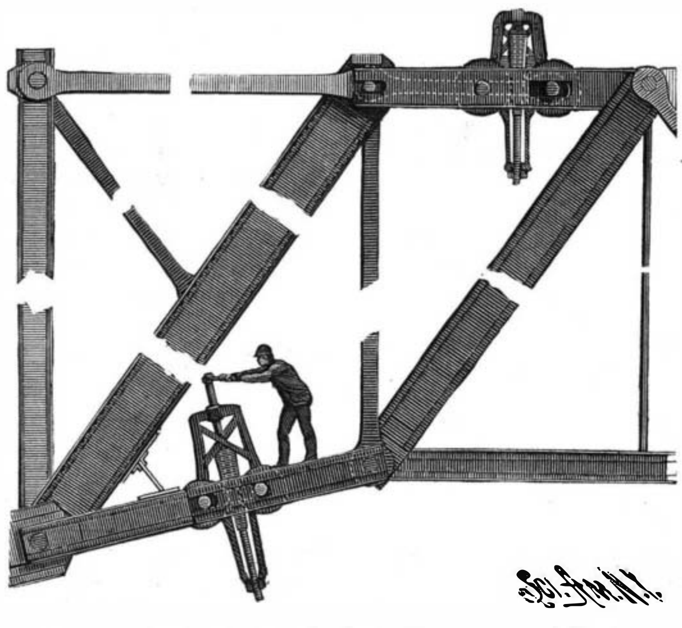
THE POUGHKEEPSIE BRIDGE.

This structure, now under process of erection by the Union Bridge Co., of this city, of importance both as a monument of engineering and as a link in the railroad system of the Eastern States, is rapidly approaching completion. About a year ago* we illustrated it, showing the proposed elevation and some general dimensions of the work. To-day much of what we then showed has been realized, and when the present year will be half over, it is hoped and believed that the bridge may be practically completed. The rapid progress is due to the system of construction. The cantilever has been utilized as far as possible. Pin fastenings have been used in the more important truss work, and small members have been employed. Almost all the riveting was done in the shops, and the eye bolts, struts, and chords were delivered on the ground ready to be put at once in place without delay. All this is in contrast to the system adopted for the Forth bridge between England and Scotland. There the bridge is built on the ground. For fastenings rivets are almost entirely depended on, and immensity of size characterizes as much the individual members as it does the whole structure. The two bridges illustrate well the difference between American and English practice.

Certain limitations were imposed upon the Poughkeepsie bridge that have affected its structure. Much opposition to its erection was offered by those interested in the navigation of the river. The great object to be attained was to obstruct the river as little as possible. To do this the four piers in the river were made very narrow. They were far too restricted in size to afford anchorage for cantilevers. A compromise structure consisting of a combination of anchorage trusses and cantilever spans was adopted. Starting from the shore at either end, a cantilever span is first encountered, next to this comes a truss span, followed by a central cantilever span. After this a second truss and a third cantilever span complete the structure as far as the river is concerned. A short cantilever at either end connects with the approaches. On the eastern side the approaches are very long, and are really an elevated railroad. The intermediate truss spans act by their weight and strength as anchorage spans for the cantilevers.



