LIFTING BRIDGE FOR DOUBLE TRACK RAILWAY.

The line of the New York, West Shore & Buffalo Railway crosses the Oswego Canal at Syracuse at a point where peculiar local conditions would not admit the use of a pivot bridge. To overcome these difficulties the lifting bridge illustrated on first page was designed; and to freely allow boats to pass, it is lifted to a height amply sufficient to accommodate travel. No delay is occasioned, as the operation of lifting takes but thirty seconds, and the bridge can be so nicely adjusted by means of the counterweights that the work required of the engine is comparatively light. An exact balance is not aimed at, as the bridge when down is disconnected from the lifting machinery, and is held firmly on its seat by a weight of several tons, and the lifting of these few tons is, practically, all that the engine has to do. The location of the road is such that the bridge makes an angle of 38 degrees with the center line of the canal.

The extreme length of the truss is 94 feet, the extreme height 23 feet, and the extreme width 30 feet and 4 inches. Each of the top and bottom chords is composed of two 3 by 3 by ⅜ inch angles, and two vertical plates 12 inches wide and ¾ inch thick, placed 13½ inches between rivets. The top chord is strapped by a lattice on the top, and the bottom chord by a lattice on the bottom. The web of the trusses is composed of angles 2 by 5 by 3½ inches, two being placed parallel but on opposite sides of the chords. In order that the diagonals running in different directions will not interfere with each other, one pair of angles is riveted to the outside of the plate of the chord, and another pair to the inside of the plate. Each pair of angles is latticed. The end posts are the same as the chords, with the addition of a ⅝-inch plate. The floor beams are plate girders 28 inches deep and placed 9 feet 3⅜ inches between centers. The stringers are 12-inch I beams, and upon them rest the ties. The end floor beams are plate girders of the same dimensions as the others, and are placed parallel with the center line of the canal.

The bridge rests upon walls of masonry built upon a solid foundation, and a masonry retaining wall was constructed along the water side of the tow path.

The end columns which carry the pulleys are made of two 15-inch channels, latticed. The back struts for bracing these columns are of two light 15-inch channels, latticed. The tops of the columns are connected by a stiffener, made up of two 8-inch channels on top and two of the same size on the bottom, the web being of 1-inch rods. A similar stiffener connects the tops of the struts.

Each of the counterweights is suspended by two steel wire cables 1¾ inches in diameter, carried over pulleys on top of the columns. The weight is obtained from pig iron and slag put in a wrought iron box having a cast iron yoke extending across the bottom, and to which the ends of the cables are fastened. The other ends of the cables are attached to each end post of the bridge. Attached to each column and freely suspended from its upper bearing is a double threaded steel screw 3½ inches in diameter and 2 inches pitch, and long enough to reach a short distance below the top chord when the bridge is down. To each end post and upper chord of the bridge is riveted a bracket carrying a phosphor-bronze nut through which the steel screw passes. This nut forms the center of a bevel gear, and each one of these gears is actuated by a bevel gear at the ends of two lines of shafts placed on the upper chords of each truss. The shafts are driven by two 8 by 8 inch engines coupled at right angles, one revolution of which gives the nuts a half turn and raises the bridge one inch. When the bridge is lowered, the screws disengage at their upper bearings and allow the bridge to adjust itself to the masonry.

The machinery is located in the center of the top of the bridge.

The bridge is built entirely of iron, and weighs, with the machinery, 146 tons; the counterweights weigh 138 tons. The height of lift from the bridge seat is 10½ feet.

The bridge was designed by Albert Lucius, Engineer of Bridges, New York, West Shore & Buffalo Railway; and was built by the Hilton Bridge Company, of Albany, N. Y., the erection being supervised by H. L. Forte, C.E., New York, West Shore & Buffalo Railway. The machinery was constructed by C. H. Delamater & Co., of this city, after designs by their engineer, H. B. Roelker.

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Manufacture of Sorghum Sugar.

The works of the Kansas Sugar Company, at Sterling, Kans., is one of the large and successful concerns in that State. The following account of the process and works of this company, condensed from the Sterling *Bulletin*, will be interesting:

These works are fitted up with $17,000 worth of new machinery. The crusher is located on the main floor of the mill, and is a three-roller machine, each roller measuring 4½ feet by 30 inches, the whole weighing 100,000 pounds, and is driven by a 100 horse power engine. The cane is carried into the mill and fed to the crusher on a carrier, on the endless belt principle, from a point forty feet outside, and the cane after being crushed is carried out on a similar carrier on the other side of the mill in the form of bagasse, where it is spread out to dry, after which it is used for fuel. The steam for running the engine and other machinery, evaporating pans, heating purposes, etc., is generated in a battery of six boilers, 15 feet by 50 inches each, with the aggregate capacity of 350 to 400 horse power.

