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NEWARK BAY DRAW BRIDGE.

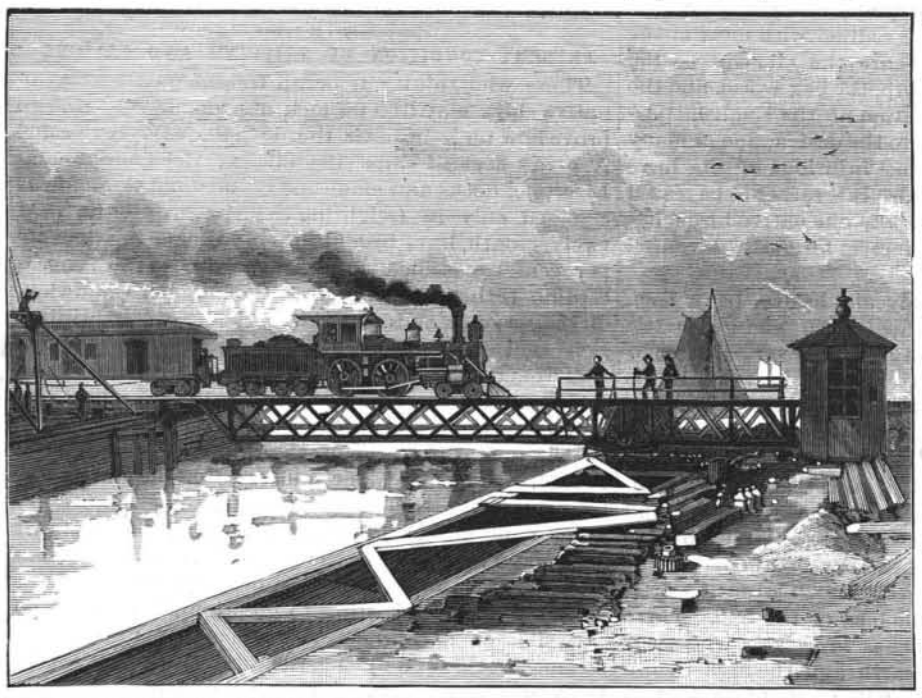
The Central Railroad of New Jersey crosses Newark Bay upon a trestle nearly two miles long. Near the eastern end of the trestle is a draw span which, after having performed its duty for many years, and been re-enforced to enable it to accommodate heavier loads, is now being replaced by one more in keeping with modern practice, and better proportioned to carry the heaviest engines now built, and to provide for any increase that may take place in the future. The old draw was moved by hand, a couple of men turning a crank connected with a simple system of gearing. The opening and closing of the bridge was consequently a very slow operation, and seriously delayed the traffic of the road. The new draw will be provided with the most improved machinery, placed in an overhead engine room at the center of the span, and powerful enough to quickly move the bridge under all circumstances.

The first proposed method of doing the work was to raise the old draw upon floats and remove it, putting the new one in place in the same way. This plan, although economical and expeditious, was abandoned, owing to the difficulty that would have arisen had the center pier and abutments been found to be out of level, and a temporary side track and single opening draw were built. The location of these is clearly shown in the accompanying engravings, in which it will be seen that the side track, carried upon piles, is extended sufficiently far from the main line to permit the erection of the new draw upon its center pier.

