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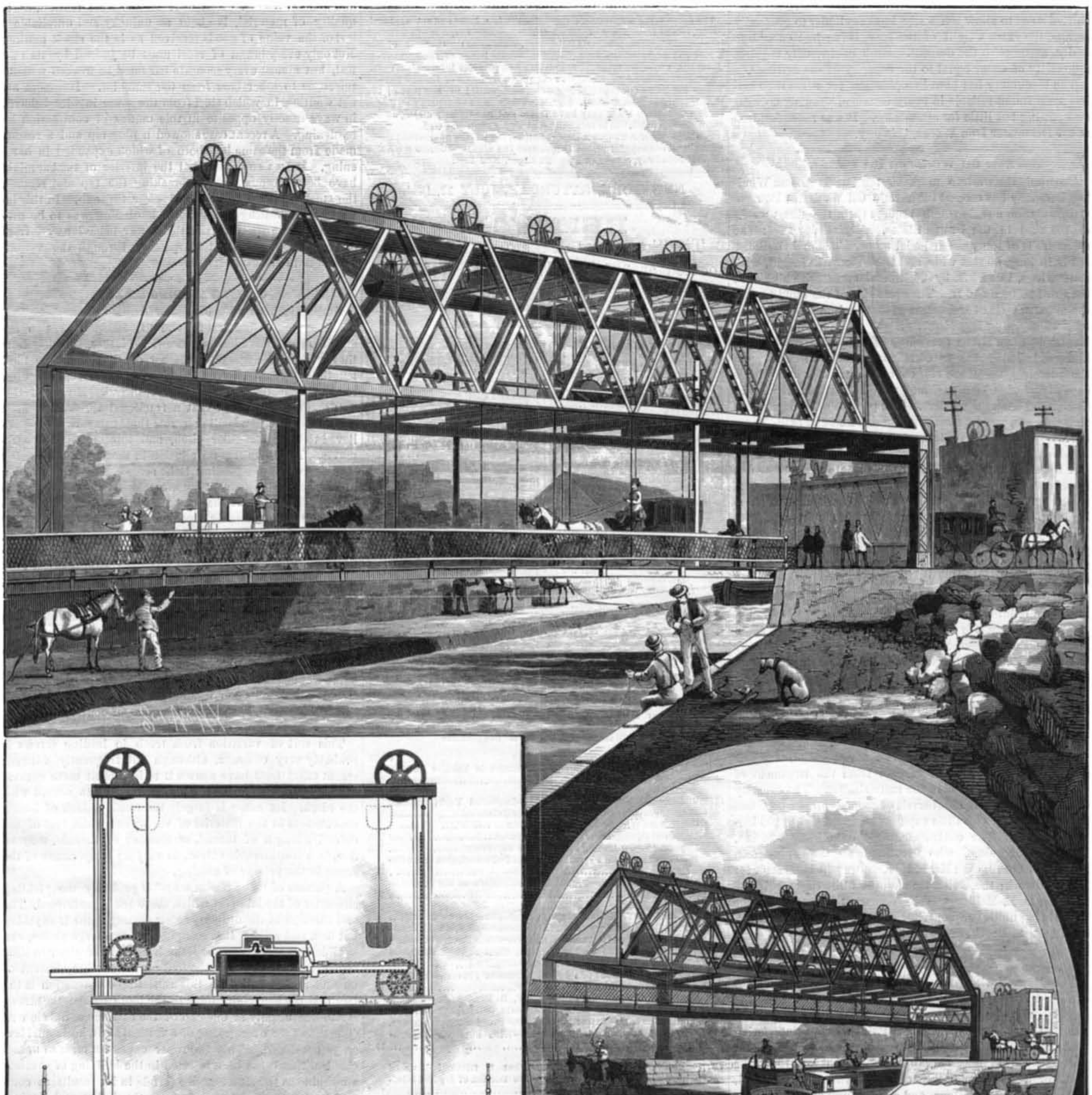
HYDRAULIC LIFT BRIDGE.

A short distance from the screw lift bridge which we illustrated in our issue of October 20, 1883, is the bridge shown in the accompanying engraving. It was built by the New York, West Shore, and Buffalo Railway, and spans the Oswego Canal at Salina Street, Syracuse, N. Y. Its construction was made necessary, as the line of the railroad changed the grade of the street.

In order to allow canal boats to pass, the floor of the bridge is lifted a distance of 9 feet, thereby increasing the head room just that much. The method of accomplishing this is simple in all its details, economical in working, effective in operation, and most decidedly novel. The floor system is nearly balanced by counterweights, the connecting ropes passing over pulleys placed in the superstructure. The power required to lift the floor is obtained from a cylinder, the piston of which is moved by water admitted from the city mains. The structure may be defined as a bridge elevated upon four end posts, and carrying a floor system which is moved vertically up and down in order to accommodate travel.