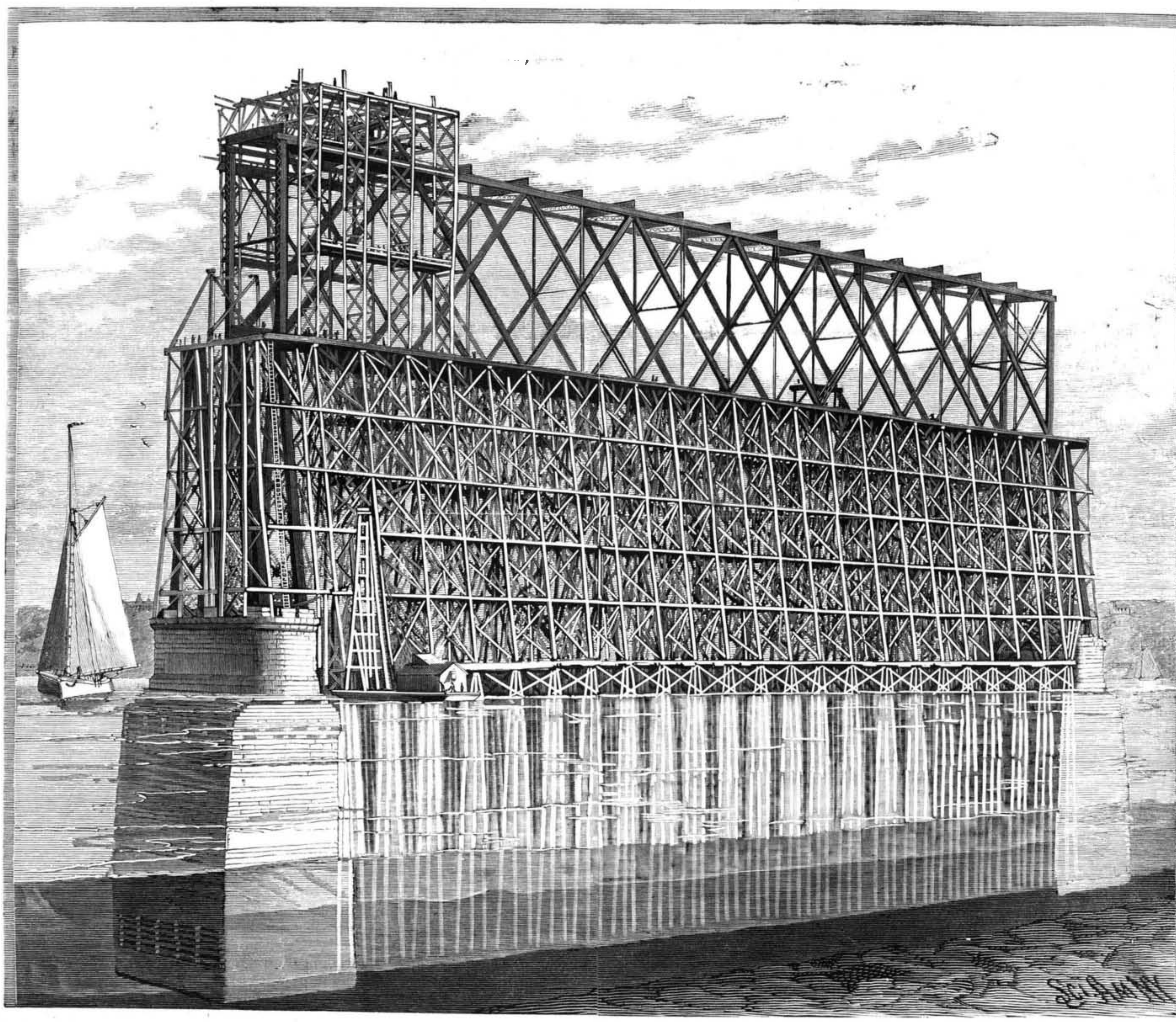
WEDGES BETWEEN CANTILEVER AND HANGING TRUSS.

The river is crossed, therefore, in five spans, involving the placing of four piers in the channel. The clear opening of the spans varies from 500 ft. to 521 ft. 6 in., with 130 and 160 ft. head room.

These piers are twenty-five feet wide at water line. Thus it will be seen that little obstruction is offered to navigation. To provide against that little the bridge company is obliged by their charter to keep a tug-boat at hand for helping vessels through, and to place lights upon the piers. The latter consist of masonry bases that rise about 30 ft. above the water. Upon these the iron superstructure is erected, carrying the piers up 130 ft. Upon these the trusses rest.

A cantilever may be described as a gigantic bracket. To bridge an opening by them, two are carried out from either side projecting over the space below. When sufficiently close they stop, and the space between is closed by an ordinary truss suspended from their ends. But a bracket is without stability unless it is held in position. To provide this holding, the anchorage spans are made to alternate with the cantilever spans.

The piers being in place, the general method of erecting the bridge may be thus described. False work or centering of timber is first erected where the truss spans are to come. This in itself is no small work, as is evident from our illustration, taken from a photograph of the structure. The depth of the river and the stratum of soft mud necessitated extra long piling. The logs are spliced or fished to secure sufficient length to reach good bottom. These are well braced at their tops, and on them the trestle work is erected. Upon the false work the great anchorage trusses 525 feet long and 75 feet deep are set up. When one truss is completed, the false work is removed and stored away for future use, leaving one span completed, and standing isolated over the river. From one of its ends a cantilever is carried shoreward, while from the shore end a second cantilever is run out to meet it. The shore member is a double cantilever poised at its middle on its pier like a balance beam, and anchored down by great tie rods at the inner end.



