THE VICTORIA JUBILEE BRIDGE.

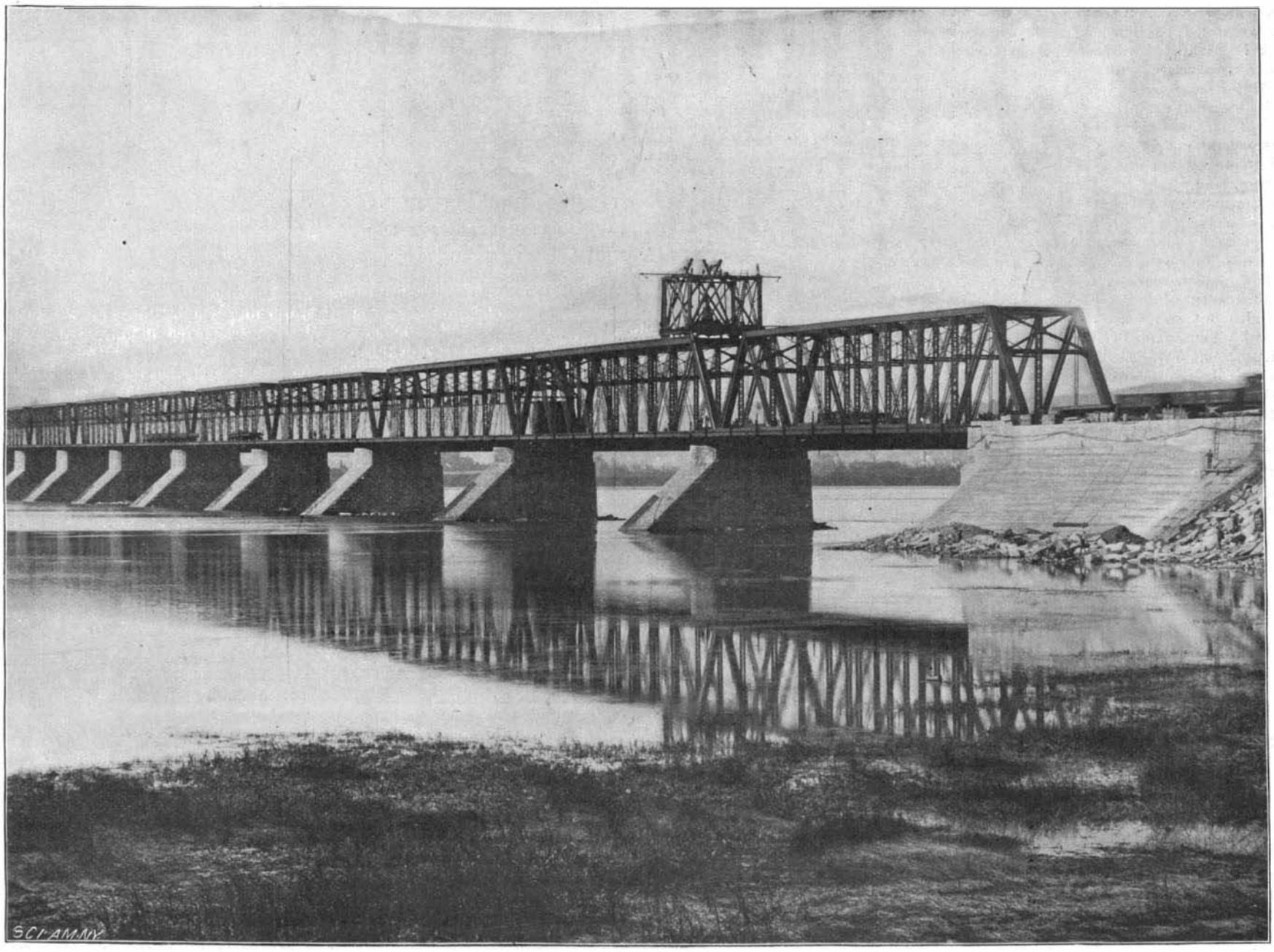
The completion of the new Victoria Jubilee Bridge across the St. Lawrence, at Montreal, will mark the disappearance of one of the most famous landmarks in the early history of iron and steel bridge construction. The new structure is being built to take the place of the old Victoria Tubular Bridge, which, built by Robert Stephenson for the Grand Trunk Railway in 1849, has now for half a century been conspicuous as one of the most notable engineering structures in the world. The old bridge, which was a tubular plate iron structure, square in cross section, was the third bridge of the kind to be built by that famous engineer, Robert Stephenson, son of George Stephenson, the builder of the first successful locomotive. The first tubular bridge of the kind was that built by Stephenson, assisted by Mr. William Fairbairn, across the Menai Straits, between the Isle of Anglesea and the mainland of Wales. It carries the tracks of the London and Northwestern Railway and forms an important link in the great mail route between London and New York. It consists of two spans of 230 feet and two of 460 feet in the clear, each of the shorter spans weighing 630 tons and each of the main spans 1,587 tons, or nearly 3½ tons to the foot. The tubes were 15 feet in width and varied in height from 23 feet at the ends to 30 feet at the center. The webs consisted of continuous solid plating and the top and bottom of the tubes were cellular in construction, the full width of 15 feet being divided in each case into 9 rectangular cells 21 inches square in section. The structure was stiffened laterally by plate gussets 5½ feet deep by 2½ feet wide, worked in at each angle of the tube. The bridge was, of course, enormously heavy, and its strength and stiffness were out of all proportion to the light trainloads of that day; at the same time it speaks volumes for the merit of the design and good quality of workmanship that a bridge designed in the forties (the first train passed through in 1850) should be carrying the heavy passenger and freight trains of the present day.