The juice falls into a large copper pan, 4 by 6 feet, 4 inches deep, whence it runs through a trough into a juice vat below the floor, from which it is pumped by steam into four tanks in the upper story of the mill, which have an aggregate capacity of 6,000 gallons. Each of these tanks has two valves, one to admit, the other to let out, the juice. From these tanks the liquid passes into four defecators of 600 gallons capacity each, at a charge. In these the juice is neutralized with lime, after which it is boiled by ingeniously contrived steam appliances, during which a great portion of the impurities and foreign substances are eliminated by skimming. This process does away with the so-called sorghum taste. From the defecators the material is drawn into four settling pans, of the same capacity as the defecators, where it is allowed to settle, leaving a flocculent precipitant at the bottom, after which the fluid is drawn into another tank, whence it is again pumped by steam into a tank situated above the evaporators, on the second floor, from which it is drawn into the evaporators. These evaporators are made entirely of copper, are 6 feet in diameter and 3 feet in depth. In these the juice is evaporated down to about 20° Baume, which is a comparatively short process. After leaving the evaporators, the semi-sirup, as it is now called, passes through a series of settling tanks to remove whatever of foreign substances may remain, from which it is pumped by a small engine into a tank in the tower. The object of this is to give it height to allow of subsequent filtration, which is accomplished by passing through six bone-charcoal filters 3½ feet in diameter and 12 feet in length. These filters are so connected by pipes and valves as to allow the semi-sirup to run through one or more of them, as required, and thence into the tank beneath the vacuum pan. This vacuum pan, which is situated on the second floor, is 8 feet in diameter, and has a capacity of 2,200 gallons, and will make 15,000 pounds of sugar at a strike, and is capable of making six strikes every 24 hours. The air is exhausted by a Blake combined vacuum and water pump, having a 5-inch suction and 4 inch delivery.

The clarified juice, or semi-sirup, is sucked up from the filter reservoir into this pan, and is evaporated at 120° to 150° Fahr., until the proper number of sugar crystals are obtained, when it is drawn off by a huge gate in the bottom into the crystallizing tanks or wagons. These tanks, eighty in number, are 4 x 5 x 2 feet in size, and mounted on wheels; and, as they receive the contents of the vacuum pan, they are rolled into the crystallizing room and allowed to remain a day or two. This room is 40 x 40 feet in size, with very low and tight ceilings, and is kept at a steady and even temperature of about 100° Fahr., which is done by steam pipes running around the room. This process keeps the sirup in a condition to purge from the sugar.

The material has now assumed a bright, beautiful amber hue, and is designated as malada, or mush sugar. From these tanks the malada is dumped in a huge mixing tank, which is just below the floor of the crystallizing room. The apparatus in this mixer is a long toothed arrangement with a worm motion, which breaks up the lumps, and makes an even mixture. From the mixer the malada is run by small gates into the centrifugals, of which there are four, each 4 feet in diameter. A large, round cast iron box, about a foot from the floor, through the center of which runs a spindle; attached to this spindle is a brass basket, the sides of which are composed of a double casing of woven wire, one coarse, the other fine. The spindle turns these baskets at the rate of 1,400 revolutions per minute. The malada is drawn into the baskets, and the centrifugal force of the fast revolving baskets forces the molasses through the screens and retains the sugar in the basket. A little cone on the spindle at the bottom of the basket is lifted, and the sugar taken out at the bottom in small boxes and immediately barreled. In case the sugar is not to be barreled immediately, it is stored in a room 12 x 12 x 8 feet, on the ground floor.

The molasses (for molasses it is after it has passed through the centrifugals, and the sugar is taken from it) is reboiled in the vacuum pan and then barreled. This article is of a darker hue than if the sugar had not been taken from it, but it is free from the sorghum taste, as is also the sugar.

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High Speeds on Railways.