ERECTING ANCHORAGE TRUSS ON FALSE WORK.

Representing, as before said, two immense brackets, the pair of cantilevers are carried out over the intervening space without any false work. The strain exerted by each is a thrust backward at the foot and a pulling forward or tension at the top corner. These strains are sustained by the anchor truss or by reversed cantilevers. When the two have approached within 200 ft. of each other, work begins upon the connecting or hanging truss. Member by member this is put to-

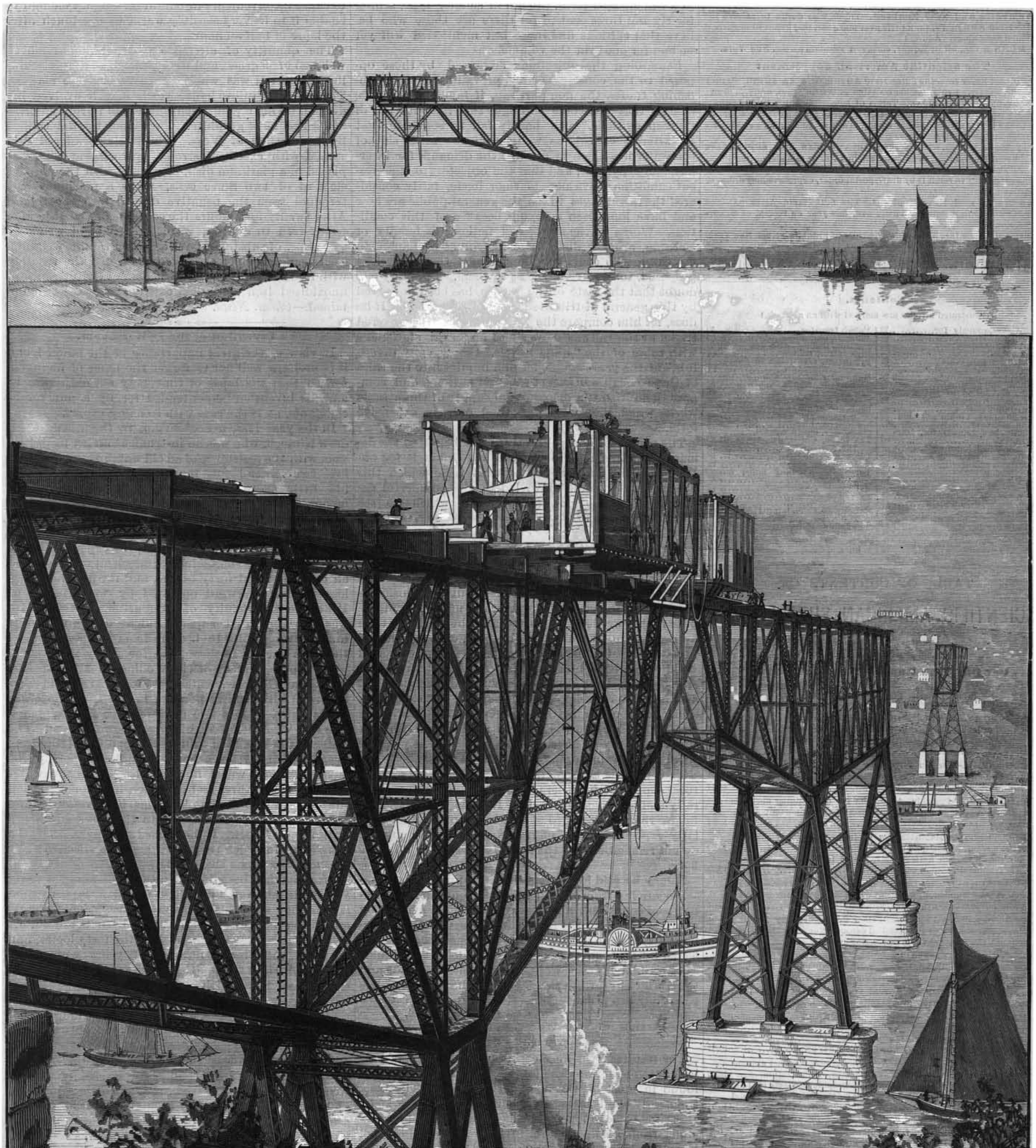
* See SCIENTIFIC AMERICAN, Vol. 56, No. 6.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyrighted, 1888, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LVIII.—No. 5. [NEW SERIES.] NEW YORK, FEBRUARY 4, 1888. [$3.00 per Year.



