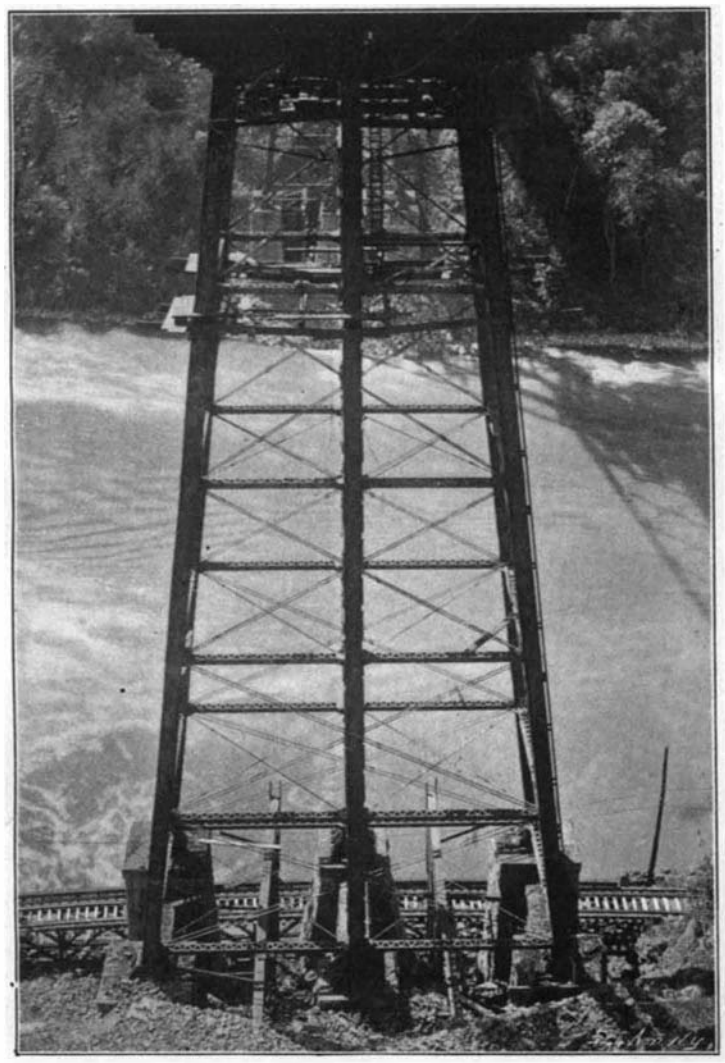
STRENGTHENING THE CANTILEVER BRIDGE AT NIAGARA.

Niagara has a world-wide reputation for its famous bridges. More than one notable suspension bridge has been built in wood, remodeled in steel, and then has given way to the more modern steel arch, in order to meet the requirements of present day railroading and road traffic. This work has called for the exercise of unusual engineering skill and some daring originality, and, indeed, it is difficult to find any spot which possesses more interest for the bridge engineer than the Niagara Gorge.



ONE OF THE TOWERS, SHOWING THE CENTER STRENGTHENING COLUMNS.

The accompanying photographs draw attention to the latest difficult feat to be accomplished in this locality. They show the work of strengthening the steel cantilever bridge of the Michigan Central Railroad, which, completed in 1883, finds itself quite unequal to the traffic demands of the year 1900.