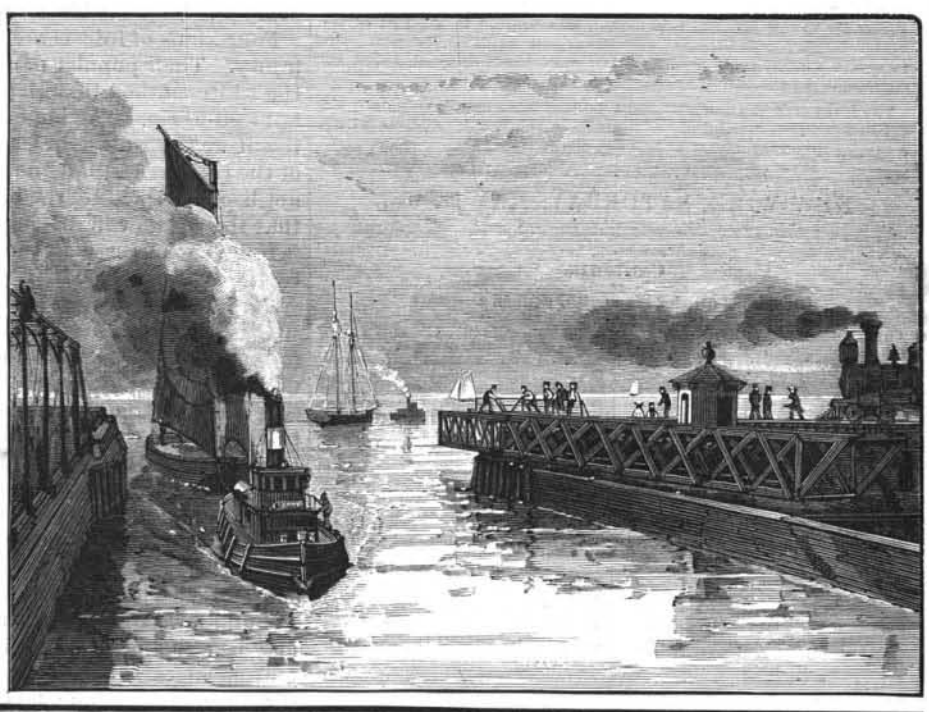
The two upper engravings show the small temporary draw in both its closed and opened positions. This draw has a total length of 97¾ feet, and it is so pivoted that its short arm is 30¼ and its long arm 67½ feet. The difference in the weight of the two arms is counterbalanced by pig iron placed at the extremity of the short arm. The draw is composed of four girders, latticed in pairs and united to form a box six feet deep and six feet from center to center of girders. The draw turns upon four wheels 20 inches in diameter, arranged at equal distances apart and rolling upon a track circle eight feet in diameter. Placed concentrically with its circle is a large gear, meshing with which is a pinion on a vertical shaft carrying at its upper end a second gear, in engagement with which is a pinion, to the shaft of which the crank is applied for operating of the draw. When opened, this bridge rests parallel with the eastern abutment of the permanent draw.

The new draw, of which we present a side elevation and cross section, will be 217 feet between centers of end piers, and 28 feet center to center of trusses. It will be noticed that the bridge consists practically of two independent spans, having inclined end posts and united by a center panel resting upon the pier. The inner ends of the bottom chords abut against the bottom member of the center panel, and which is proportioned to resist the compression thus brought upon it when the free ends of the bridge are unsupported. The inner end of each of the top chords is united to the top of the center panel by four bars five inches wide by 1⅜ inch thick. These bars support the weight