The bridge is 85 feet long, 38 feet 6 inches wide, and is placed at an angle to the canal of 33½ degrees. Two latticed trusses having inclined end posts are supported upon four latticed columns, one at each corner of the structure, and are connected together as shown in the engraving. Between the bottom chords of the superstructure is placed the water engine, with its axis perpendular to the center line of the bridge. The cylinder is 33 inches in diameter, the stroke is 5½ feet; the ports are 2½ by 11 inches, exhaust port 4 by 11 inches. On each end of the piston rod, which is 4½ inches in diameter, is a rack 8 inches wide, with 3 inch pitch.

Each of these racks engages with a pinion on a shaft 5 inches in diameter running parallel with the lower chords. The pinions are 24 inches in diameter, pitch 3 inches. At intervals on this shaft are pinions 39 inches in diameter, 2½ inch pitch, which engage with vertical racks working in bearings attached to the sides of the structure. To the up-



NEW YORK, WEST SHORE, AND BUFFALO RAILWAY.—HYDRAULIC LIFT BRIDGE AT SYRACUSE, N. Y.

per ends of these racks are attached suspender rods 1¾ inches in diameter; and to those are secured steel ropes ¾ of an inch in diameter, which pass over pulleys placed on the top chords. These pulleys are 42 inches in diameter, and are mounted on 3 inch shafts. To the inner ends of the ropes are attached long buckets which carry weights nearly sufficient to balance the floor, which is a plate girder system. The valve is an ordinary D valve, and the valve rod is so connected that it can be shifted from the ground. The inlet is connected with the city water mains, and although the pipe is throttled—the authorities being fearful of an excessive use of water to lift the bridge—the bridge can be raised in 15 seconds. A shoulder on the suspender rod rests on the lower chord of the overhead truss; this rod carries the dead load, the rope running over the sheaves carrying the live load. When the floor is down, its ends rest upon stone abutments.

Water being admitted to the cylinder, the piston is moved, the water pressure being amply sufficient to lift the unbalanced weight of the floor. The racks upon the ends of the piston rod, engaging with the upper side of one pinion, and the lower side of the other, move the pinions in opposite directions. The pinions upon the longitudinal shafts move all the vertical racks up, since the racks are so placed that the teeth of those in one row face those in the other. The arrangement of these parts is plainly shown in the sectional view. Thus the bridge is raised, the motion being regular and easy, the counter weights descending at the same time. To lower the bridge the water is turned off, and the valve shifted so as to allow the water in the cylinder to gradually escape, the extra weight of the floor being just enough to easily accomplish the descent. Each raising only requires a quantity of water equal to the capacity of the cylinder.

The machinery has been in operation for some time and has been found reliable in every instance, showing no wear and costing but little for attendance. It was manufactured at the Delamater Iron Works, this city.

New Oil Works on the Pacific.

To supply the western markets, the Pacific Steam Whaling Company has erected the Arctic Oil Works at Potrero, California, on a scale which renders them the finest works of the kind in the United States. *Engineering* says: The structure is of Ransome artificial stone. The main building is 150 ft. long, 40 feet wide, and three stories in height, with three wings, two 26 ft. by 26 ft., and two stories high, and the third 26 ft. by 16 ft. The great size of the building and the massive style of arcitecture give it an imposing although somewhat gloomy appearance. Besides the structure already mentioned there is a coopers' shop 24 ft. by 30 ft., two stories high, and sheds 155 ft. by 60 ft. for storing full casks. On the premises there are six enormous tanks, each with a capacity of 64,000 gallons, into which the crude oil will be discharged from the whalers. The process of refining is an elaborate one, and requires considerable time and skill. From the storage tanks the oil is carried through pipes to the main building, where it is run into tanks of 100 barrels capacity, and boiled; from there it is drawn so into pits—of which there are eight—each of 100 barrels capacity, where it is frozen by ice. When sperm oil is being treated, after freezing it is placed in bags and put under hydraulic presses, where it is subjected to great pressure. The first running from the press is called winter oil. The stearine or spermaceti remaining in the bags is again pressed, but the temperature is raised to 50 deg. The oil from this second pressing is called spring oil. The residue still remaining in the bags goes through a refining process, and is then taken to a hot room, at 85 deg., where it is again pressed. After this it is again refined and produces the spermaceti of commerce, or is ready to be manufactured into candles. The oil, as it comes from the presses, is put into vats under the roof, which is of glass, where it receives a sun bath, and is ready for the barrel and the market, under the name of natural winter and spring oil, as the case may be. Or else it is run into large bleaching tanks before being sunned, and then is marketed as winter or spring bleached oil. The manipulation of whale and fish oil differs in some respect from the treatment of sperm, but the process is in the main similar. The capacity of the new works is 150 barrels of refined oil per day, and this output can, with little expense, be increased to 250 barrels per day. The contractor for the building was Mr. Ernest L. Ransome, who furnished all the stonework, foundations, wall, etc.; Mr. S. H. Kent was the contractor for the woodwork; the Union Iron Works built the machinery, and Mr. D. E. Melliss was the constructing engineer; the whole being under the superintendence of the future manager, Mr. F. A. Booth, of New Bedford.