The next tubular bridge was built over the Conway, at a point on the same line a few miles distant from the Britannia Bridge, and this was followed in 1859 by the great Victoria Bridge, at Montreal, which was built on the same system, but contained several modifications and improvements. It was the largest bridge in the world at the time of its erection, and even to-day must be reckoned as one of the greatest. It consisted of twenty-four spans, each 254 feet long, and one channel span of 348 feet, the total length of the bridge and approaches being 6,592 feet. The total weight of all the spans was 10,000 tons and the total cost of the bridge was $7,000,000—a sum which appears enormous in the present day, but does not seem so excessive if we remember that half a century ago engineers were not equipped with the splendid machinery and appliances which are in use to-day, and the cost of material was very much greater.

In addition to the Grand Trunk, other roads made use of the bridge, and of late years it had become overburdened with traffic. Moreover, the advantage of using the bridge for wagon, street-car, and foot-passenger traffic was obvious. These considerations finally led to the removal of the old structure and the erection of a new bridge of much greater capacity in its place. As it was necessary to interrupt the travel as little as possible, and the existing piers were found to be adequate to carry the new bridge, the engineers determined to erect the new spans around the old tubular structure and remove the latter piecemeal after the new work had been completed.

The new bridge is of the standard American pin-connected type,

VICTORIA JUBILEE BRIDGE—END VIEW, SHOWING PIN-CONNECTED STRUCTURE ERECTED AROUND THE OLD TUBULAR BRIDGE.



THE RECONSTRUCTION OF THE VICTORIA TUBULAR BRIDGE—VIEW FROM EASTERLY SHORE, SHOWING OLD TUBULAR BRIDGE IN COURSE OF REMOVAL.

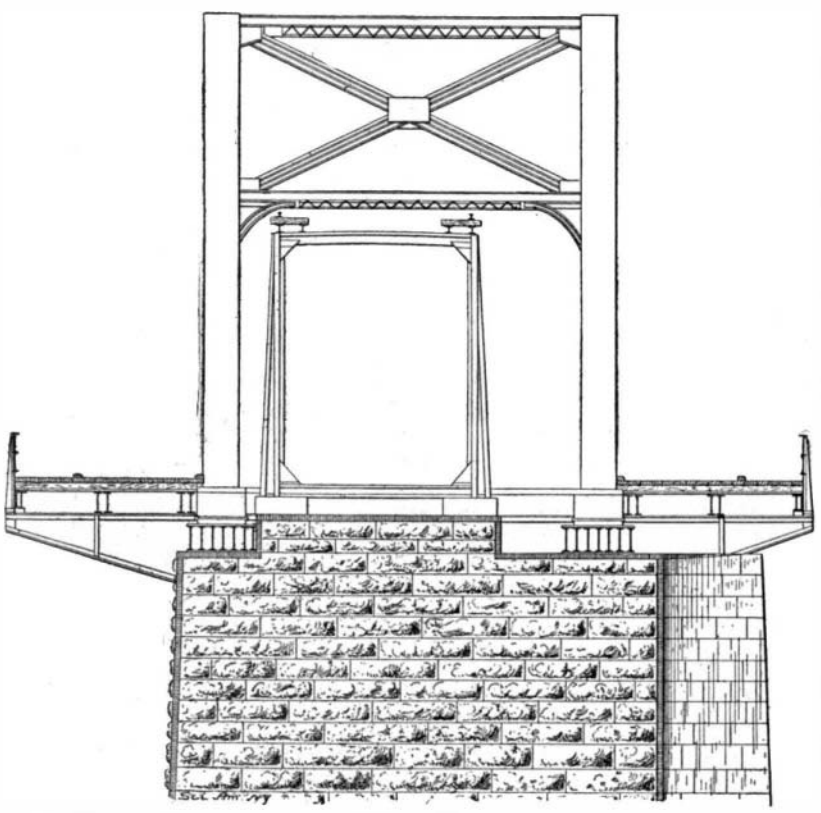
with vertical posts and inclined ties. It will have a double line of railroad tracks (the old bridge had but one), carried within the trusses, and the floor beams will be extended, as cantilevers, beyond the trusses sufficiently to provide for a roadway and sidewalk on each side of the bridge, the total width of the floor thus formed being 66 feet.