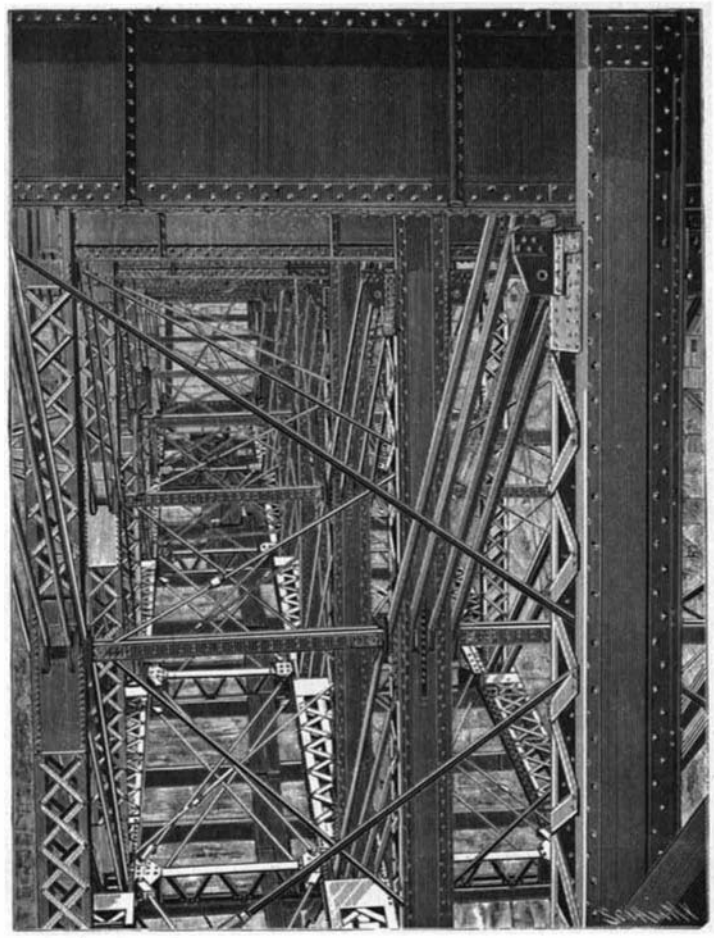
This bridge, which is 910 feet long, and consists of two cantilevers and a fixed span in the center, the "cants" resting on towers 130 feet high, was originally designed to carry on each track a train consisting of two 65-ton locomotives followed by a train load of 2,000 pounds per lineal foot. When the improvements have been completed, the bridge will support two trains of over 3,000 pounds weight per lineal foot, headed by two 150-ton locomotives.

The work that is now being done is the insertion of a center truss, and this is accomplished by cutting the great structure in two longitudinally through the center and building the new steel work into place. The new truss is three times heavier than either of the old trusses, and the work will increase the carrying capacity of the bridge by from 75 to 100 per cent. The reconstruction has been in progress since last winter, and is being done by men employed by the Michigan Central. Between the old piers at the water's edge two new stone piers have been erected on each side of the river, and each of these piers supports one of the new columns. On top of these new piers iron shoes weighing 10 tons each have been placed. These shoes are heavier by four tons than the shoes on the old piers. Reaching up from the shoes to the bottom chord of the bridge are columns of steel, which were placed in 25-foot sections, and weigh 12 tons to a section.

When the new columns had been carried up to their full height and riveted in place, they were capped by two massive 7-ton castings, whose duty it is to transmit the loads of the new truss to the new tower. Between these castings was placed the section of the bottom chord of the new truss that extends over the tower, and above them were placed the vertical posts 55 feet long that extend between the bottom and top chords. On the top of these posts were placed other steel castings. In these castings in top and bottom chords are assembled the various eye-bars, posts, struts, etc., that cluster at these points, each series being connected by large, turned, and snugly-fitting pins. The center truss was then built out over the river, the various posts, ties, etc., being lowered into place from the floor of the bridge by means of a temporary "traveler," which was shifted from time to time as the work progressed.

With the addition of so much dead and live load to the bridge it was, of course, necessary to increase the anchorages. The old anchorages were about 26 feet long, and extended down to the bottom of the shore abutments. The new anchorages are 40 feet long, and extend down into the solid rock 16 feet. The addition was made by opening the abutments and blasting out the rock to the required depth. At the bottom of the hole so formed, cupboards about 7 feet wide and 12 feet long were opened, and in them I-beams seven in number were placed. Each of the I-beams weighs 900 pounds. The holes are to be filled in with concrete.

The old laterals were about 30 feet long and extended diagonally from one post to another. In the reconstructed bridge they will extend from the outside posts to the posts of the center truss. In rebuilding the bridge it was found necessary to cut 2 feet 2 inches out of the floor beams over the tower, temporary timber supports being inserted to support the severed parts of the floor beams. These timber supports rested upon the outer chords. In all about 1,700 tons of new steel have been placed in the bridge.



VIEW LOOKING THROUGH CANTILEVER, SHOWING NEW CENTER TRUSS.

The work of rebuilding the cantilever has gone on undmindful of the traffic across it, which has suffered but little interruption or delay. A traveling derrick 28 feet long, 28 feet wide in the clear, 21 feet clear of track and 30 feet high, has been used. To lower the castings required 3,600 feet of manila line 1½ inches thick, with 10-ton blocks on the traveler. The cantilever is a double-track bridge, and in order to lower the iron it was necessary to cut the ties between the tracks, giving an opening 6 feet wide by 11 feet long. Some of the iron lowered was 50 feet in length. Material was carried out on the structure from both sides of the river.

