by the electroscope showed that one was charged with positive and the other with negative electricity.

An Undulatory Current in a Closed Circuit not Necessary for Telephonic Transmission.

Under the above heading the London *Electrical Review* publishes a communication, in which the writer details some experiments bearing upon this subject. He connected up a Boult (De Kraft) transmitter and receiver, using three medium size Leclanche cells connected to the carbon microphone through the automatic transmitter, in which he used a ribbon of paper having a line of small holes very close together, running longitudinally through the center, similar to the paper used by the Wheatstone instrument. The automatic transmitter was then put in motion, and the paper was passed over the metallic drum beneath the wire brush, which made the contacts through the holes in the paper, and allowed the current to pass on through the microphone at a speed of about 1,000 words in one minute. While this paper was passing, and the continuity of the current was continually broken, words spoken directly to the carbon microphone without the intermediary of a diaphragm, and without any substance whatever below the carbons, were distinctly heard from the receiver, and the articulation was as perfect as when the current was continuous. With these facts as a premise, the writer reasons that the closed circuit is not necessary for telephonic transmission, and that Bell's theory to the contrary is thus experimentally disproved.

A Distinction with a Difference.

For the last twelve months, more especially, strict conservatism has characterized the management of many departments of business. Producers, fearing the evil of overproduction, have taken good care to avoid overstocking the markets. The consumptive demand has been kept in full view, and the production of goods between seasons has been confined to such limits as to assure ready sale at the proper time. Producers, seeing that the middlemen refused to carry stocks not readily salable, and realizing the additional risks which such a course has imposed upon them, have interested themselves in the question of supply and demand more generally than ever before.

Under such circumstances, says the *Age of Steel*, it is but natural to expect that conservatism may at times overleap itself; indeed, that it has done so at times in the last year or two is a fact well known in trade circles. An occasional and short-lived advance on the price of this or that article, not referable in the slightest to speculative influences, shows how near together consumption and production have latterly been. True, there is a large producing capacity now unemployed, but readily available, with which to meet the demand for any and all manner of manufactured goods; and it is this fact, not actual overproduction of goods, that darkens the business sky like an overhanging cloud. The country is overburdened with manufacturing facilities, not with manufactured goods.

An Impromptu Ice Palace.

BY H. C. HOVEY.

On one of the coldest nights of this remarkably severe winter the entire fire department of Minneapolis was called out by an alarm from the Academy of Music block. The building was large and costly, with its contents being estimated at $225,000; and its location, on the corner of Washington and Hennepin Avenues, was such as to make a wide conflagration probable, in case the fire should get beyond control. Hence, although the mercury stood at thirty degrees below zero, the whole force was called, and thousands of people stood in the streets and on the house tops watching results. Six powerful pumps, with a united capacity of thirty million gallons a day, supply the city with water from the Mississippi River; and by a system of gates and distributing apparatus, fire pressure may be put on at any instant and concentrated where it is needed. The department also has a number of excellent steam fire engines, and a force of about one hundred men. With these facilities, and knowing the importance of preventing the spread of a blaze that might cost millions of dollars in a few hours' time, the firemen deluged the Academy of Music with torrents of water, that for the most part seemed to freeze as it fell. The surrounding network of telegraph wires broke the smaller streams into spray, that coated the burning building with frost. By using a combination nozzle four of the largest streams were consolidated into one, and thus the interior of the block was reached. Part of this huge volume of water was changed into vapor, and part into ice. At one time the singular spectacle was afforded of an ice palace blazing like a volcano, and overhung by a vast cloud of rising steam that was transformed into hail and sleet as soon as it reached the colder atmosphere above. Finally the fire yielded to the flood and the frost, and although the Academy itself was in ruins, the conflagration was prevented from spreading further.

The next day the scene was visited by thousands of spectators. Photographs were taken both of the exterior and interior, from which the fantastic results can be imagined. The roof had partly fallen in, carrying the inner galleries with it. Heavy timbers had crashed through to the ground. The costly law library of the Minneapolis Bar Association was a complete loss. The four outside walls seemed to be intact, though since condemned as unsafe and now being torn down. But what interested visitors most of all was the grand spectacle of the extempore ice palace thus reared in a night. The whole building was wrapped in a heavy mantle of ice descending in graceful folds from the Mansard roof to the pavement. Huge icicles, many yards long, hung like great stalactites; while smaller ones festooned the cornices and decorated every part of the burnt and blackened walls. The sidewalks and streets were barricaded by banks of solid ice, white as marble, and almost as firm in its texture. These banks varied from ten to fifteen feet in thickness. The starting office of the city street cars is here, and consequently the entire lines of travel of that sort were disarranged. The tracks lay embedded in ice that could only be cleared away by the labor of many men for many hours. Myriads of icicles were suspended from the interlaced and twisted telegraph wires.

The interior view was even more striking and beautiful. The remaining staircases and balustrades were coated with discolored ice, resembling Mexican onyx or the mottled alabaster from Luray Cave. The heaps of fallen rubbish in the courts below were incrusted with crystals like the frozen billows of some Arctic sea; while from the charred rafters and swaying gas pipes bending above them hung fantastic ornaments, reminding one of crystal chandeliers. Through all this fairy-like scene the brilliant sunshine from a cloudless Minnesota sky made its way, reflected from a million diamond points, and here and there showing prismatic colors. Hardly an object of any sort was visible that had not, in some manner, been thus glorified. Even the scattered fragments of furniture, the splintered beams, the torn and dismembered volumes of the lamented law library, were all congealed into so many pieces of marble.

The basement was occupied by the largest clothing store in the Northwest; and the coats, vests, and other garments, frigid with ice, stood out from the walls, or lay in half burned heaps, in every grotesque shape imaginable.

An unusually heavy fire pressure was on at the pump house, the gauge registering 122 pounds, and it was afterward discovered that as a consequence the water mains on Washington Avenue were, some of them, burst.

The picturesque ruins, after having stood for a while to be admired by the public, will be torn down altogether, as the inspectors have decided that the walls are unsafe and must be removed.