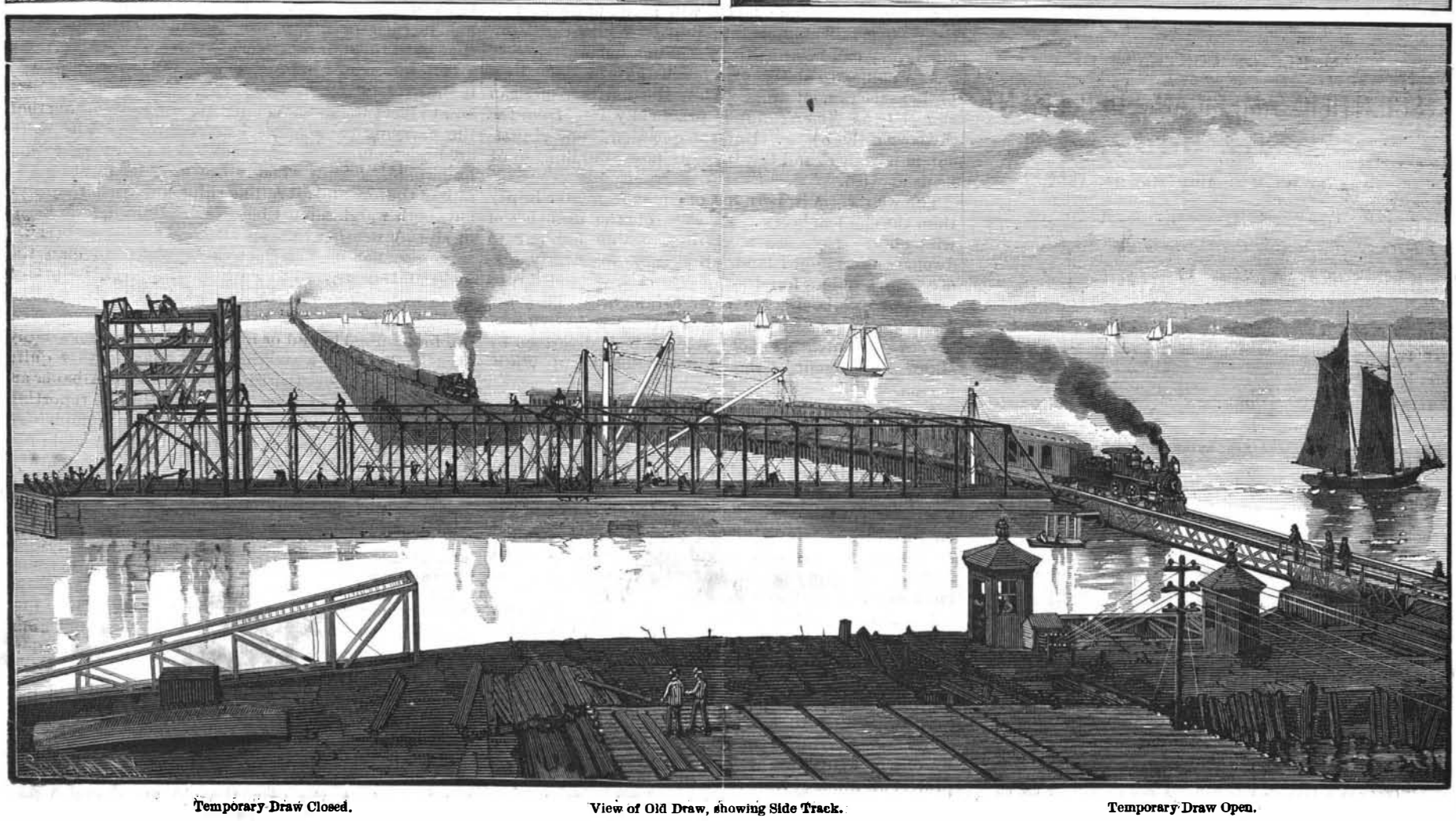
(*Continued on page* 340.)



Temporary Draw Closed.



View of Old Draw, showing Side Track.



Temporary Draw Open.

NEW DRAW BRIDGE OVER NEWARK BAY ON THE N. J. CENTRAL R.R.

NEWARK BAY DRAW BRIDGE.

(*Continued from first page.*)

of the two spans when the bridge is open. The bridge rests and turns upon cone wheels mounted upon the outer ends of rods radiating from the pivot. The outer ends of these rods are placed lower than their inner ends, so as to bring the upper surfaces of the wheels horizontal. This construction obviates the necessity of making two coned tracks for the wheels to run between. Concentric with and just outside of the wheels is a rack, with which engages a pinion operated by the engine to turn the draw. The draw is also provided with suitable gearing, so that it could, if necessary, be operated by hand.

The bridge was designed and is being erected by the Phœnix Bridge Company, of Phœnixville, Pa.

Varnish Resins.

BY P. LUND SIMMONDS.