When the cantilever bridge was erected, all riveting and drilling was done by hand, but in rebuilding the structure modern appliances were brought into service, and riveting, chipping and drilling were done

NIAGARA CANTILEVER BRIDGE BEFORE INSERTION OF NEW CENTER TRUSS AND TOWER COLUMNS.

by compressed air, which was supplied by a plant located on the New York side. In the compressing station there are two gasoline engines, one of 24 horse power, the other of 12 horse power. A 2-inch pipe leads from the storage tanks clear across the bridge, and from this main, connection is made by hose to the points of operation.

Benjamin Douglass, bridge engineer of the Michigan Central, designed the new work, and it was carried on under the supervision of his office, with G. C. Tuthill as the assistant engineer on the work, and David Coughlin as superintendent of erection. The work will be completed during the fall of the present year.

Transportation Exhibits at Paris.

Much space has been devoted to the transportation exhibits at Paris; an international station is established at Vincennes, covering an area of about 21,500 square meters. The station is a series of halls (says The Railroad Review) about 200 meters long and 120 meters wide. There are shown about sixty locomotives, most of them being large machines, and also more than 200 cars of various kinds. The United States is there "with its remarkable wagons, its practical and comfortable luxury, and with six examples of its colossal and renowned locomotives." Austria with seven engines, Germany with six locomotives and with splendid coaches. Russia, which shows five carriages, attracts attention by the magnificence of the material and the finish of the construction, giving evidence of its great industrial progress. Switzerland shows, among other engines, an electric locomotive for working rack railroads. The French locomotives are seventeen in number. Around the international station are installed signals and various apparatus for protecting trains used by the great French companies and by foreign roads. A German establishment is in operation injecting ties for preservation, and near by one may see a section of the Barmen-Elberfeld suspended electric tramway and a section 50 meters long of a Temperly transporter. Here may also be seen brakes, couplers, axles, wheels, switches, crossings, etc. According to the Journal des Transports, of Paris, the Exposition is a triumph of the compound locomotive and the American car. The long car with bogie trucks, so much criticised among us for twenty years, is no longer a novelty, and now the time of experiment is past. All of the great French companies now use long cars with bogie trucks and corridors for inter-communication. The colossal machine shown in the Russian section seems to be only a Mallet compound locomotive, with two trucks and four cylinders. Germany shows a triple-expansion engine, in which the problem of condensation is courageously attacked. Finally, the electric locomotive is in force. The Paris, Lyons and Mediterranean Railway shows its storage battery engine, and the Orleans Railway its Thomson-Houston trolley locomotive. This latter company makes the most impressive electrical exhibit by the mere fact of putting in operation its city line, underground and worked by electricity.

The Age of the Earth.

We commence our history with a rapidly-rotating molten planet, not impossibly already solidified about the center and surrounded by an atmosphere of great depth, the larger part of which was contributed by the water of our present oceans, then existing in a state of gas. At what period did these great cosmical changes occur? The answer to this question has long occupied the attention of geologists, and the opinions of the greatest lights of modern science are at variance. At the Bradford meeting of the British Association for the Advancement of Science, Prof. W. J. Sollas, one of the greatest geologists of the century, made a most important address, dealing with the age of the earth. He first gives his attention to the estimates of others, Lyell, Kelvin, George Darwin, Joly and others, and then develops his subject with particular relation to the depth of those rock formations which are clearly of sedimentary origin. He takes them at their greatest thickness, which he finds to be about fifty miles. Naturally, great difficulty is experienced in obtaining even an approximately accurate average rate of deposition, but Prof. Sollas adopts one foot a century as the most satisfactory standard, and on this basis would place the age of the earth approximately at about 26,000,000 years. His arguments tend to harmonize the estimates of others, as far as possible, and he more nearly approaches those of Lord Kelvin than those of other scientists. The estimates suggested by other data are as follows:

1. The time which has elapsed since the separation of the earth and moon, 56,000,000 years. This is the minimum estimate of Prof. G. H. Darwin.