POUGHKEEPSIE BRIDGE OVER THE HUDSON RIVER—COMPLETING ONE OF THE MAIN SPANS.—[See page 70.]

gether, and the work is carried out from the cantilevers as a base. The strains during erection, it will be clear, resolve themselves into one of tension for the upper chords and of compression for the lower chords of both truss and cantilevers. These are provided for by making the lower chord of heavy lattice and plate work adapted to resist a thrust until the central panels of the hanging truss are reached. The lower chord for these panels is composed of eye bars. The reason for this will be evident. So far the whole strain has been one of tension for the upper chord and of compression for the lower. The tension has come against wedges situated near the end of each cantilever. As soon as the members of the truss are in place, the wedge is backed out and the upper chord of the connecting truss is relieved from tension, and at once becomes a compression member, while at the same instant the lower chord of the truss ceases to be compressed and enters into tension. The only reason the lower chord is made of rigid character for the greater part of its length, enabling it to resist compression, is to make it capable of sustaining the strain of erecting. Its last chord members are put in as simple eye bars, because for the last panels the erecting strain is very light. As far as the actual bridge or truss functions are concerned, the whole chord might be of tie rods. The stiffness of the bottom chord takes the place of false work.

The wedge we have alluded to is in the upper chord. A second one is in the lower chord. The two are shown in the cut. Both are removed when the structure is joined. They are used during the last connecting to bring the parts together. By working them in or out, the projecting and meeting portions of the truss can be swung up or down and to right or left, so as to come into accurate alignment. When the last tie rods are in place and the wedges removed, the cantilever span can be distinguished as of three parts. By removal of the upper wedge the upper chord is "cut," by removal of the other the lower chord is "cut." Hence the through connection of both chords being destroyed, the truss exists as an independent structure. It is suspended at each end by a tie rod which is attached to the upper and outer corners of the cantilevers and to the lower corners of the truss. As the truss and cantilever expand or contract with change of temperature, the suspending rod swings back and forth, but no effect is produced upon the cantilever, as no thrust or pull in the absence of the wedges can be exerted upon it.

To carry on the work of construction, engine houses are mounted on wheels and travel out on rails as fast as the panels of the trusses and cantilevers are constructed. These contain hoisting machinery. The iron work is brought on scows, or on the shore underneath them, and the pieces are hoisted by steam power. As each piece comes into its place, the pins are driven in place. Where rivets are required temporary bolts are used, to be replaced by rivets in due time. Each foreman has a book giving explicit directions how to put the work together. The men, by practice, become apparently quite reckless in working at so great a height, but this is only apparent. They all wear arctics or rubber overshoes of some kind in winter, and rubber-soled shoes in summer, to be secure from danger of slipping. So far the casualties have been few.

The bridge is made of steel, of about 63,000 pounds breaking strain. The members of largest section are the lower chords of the anchorage trusses. These represent a species of box girder in exterior dimensions, 30 inches deep and 40 inches wide. The largest member weighs less than 20 tons. The largest eye bars are 8 by 2 inches in section and 49 feet long. Others are 8 by 2¼ inches in section and 37 feet long. The largest eye bolts or pins are those receiving the thrust of the lower chord of the cantilevers. These are 9 inches in diameter. These dimensions may be contrasted with those of the Forth bridge, whose lower cantilever chord is a plate iron hollow cylinder 9 feet in diameter, and one of whose pieces is a cylindrical member 12 feet in diameter.

On each of the two piers nearest the shore, four sets of steel rollers, 3 inches by 3 feet 6 inches, and twenty-four in a set, carry the ends of the anchorage trusses and of the cantilevers of the east and west spans. These allow for expansion and contraction under changes of temperature.

Madder.

This coloring matter is more extensively used by cotton dyer and calico printer than by the wool dyer. It has been the subject of much research, and the composition and nature of its coloring principles are now well understood. It has long been used as a dyestuff. The ancient Egyptians, the Greeks, and the Romans are said to have used it. Though not a wood, it will be best to discuss it here in connection with the redwoods, as it holds, as a wool dye, a position intermediate between that of the redwoods and the yellow-woods. It is the root of a plant called *Rubia tinctorum*. Dr. Schunk states that the coloring matter exists in the plant as a glucoside, that is, in combination with a sugar. He calls the glucoside *rubian*.