While there can be no doubt that as regards cheapness and rapidity of construction, general excellence of bridges, locomotives, and cars, the railways of this country are ahead of the rest of the world, the signaling arrangements here, with few exceptions, are rudimentary and inefficient, and render fast traveling a matter of considerable difficulty, if not danger. It is impossible to run a really fast express train if the signals are ambiguous, and if every level crossing is made a compulsory stopping place. The saving in time by fast trains can only be fully felt in a great country, where very long journeys are not only possible, but are frequently undertaken; but hitherto this fact has been little appreciated, and people have been content to travel at a slow speed and put up with frequent stoppages because the railways were new, the rails roughly laid, and many bridges unsafe at a high speed. But of late years these conditions have been materially changed. The widespread use of steel rails, the greater care bestowed on the roadbed, and the introduction of iron bridges of first-class workmanship, have rendered high speed perfectly safe and easy on most parts of good roads in the Eastern and Middle States; but it is rendered unsafe where switches are so arranged that they may be left open to an approaching train without any signal warning the engineer, or the signals are so formed that the difference to the eye between a clear or all-right signal and a danger or stop signal is slight in snowy weather, or under certain atmospheric conditions which render the difference between colors imperceptible, though a difference in form may be perceived.

The real gain of time to a business man obtained by a difference of a few miles an hour in the speed of a long-journey train is best illustrated by an actual case. A man in New York wishes to do a day's work in Chicago. He takes one of the fastest and best appointed trains he can find—the Chicago limited. It leaves New York at 9 A.M., and lands him at Chicago at 11 the next morning, having accomplished 911 miles in 26 hours 55 minutes, allowing for the difference in time between the two cities. This makes an average speed of 33·8 miles per hour, including all stoppages. But assume, what is surely not extravagant, that as high a speed can be attained on the Pennsylvania or any other first-class American road as on an English main line, and what shape does the problem assume? On one English road, the Great Northern, the distance between Leeds and London (186¾ miles) is done in 3 hours 45 minutes, including five stoppages; on another, the Great Western, the 129¾ miles between Birmingham and London is run in 2 hours 45 minutes, including two stoppages; and as neither of these routes is particularly level or straight, and both pass through numerous junctions with a perfect maze of switches and frogs, they give a fair idea of what is possible in speed on the railroads of this country. These figures give, respectively, speeds of 49·8 and 47·2 miles per hour. Taking as a fair average 48 miles an hour, including stoppages, the journey from New York to Chicago should be done in 18 hours 59 minutes, or say 19 hours—a saving of 7 hours 55 minutes on the present time; so that, if the train were arranged to leave at 55 minutes past 4 in the afternoon, instead of 9 o'clock in the forenoon, the whole of this time would be saved in the busy part of the day; effectually adding a day to our imaginary traveler's business and dollar-making life.

It may be thought that such a deduction is unfair, as the English style of car is so much lighter than the American; but, as a matter of fact, the average English express train is considerably heavier than the Chicago limited, and conveys about three times the number of passengers; and, as trucks and oil-lubricated axle boxes are not yet universal there, the tractive resistance per ton is probably higher. It certainly, therefore, seems not only possible, but feasible, to attain these high speeds in this country, where, owing to the long distances to be traveled, they are more valuable than in England; and the great step toward attaining that end is the adoption of proper and efficient signaling arrangements. All the other steps are achieved; the American passenger locomotive of the present day is perfectly competent to drag a heavy train at a speed of over 60 miles an hour; the cars, as now constructed, can travel safely and smoothly at that speed; and the steel rail, the well ballasted tie, and perfect workmanship of the modern iron bridge can well support the thundering concussion of an express train at full speed. But this speed can only be maintained for a few miles at a time, if the engineer who guides this train be doubtful whether the dimly-seen signals imply safety or danger, or if the laws of the State bring him to a full stand where his road is crossed by a small corporation with a high sounding title, which owns one locomotive with a split tube sheet and two cars down a ditch.

To run a fast train, a clear, uninterrupted road is absolutely necessary; and the reason is not far to seek. To move a body from a state of rest to a velocity of 60 miles per hour, or 88 feet per second, an amount of work must be performed equivalent to lifting that body 121 feet. Now, it is apparent to the simplest capacity that it requires a pretty powerful engine to overcome the resistance of a train running at 60 miles per hour without every few miles putting on brakes to destroy this velocity, and then to lift it 121 feet again to attain speed; the resistance of the air, and the friction of bearings on journals, and of flanges against rails going on all the time. As a matter of fact, showing what severe work this is on an engine, the Zulu express on the Great Western Railway of England, which is the fastest train in the world, has been repeatedly carefully timed; and it is found that, though running over an almost absolutely level and straight road, it takes a distance of 26 to 28 miles to attain its full speed, about 58½ miles an hour.—*Science.*

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Alleged Lack of Technical Education among American Machinists.