It will be noticed in the cross-sectional drawing of the bridge that two lines of rails are laid upon the top of the old bridge, one at each edge. These were used to carry a light temporary erecting truss, which was blocked up on a series of trucks to the required height, and served to carry each span of the new bridge during its erection. The traveling truss was placed over a given tube of the bridge and the chords, posts, eyebars, etc., of the pin-connected span were carried by it until they had been connected up, when the blocking was removed, allowing the new span to rest on its own bearings. The erection truss was then drawn forward onto the next tube by means of block and tackle and a stationary engine which was bolted down to the next tube ahead. The plan worked so well that only four to six minutes were consumed in moving the truss from one pier to the next. Two erection trusses were used, one on each side of the central channel span.

The reconstruction of the first span of the superstructure of the bridge commenced on December 8, 1897, and was completed on the 25th of the same month. Work was suspended during the winter and opened up again on March 23 of this year, when the erection of the second span was commenced. By August 19 the whole of the twenty-four spans were in place, and the total amount of time during which traffic had been suspended in the five months amounted to only twenty-five hours.

When the new spans were all erected and swung the tedious work of removing the old structure was commenced. This is in itself no small task. The rivets have to be cut and the multitude of parts—plates, gussets, angles, girders, etc.—must be removed piecemeal without interfering with the constantly moving traffic.

Our thanks are due to Mr. Joseph Hobson, Chief Engineer of the Grand Trunk Railway, for courtesies extended in the preparation of this article.



PORTAL VIEW OF THE TWELFTH SPAN, SHOWING ROADWAYS AND SIDEWALKS CARRIED ON EXTENSIONS OF THE FLOOR BEAMS.

New Method of Disinfection.

No sanitary subject has received more attention lately than that of disinfection. Drs. Walther and Schlossmann give the following details of a new method of disinfection: By means of a specially constructed apparatus a mixture of formaldehyde and glycerine is sprayed into a room which is to be disinfected, until a thick fog results; about 4 pounds of the mixture are needed per 1,000 cubic feet. The room need not be hermetically closed during the operation, as the ordinary circulation of air assists in spreading the disinfectant, and in enabling it to reach remote corners. Three hours' exposure was found sufficient to kill all germs in the rooms experimented on, though the test objects were purposely chosen of the most refractory nature.

For example: Pieces of linen thickly coated with a paste of white of egg and garden soil, dried in an incubator; layers of soil 3 or 4 millimeters thick with potato skins under and above them; potato skins alone. These were placed, open and covered, at various heights in the room, in recesses in the wall, on the floor, under pieces of furniture, in tall glass cylinders, or in shorter cylinders under a layer of wadding, in the pockets of thick winter clothing. Fæces were also sterilized by this exposure. Live guinea pigs and rabbits were also found to be freed from bacteria in their skins, their bedding straw, and their excrement.

The authors attribute the very advantageous effect of adding glycerine to the formaldehyde to its hygroscopic character and its power of adhering to and penetrating most of the ordinary porous materials found about a household. They anticipate that it may be found possible to diminish still further the necessary duration of the period of disinfection, and that their method will become a much more powerful agent than any yet known against the spread of infectious diseases, not only in man, but in the lower animals.—Prakt. Chem.

PRINCE ALBERT of Monaco is having an observatory built at the Azores for the taking of magnetic observations. The advantages of having a station there will be that a situation will be obtained near latitude 40°; the permanent causes of perturbation, electric lighting, tramways, etc., will not be present; and the geographical position, intermediate between Europe and America, would be capable of furnishing useful indications for the comparison of the magnetic curves obtained in these two parts of the world.

Mysteries of Sound.