The principal coloring matters yielded by madder are alizarine, purpurine, and pseudo-purpurine, of which the first is by far the most important, being the only madder color which may be considered fast and permanent. The artificial production of alizarine from anthracene, one of the products of the distillation of coal tar, is one of the most important and interesting applications of chemistry to the arts that has been made of late years. In 1868, Graebe and Liebermann found that when alizarine and zinc dust were distilled, the hydrocarbon anthracene was obtained, and by reversing the process they succeeded in obtaining alizarine from anthracene. The artificial coloring matter seems to possess all the properties of the alizarine of madder. In wool dyeing the chief uses of madder, besides acting as a ferment in the indigo vat, are for the production of drabs, browns, and olives, for which its coloring matters are well adapted. The colors obtained with madder on wool are very fast and permanent.—*Indus. Record.*

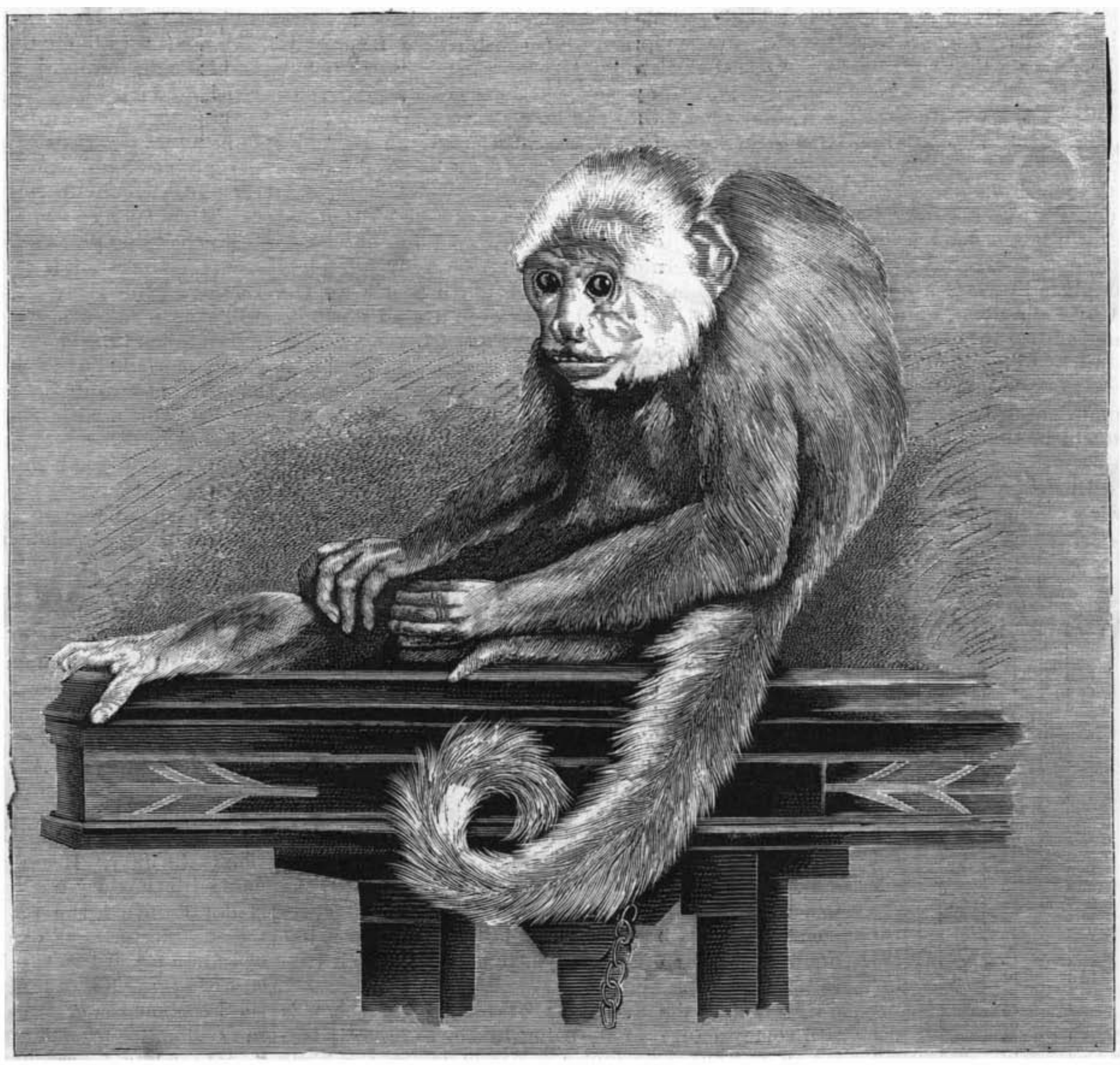
The Nose the Source of all our Woes.