2. Since the "consistentior status" of Lord Kelvin, 20,000,000 to 40,000,000 years.

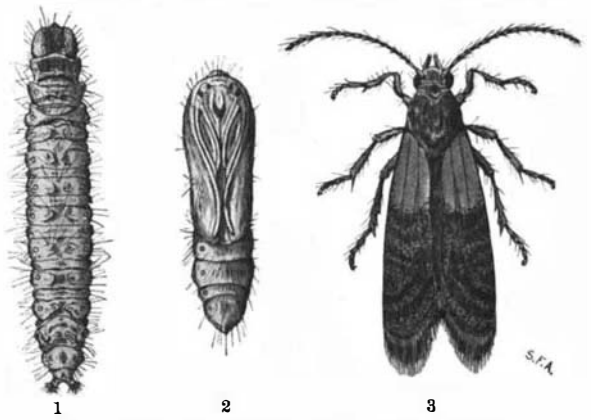
3. Since the condensation of the ocean, 80,000,000 to 90,000,000 years, the maximum time which Prof. J. Joly considers to have elapsed.

It may be at once observed that these estimates, although independent, are all of the same order of magnitude, and so far confirmatory of each other. Prof. Sollas's arguments are most interesting, and his complete address will be published in the SUPPLEMENT, beginning with the current week.

THE PANTRY MOTH.

BY S. FRANK AARON.

This insect, which has also been called the Indian meal moth, and is known to naturalists as Plodia interpunctella, is, next to the cockroach, perhaps the most troublesome pest of the housekeeper. It is a small insect allied to the clothes moth and the grain moth, and not unlike them in appearance. The pantry moth, however, is more showy in appearance and is bicolored, the outer half of the wings and parts of the body being of a chocolate brown, the rest buff or drab. It is about three-eighths of an inch long when the wings are folded or at rest. The larva is pale, varying from pinkish to gray blue, the tint being influenced by the character of its food. The eggs hatch in a few days after being deposited here and there upon suitable food by the female moth.



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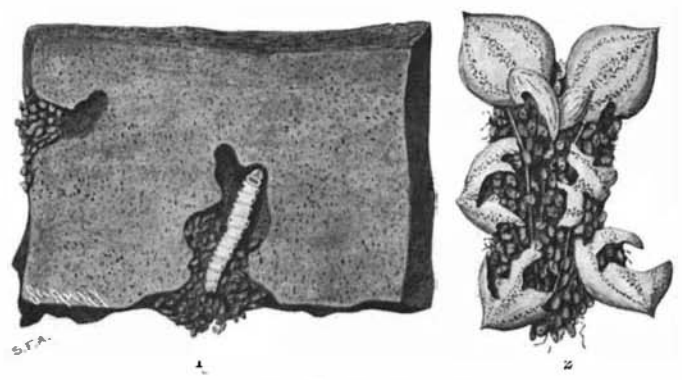
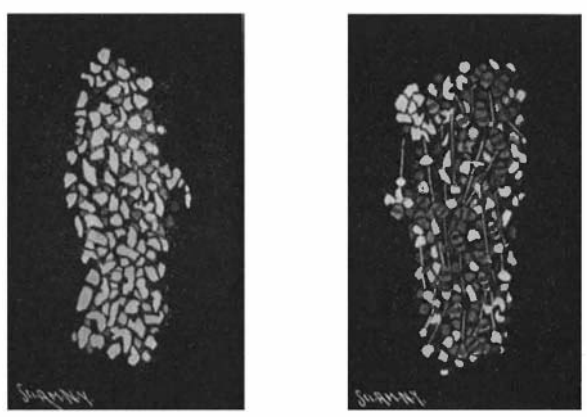
THE PANTRY MOTH AND ITS STAGES.
1. Caterpillar. 2. Chrysalis. 3. Moth. (Magnified.)

Nearly everything edible or nourishing serves for food to this insect, but the materials that it commonly infests are flour, corn meal, grain of all kinds, beans, seeds, dried fruits and vegetables, and chocolate. It is not the quantity the larva eats, however, that makes its presence objectionable, so much as the defilement it causes. Wherever it goes it leaves a silken strand behind it, adhering to its excrement and to the particles of food left uneaten, thus rendering the material utterly unfit for human use.



INJURY BY PANTRY MOTH.
1. Cake of chocolate, showing larva at work (natural size). 2. Millet seed after infestation (magnified).