The number of substances suitable for coarse varnishes has lately become very numerous in Europe. Common resin is now purified by a patent process consisting of distillation with superheated steam, by which it is obtained nearly transparent and colorless as glass. Resins suited, however, for the preparation of the finer descriptions of varnish are still very limited. All plants produce, indeed, resins in a greater or less degree, but the trees which produce them in sufficient quantities to be of commercial value are to be found principally in South America, India, Africa, and New Zealand. These belong principally to the pine tribe, the *Dipteraceæ* (only found in India and the Eastern Archipelago) and the *Leguminosæ*.

Of the latter, the *Hymenæa* seem to be the trees from which the resins most nearly akin to the true hard, or fossil, copals are mostly derived. The copal of Africa and the dammar of New Zealand (known in commerce as kowrie gum) are the best known and most esteemed.

The word varnish covers a very wide field, as the term, in its fullest sense, can embrace all the thousand and one prepartions compounded for as many different purposes. An essential quality of varnish is that it must harden without losing its transparency, as it must not change the colors it is intended to preserve. It must exclude the action of air, because wood and metals are varnished to protect them from rust and decay. It must also be waterproof, else the effect of the varnish would not be permanent. And a point of primary importance is that it must possess durability. New uses are constantly being found for varnish, by which it embellishes the article to which it is applied, affording satisfaction to the buyer and profit to the manufacturer. A few notes on the chief varnish resins may therefore be acceptable.

East Indian dammar is the name applied by varnish makers to the resin of *Dammara orientalis*, imported chiefly from Singapore, which is straw colored, or, like pale amber, very clear or transparent. It is easily and entirely soluble in benzole, ether, or chloroform, less rapidly so in turpentine, forming a clear, nearly colorless varnish, which dries rapidly on exposure to the air. Dammar comes principally from the Lampong islands and Sumatra, and the yearly receipts may be given at about 32,000 cwt.

This resin is produced by many kinds of trees in the State of Perak. The principal are *Dammar mata kutching*, *D. Meranti*, *D. Lant*, *D. Degon*, and *Dammar Batk*. It is the sap which exudes spontaneously, and being exposed to the air acquires a flinty hardness, from which the epithet batu, or stone, is given, to distinguish it from the softer resins. The dammar is found either in large masses at the foot of trees which yield it, or floating in rivers, drifted to them by the floods of the rainy season. The natives apply it to most of the uses to which we put tar, pitch, and resin. Most of the family of *Dipterocarpeæ* yield balsamic, resinous juices, those of the genus *Dipterocarpus* the wood oils, and of *Vateria* indurated dammar. The natural order abounds in Sumatra, Java, and Borneo, which are the chief sources of the dammar of commerce. In Borneo, dammar is generally found in the ground below the trees, but may occasionally be seen in huge masses, not unlike icicles, hanging from the sides of the trees. A single piece weighing 6 cwt. has been found on one tree, but necessarily these large masses get broken in collection. The value of the dammar found in the Sandakan district, North Borneo, is rarely over 10s. per cwt. Further to the north much better sorts are found. The dammar mata kutching (or cat's eye), of Palaman, brings £2 per cwt.

Of resins, chiefly dammars, we import 20,000 cwt. from Singapore and 6,000 cwt. from Java.

Two or three species of dammars are met with in British India, but are of no great commercial value. *Canarium strictum* is known in Malabar under the name of the black dammar tree, in contradistinction to the *Vateria indica*, known as the white dammar tree.

The Sal tree (*Shorea robusta*) furnishes also a dammar which dissolves much more freely and speedily in benzole than in spirits of turpentine. This resin is usually of a pale, creamy color, nearly opaque. *Shorea sericea* yields a kind of dammar which closely resembles the Indian kind.

Hopea odorata, of Burmah and Pegu, yields the rock dammar of commerce, a yellow resin which dissolves readily. The trunk of *Hopea Mingarawan* furnishes a white dammar of a superior quality. The resin yielded by *Hopea Micrantha* in Borneo, Sumatra, and Malacca is not so good, but that obtained from Belambang is much sought after for the luster it gives. This resin is of a yellowish color, and exudes in large lumps from the trunk and branches. It is soluble in turpentine or benzole, and forms a clear, limpid varnish.