At the last congress of German naturalists and physicians, held in Wiesbaden, Dr. Gacy reported several cases of mental disturbance characterized by an impossibility of fixing the attention on any subject, except for a very brief period, or of prolonged mental effort of any kind whatever. This condition, to which the author gave the name of aproxia, was always associated with certain lesions of the nasal mucous membrane and obstruction to the passage of air through the nasal fossæ.

This is, we believe, the latest accusation which has been brought against the sinful nose. Headache, cough, dyspnœa, earache, neuralgia, hay fever, acne, convulsions, and syncope are only a few of the many evils which this troublesome organ is accused of having inflicted upon long suffering man, and it bids fair to outstrip even the ovaries as a center for morbid reflexes. As regards aproxia, however, it is said not to be a reflex, and the mechanism of its production is assumed to be a purely physical one. The lymphatic spaces beneath the dura mater have been found to be in direct communication with the mucous membrane of the nasal fossæ, and inflammation of the latter is supposed to interfere with the elimination of the waste products resulting from cerebral activity, thus leading to mental sluggishness. But whatever may be its methods, the nasal organ is evidently responsible for many, if not most, of our ills. Clearly, the nose must go.—*Medical Record.*

MATHEW, THE CUBAN MONKEY.

We give an engraving, from *La Ilustracion Cubana*, of an educated monkey, brought up by Messrs. Lopez & Inelan, of Havana, where the animal enjoys a great reputation for intelligence. He will stand erect and salute all present, wrestle and fight with any dog of his size, compel a cat to be his most patient servant, capture a pigeon and make it open and shut its bill like a parrot, strike an attitude of the fiercest attack on signal from its master, or on a contrary signal relapse into the most submissive and inoffensive of creatures. The above is only the merest outline of a few of the many things which this remarkable animal has been taught to do. His fame having reached Madrid, he has been sent over there, where he now attracts great attention at the Retiro.



MATHEW, THE CUBAN MONKEY.

Kerosene Oil as an Anti-Incrustator for Steam Boilers.

Mr. Lewis F. Lyne read a paper before the last meeting of the American Society of Mechanical Engineers upon the use of kerosene oil for preventing incrustation in steam boilers. The experience upon which the paper was based was gained in connection with the working of the Jersey City Electric Light Company's station, where there are in operation two 100 horse power Root's boilers and one boiler of the same type developing 155 horse power. The water used in these boilers made a great deal of scale—so much, indeed, as to half fill with hard deposit the 4 inch tubes of which the boilers are principally constructed. Finding that no other expedient would rectify this evil, Mr. Lyne commenced to experiment with kerosene oil; allowing some of this kind of oil to flow into the boilers by means of an arrangement like a large steam cylinder tallow cup fixed upon the water feed pipe. When the experiment was started, there was about one-fourth inch of scale in the boiler tubes. Two quarts of kerosene were put into the boiler every alternate day for a month, when it was found that the scale was so far dissolved and loosened that a scraper would clear off most of it. Continuance of the treatment eventually cleared the boiler from scale in every part. Finally the rule was adopted of putting in one quart of kerosene oil per day for each 100 horse power boiler, and three pints per day for the 155 horse power boiler. The water is blown down two gauges every week, and the entire contents once a month. Water is never used to wash the boilers out, nor is a scraper necessary, for the mud all goes away with the water. Another thing worthy of notice is that, whereas it was impossible to keep gauge glass tubes in use more than a month or two, because they became badly corroded and grooved, and consequently broke, since kerosene has been regularly employed this corrosive action has ceased.

TO keep frost, etc., off plate glass windows, keep the inside air dry, or inner sash tight, so that the air in window inclosure will be cold, and ventilated from the outside. A partial remedy is to have ventilating openings in the top of the window casing.