When full grown, the caterpillar spins a flimsy cocoon, within which the pale yellowish or brown pupa rests but a few days in warm weather before emerging as a moth. If, however, the surrounding temperature should be cold, the pupa may remain in the cocoon all winter. The entire period covering all the stages, egg, larva, pupa and moth, averages, during warm weather, about six weeks, and in artificially heated buildings that cool at night during winter, two or three months. There are, then, about three broods normally during the summer, and in well warmed buildings during winter about two broods, perhaps three. Thus, we have from three to six broods annually, and in very warm climates as many as seven or eight may appear.



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FLOUR INFESTED BY PANTRY MOTH. (MAGNIFIED.)
1. Normal condition. 2. Webs and excrement after being infested.

The pantry moth is practically cosmopolitan, judging from the infested food stuffs received from nearly all parts of the world. There are isolated sections where it does not occur, but in these days of vast commercial intercourse a pest having these food habits is certain soon to be carried everywhere. Only the greatest care, most thorough inspection and fumigation can prevent this result, if at all.

To insure against the presence of this moth, the housekeeper or dealer must resort to storing his food stuffs in insect-proof receptacles. With materials that must have air, a box with wire netting covering the openings for ventilation will suffice, but these openings should be at the side of the box, as it is probable that the moths would drop their eggs through the wire mesh if placed on the top. If material is already infested and only slightly injured, the only way to kill the insects within it is to fumigate with carbon bisulphide, an inexpensive disinfectant. A wad of cotton as large as a lemon of average size, and saturated with the bisulphide, placed in the top of a large can, tight box or keg holding two or three gallons, care being taken to replace the cover quickly and tightly, will destroy all insects and vermin infesting the material previously placed therein. The vapor of carbon bisulphide is heavier than air and sinks to the bottom of a vessel containing it. It is extremely poisonous, and so inflammable that on no account must flame be allowed to approach it.

To insure successful fumigation, the receptacle must remain tightly closed for at least six hours. It can then be uncovered and turned upside down for a few minutes, after which the pungent odor can no longer be perceived. Another way to kill the larva of the pantry moth and similar pests in food stuffs is to subject them to a perfectly dry heat for at least one hour at a low even temperature.

Automobile News.

There are at present thirteen incorporated automobile clubs in the United States.

Experiments have been conducted in New York with electric vehicles for collecting mail from street boxes. It was found that fifteen minutes were saved per trip.

At the Paris Exposition a dinner was given to over twenty thousand mayors of French cities and villages. This is probably the largest number of persons who were ever served at one time. The tables, if placed end to end, would have been four miles long. Several motor cars and four motor cycles were used to increase the rapidity of service.

A new electric automobile has been brought out by the National Carriage Syndicate, of London. It is of elegant design, each of the wheels being 36 inches in diameter and the distance between axles 67 inches. The force is furnished by two small motors, which operate the rear wheels by a chain which passes from a pinion on the axis of the motor to a large wheel placed on the inside next the spokes. The motor is mounted upon an independent frame, which is supported upon springs. Two sets of accumulators are used, which are contained in two boxes placed under the front and rear seats. Each of the motors gives 2 horse power, working upon 40 volts; it gives 600 to 700 revolutions per minute. The motor is very light, weighing only 105 pounds; besides, it can, if necessary, be worked up to 3 horse power, and runs without noise. The motors differ from the usual type, as the armatures are at the exterior and revolve around the field. The winding of the armature is very simple, and is arranged so as to give a motor of small weight and high efficiency; it may be overloaded as high as 100 per cent without danger. The armature, being of large diameter, acts as a fly-wheel and regularizes the speed. The fields have twelve poles arranged in a circular crown on the inside of the armature. The motors are entirely inclosed and protected from dust. The battery used is of the Rosenthal type; it has forty cells in all, which gives a total weight of 950 pounds. They will give a discharge of 20 amperes for seven hours, and will also stand a considerably higher rate, giving 40 amperes if necessary. The controller is arranged for five speeds, 3, 6, 8, 10, and 12 miles per hour, with a reversing speed of 3 miles. The controller handle is pushed to the front and rear for forward and back movement; it is arranged to give the proper connections for charging the batteries. As the field is separately excited, the motors themselves serve as brakes by the reverse action of the armature upon the field, the motor tending to run as a dynamo. This machine will cover a distance of fifty miles at a single charge.

THE Commissioner of Immigration has decided that tuberculosis is a disease which can subject the patient to quarantine. A Japanese with tuberculosis arrived at San Francisco and it was decided that the patient could not land and must return to the port from which he sailed.