The Kauri gum of commerce is the produce of *Dammara Australis*, a coniferous tree which occurs only in the north island of New Zealand, over a large area of land which has been exhausted by forests in past ages, and is now barren. The turpentine that has exuded from the dead trees is found at a depth of from 2 feet to 3 feet. The export of this fossil resin has been steadily increasing the last thirty years. In 1855 only 355 tons were shipped, while in 1883, 1884, and 1885 the annual shipments were over 6,000 tons, valued at £320,000. We received in 1885, 81,000 cwt., valued at £254,000. This fossil resin is often found in immense masses, larger than those of any other known resin. Fine blocks were shown in the New Zealand court at South Kensington last year, as well as large collections of trade samples of the different commercial varieties.

Copal of Zanzibar.—This, sometimes called Indian anime, has been found to be the produce of *Hymenæa Mosambicensis*, or *Trachylobium Mosambicense*. The South American species, *Hymenæa courbaril*, also yield a good deal of resin.

The true, or ripe, copal is the product of vast extinct forests overthrown in former ages. The export from Zanzibar averages about 1,000,000 pounds annually. The raw, or true, copal is called chackaze, corrupted by the Zanzibar merchant to jackass copal. Copal, it may be remarked, is the Mexican generic name for all resins.

Manila copal derives its name from the port from which it is shipped. There are two varieties, known as hard and soft manila; the hard resembles kowrie in appearance, but is inferior in quality; the soft is a pale yellow kind resembling dammar.

From *Hymenæa courbaril* the soft resin known in commerce as American copal is obtained. The tree is very extensively diffused over the West Indies, British Guiana, Venezuela, Mexico, and in almost all the provinces of Brazil, though some other species of *Hymenæa* probably furnish the resin. It is found in many localities in a semi-fossil state, and is obtained by digging in the vicinity of the roots of the tree. The masses seem to have the appearance of a stalagmitic formation arising from exudations from the branches of the tree dropping in the soil below.

Guibourtea copallifera is the principal, if not the sole, source of the copal resin of Sierra Leone. All the resin exported under the name of West African copal may be looked upon as a fossil resin, produced in times past by trees which, at present, are extinct, or exist only in a dwarfed posterity.

The origin of the kind of copal known as Angola is at present undetermined. Considerable quantities of copal are washed down during the rainy season from the slopes of the mountains. The natives subject the copal to a rude washing in lixiviated ashes, whereby the outer crust and its impurities are partly removed. It has, on arrival, to be further cleansed for the trade with extreme care, and without the use of acids, which are very detrimental to varnishes in causing them to run "pinholey."

The flat Angola copal is sometimes called red anime, as it somewhat resembles it in appearance and quality. It is principally sent from here to Europe and America. The rounded water nodules, known as "pebble copal," assume this form from the abrasion consequent on their being washed down by the rapid mountain currents, from the beds of which they are obtained.

The anime of commerce is a resin of great value to the varnish maker, but it is now largely replaced by copal. The best is obtained from Zanzibar, and is derived originally from *Trachylobium Mosambicense*. The finer qualities come from the northern districts of Wande. The imports are never very large, seldom amounting to 3,000 cwt. Of copal, the imports occasionally reach 20,000 cwt., but the imports from West Africa are only about 7,000 cwt. Of dammar the imports range from 3,000 to 7,000 cwt., and of kowrie gum, 70,000 cwt. to 80,000 cwt. annually.—*Journal of the Society of Arts.*

Specific Gravity of Beeswax.*

Herr Dieterich has of late examined into the real specific gravity of beeswax, the different observers giving often widely varying figures. He found that this was due to the different ways in which the "floating" test in more or less diluted alcohol was conducted. The best dilutions are: 0·960, 0·961, 0·962, 0·964, 0·965, 0·966, 0·967.