The Philadelphia *Ledger* says that a person who recently advertised for machinists tested the proficiency of all who applied, and remarked, when summing up the qualifications of the men, that, though the American pleased him the most by their brightness, the foreign workmen were, without exception, better educated. The Americans had picked up their trades in the shops, but most of the foreigners, in addition to their shop practice, had attended technical schools. The latter could not only do good work with the tools, but they could lay it out, make sketches, and, if necessary, draw the designs to scale. The American shop-taught workmen, though quick to understand, inventive, and skilled in the use of tools, were markedly deficient in drawing and such knowledge of mechanics as is required by the designer and draughtsmen.

Perhaps there is some truth in the above; but so long as American machinists continue to maintain their supremacy for superior ingenuity, excellence of work, and greater rapidity in its execution, they can afford to spend less time on the minutiæ of the schools. In some cases, where ignorance is bliss, 'tis folly to be wise.

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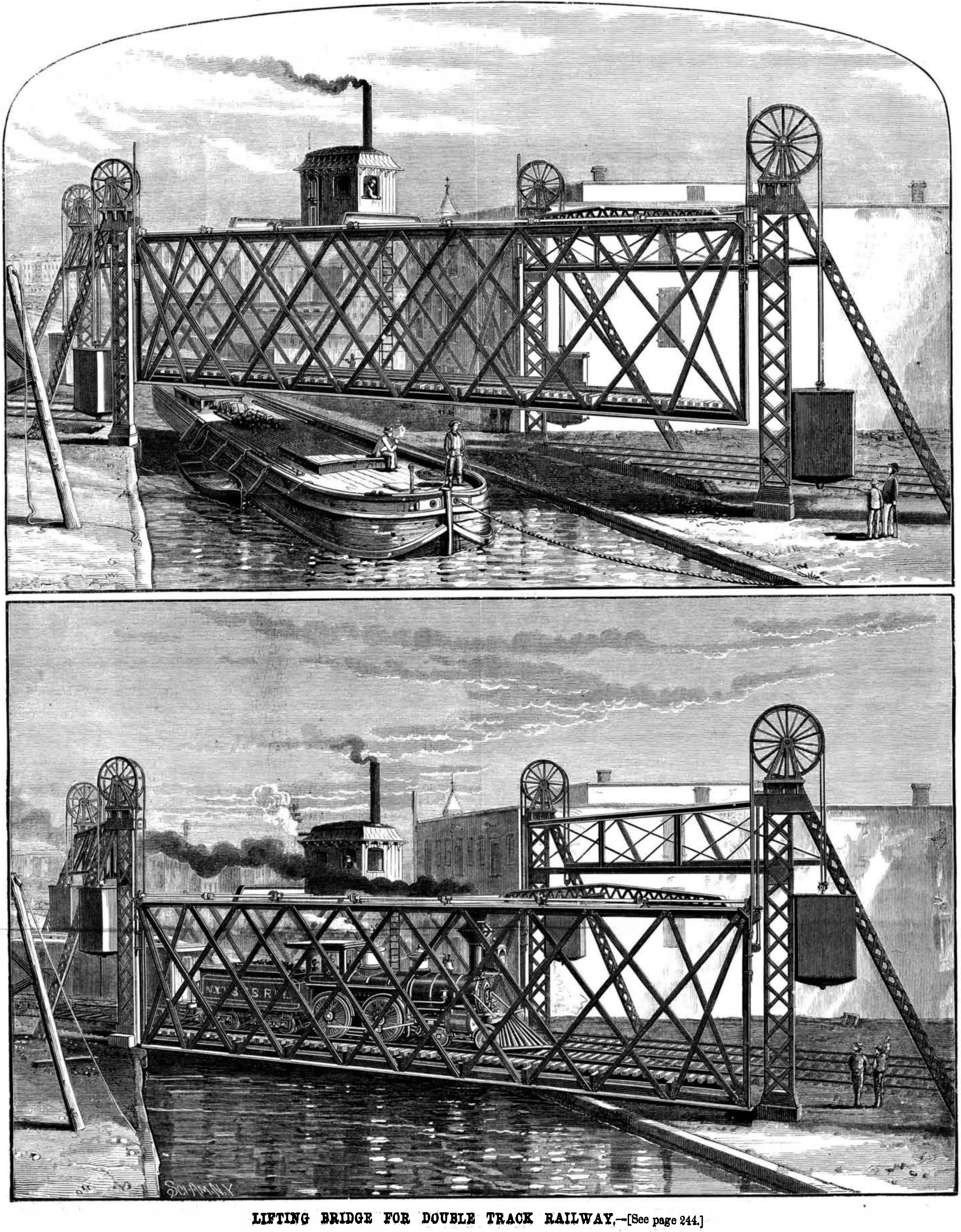

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