A Wild Cat Cannon Shot.

The New York, West Shore, and Buffalo Railway is equipped for eleven miles near West Point with electric block signals. Great precautions and large expense were incurred in order to pass West Point without interfering with the facilities for artillery practice, which was so far accomplished that nothing but a wild shot can touch the track or a train upon the track. A wild shot was fired, however, a few days since, and a 400 pound shot struck one of the 67 pound rails. The long angle fish plates broke, and the rail was forced out in the middle into a U form. Danger signals were immediately set in both directions by electric apparatus, which, if a train had been approaching within a little distance, would doubtless have prevented a serious accident.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 445,

For the Week ending July 12, 1884.

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CONTRACTION OF STEEL.

The hardening of cast steel, of the usual grades employed for tool purposes, generally contracts it. This quality in cast steel is frequently employed to reduce to exact size articles that must be hardened for their purpose. A machinist recently stated a rather unusual experience, that of rehardening six times a plug gauge in order to reduce it to size. At each hardening the steel was subjected to a close measurement test, and the successive contractions could be measured until the oversized gauge had been reduced to a size that required only the ordinary after-polishing. This quality of cast steel (contraction in hardening) is one that is generally accepted as belonging to the metal; but there are instances where expansion rather than contraction is to be expected from repeated heatings, hardenings, and annealings. So much difference, which is almost diametrical, is due largely, if not mainly, to the difference in the steel itself rather than to uneven heating and hardening.

Half of the published notices of the management of steel, whether common or unique, are given without the proper elements on which to form an opinion as to the behavior of steel under heat and in the bath. If workers of steel—cast steel, tool steel—would record their failure experiments as well as their successful experiments, we should sooner arrive at some reasonable way of treating steel, and the manufacturers would believe that the casting of steel was different from the casting of iron, and that its after-working required care enough to insure even and general results. But as it is, the steel market, as to quality of material, is about as unlucky and unreliable a test of the value of goods received as is the stock market. Not only every brand of steel must be judged by its own test, but almost every separate bar must be worked without reference to other bars from the same lot. Instances are not wanting in which steel from the same invoice behaved in ways exactly opposite in this matter of contraction by hardening. A recent case showed a plug tap and a reamer made from the same bar, both of which expanded in hardening. It was supposed that the interior of the barmight have been porous, but on breaking the tap and reamer, the steel appeared to be sound clear through. In this instance even heating and uniform hardening was to be presumed, as the specimens of this queer behavior were from a large lot of similar tools passing through the various processes in the same batch.

CUTTING LEADING SCREWS.

Under the head "Curiosities of Screw Cutting," in THE SCIENTIFIC AMERICAN of June 21, 1884, were two examples of defective leading screws for lathes, showing how they varied in aggregate number of threads in the total length, sufficiently, by cumulative errors in reproduction, to change the radical pitch of the thread. Errors of this nature are so common that a fractional thread has been reproduced from a leading screw that came from one believed to be of a regular pitch, and this in only three removes. But there was no allusion in that article to another serious error in the leading lathe screws and the elevating planer head screws, as they are usually produced on the lathe. This error is that of a defective thread, known to machinists, when largely developed, as a "drunken thread." A thread of this character is not a true spiral or helix, but twines about its core on a varying incline, sometimes—for a part of its revolution—moving at right angles to the core of the screw instead of on the incline demanded by the determined pitch of the thread.

On such a drunken thread a nut will not present a face perpendicular to the screw in all parts of its revolution, but at one point its face, if extended by a line across it, would show a dip below the horizontal, and at another point would show a projection above the horizontal. A "set-up" nut on such a screw must spring the bolt into line with its face, or strip the thread. Of course, such work is unmechanical and imperfect.

This sort of variation from truth in leading screws is probably very common, although not frequently noticed; recent exact tests have shown it to be a fault more general than that of unequal total length of thread to accord with the pitch. Its cause is largely the result of lack of homogeneousness in the material of the screw, while that of the defective length of thread, or number of threads, may be due, to a considerable extent, to varying temperature of the screw in the process of cutting.

A portion of "the reason why" is probably the yielding character of the lathe on which the work is performed. The tool carriage of the ordinary screw cutting lathe is anything but firm and solid. It is composed of two large pieces, one to slide on the ways of the lathe bed, and the other to slide transversely on it, while the tool post is another element of unstableness. Added to this rattletrap construction is the fact that the propelling force of the tool carriage, the screw, is situated usually at one end of the carriage and below it, compelling the overcoming of a vertical and a horizontal leverage combined. This improper construction is so unmechanical that it has been rejected in the building of so crude a machine as the steam engine (crude in its results as compared with those demanded from the lathe), and engines now must have the piston rod, the pitman, and center of crank shaft in line. Such simple principles should govern the construction of the screw cutting lathe; the propelling screw should be as nearly in a line, horizontally and vertically, with the tool carriage as is possible in construction, so that there shall be no invitation to "give" at a hard