There are three ways in which the test is applied:

1. A piece of wax is chipped off, cleaned as much as possible from all fragments, and allowed to float. The specific gravity of the diluted alcohol in which the wax floats in the middle (neither on the surface nor at the bottom) is the true specific gravity of the wax.

2. A piece of wax is kneaded in order to make it homogeneous and exclude all air, and allowed to float.

3. Hager's "pearl" method. Heat a piece of beeswax over a small alcohol flame till a drop of melted wax is formed, and allow it to fall into strong alcohol, keeping the wax as near over the surface as possible. Form in this way a dozen "pearls," put them on blotting paper, and let them dry at ordinary temperature for twenty-four hours (because recently made "pearls" are too bulky, and therefore give a too low specific gravity); then allow them to float in the diluted alcohol.

The following figures will show the difference in specific gravity according to the treatment of the same wax:

Chipped piece	0·963
Kneading one minute	0·957
Kneading five minutes	0·963
Recently made pearls	0·961
Pearls after twenty-four hours	0·964

Dieterich finds after several years' experience with very large quantities of beeswax that the specific gravity is between 0·963 and 0·966.

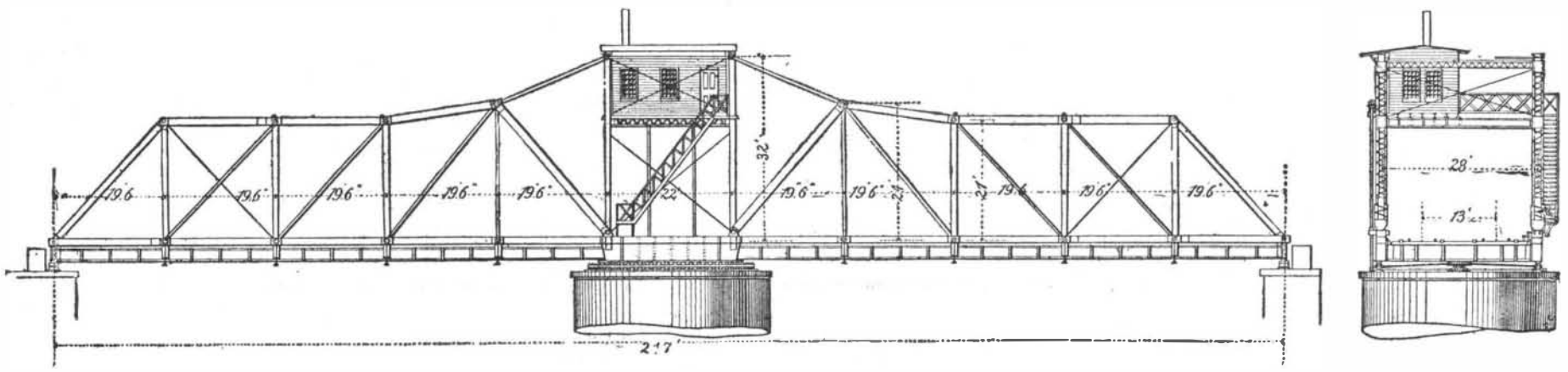
Ladislas Adolphe Gaiffe.

The well known electrician Ladislas Adolphe Gaiffe died on April 9, at the age of fifty-five years.

The number of new apparatus devised or manufactured by him is very large, and his medical electrical instruments are known throughout the world. He was one of the first, if, indeed, not the first, to recognize the advantages that could be derived from nickel applied electrolytically to oxidizable metals. What he called "nickelure," and what his imitators style "nickelage," has become an extensive industry.

Mr. Gaiffe was an able co-worker with many eminent scientists, and his fertile brain suggested many valuable improvements to apparatus intrusted by inventors to him to be manufactured. He was made Chevalier of the Legion of Honor at the time of the Exhibition of Electricity at Paris, in 1881.

* From *Pharm. Zeitung.* Reprinted from the *Pharmaceutical Record*, February 15.



NEWARK BAY DRAW BRIDGE—SIDE ELEVATION AND CROSS SECTION OF NEW DRAW BRIDGE.