Some curious experiences with regard to the trickery of sound occurred to me, says John M. Bacon, in The Strand Magazine for October, during undergraduate days at Cambridge, to which I attribute an early predilection for the science and study of acoustics. While yet an outcollege man, I was unexpectedly offered a set of rooms in the Old Court of Trinity, which rooms had been somewhat hurriedly vacated by a man of uncertain health and nervous temperament, who assigned no satisfactory reasons for suddenly going into lodgings. It was the commencement of a dull October term, and I remember well how the bedmaker warned me against with rooms, which she characterized as "dreadful dismal." The cause, however, of this forbidding description was not revealed to me till some weeks afterward, when boisterous winds chanced to set in with gloomy November weather, about which period, when sitting up reading, I used frequently to hear low, moaning sounds, as if some creature were in distress somewhere in the lane outside. No one could explain the phenomenon, and it was not until months afterward that I myself searched for the cause, and, after some little difficulty, discovered it. It was commonplace enough. In a side room a piece of wallpaper pasted across a chink had developed a crack, leaving two jagged or toothed edges, which, under certain conditions of draught, vibrated rapidly together, forming as it were a reed, and thus producing the sound above described.

That ghost, like all others in my experience, was readily laid; but another uncanny and more noteworthy occurrence shortly afterward taught me yet more clearly how capricious sounds may become, and how hard to locate or explain. In a neighboring staircase there lived (I beg pardon, "kept") another friend of mine, a man of much tougher fiber, who was reading—and over reading—for a medical examination, and once, through a sleepless night, he was driven to distraction by what, in the morning, he described as mysterious voices apparently in the court outside, accompanied by rappings on a tin tray or the like; yet, as often as he rose and went to the window, there was nothing to be seen, and at last his overwrought nerves gave way, and were not to be relieved until some of his friends succeeded in finding the cause of his disturbance, which was this: Over the way, in Caius College, where building was going on, an engine had broken down and workmen had been employed through the night in tinkering it up. This was the sole and sufficient explanation. It satisfactorily accounted for the existence of midnight voices and for the weird tappings, excited imagination supplying all the rest.

The instructive fact, however, brought home to my own mind was how unaccountably sounds may seem to behave themselves when the mind fails to interpret them aright, and how strangely different even a familiar noise may sound when heard amid dead silence. It has been my good fortune more than once since then to dispel idle imaginings that had been causing real disturbance and distress.*

Occasions also have arisen which have stimulated me to construct sound instruments which, in performing certain novel functions, should attain objects of practical value. For example, on the occasion of an annual flower show held in my grounds, it has been necessary to summon visitors, many hundreds in number, and scattered over a large area, to certain side shows. A horn or bell conveyed nothing in particular, but a specially made trumpet, rigged on a scaffold 30 feet high, commanded the whole ground, and a polite invitation gently spoken to the four winds has been easily heard by all. Some ten years ago my attention was accidentally directed toward kindred acoustical problems by circumstances which again may be considered as outside common experience. By the kindness and courtesy of the late Dean Church, I had been granted the privilege of making use of St. Paul's Cathedral for carrying out certain experiments dealing with terrestrial magnetism. I had chosen for my purpose a quiet summer's night, and, all due arrangements having been made, I commenced a long vigil, sitting alone for hours in the loftiest chamber of the building watching the readings of an instrument, while a colleague watched a similar instrument in the crypt 400 feet below. It was while occupying this elevated position, with attention well braced, and in that night silence which falls even over our great metropolis, that I learned how remarkably certain sounds can be recorded over vast distances. The measured tramp of the policeman rang as sharp or sharper than if I had been on the pavement beside him. The fog-horn of the bicycle—then in vogue—could be heard streets away, and railway whistles on distant lines and hooters on the shipping far down the river seemed unearthly in their carrying power and clearness.

The experiences of that night were further confirmed on yet another occasion when, about the same period, I chanced to make my first balloon voyage, and when, by rare fortune, our balloon drifted over the very heart of London and almost directly over St. Paul's Cathedral, at an elevation of 3,000 feet above its golden cross. It was a noteworthy voyage, and deeply impressed upon my mind afterward by the fact that it was one of the last conducted by the late Captain Dale, who shortly afterward lost his life while ascending from the Crystal Palace grounds. It was while we were maintaining a high elevation that we made out Kennington Oval immediately below us, and we could actually watch a game of cricket in progress. Soon, however, it became apparent that play was suspended, and then, manifestly in our honor, a ringing cheer came up with a distinctness that I was wholly unprepared for. I learned then that an English cheer is a very arousing, and may become a very astonishing, sound; but my wonder grew as we swept on and presently caught the gathering rattle of the streets below, which soon increased and grew to a deafening roar positively painful by its harshness and intensity. So far, these experiences were but proofs of the great carrying power aloft of loud and familiar natural noises, but I was now to be impressed quite equally with the penetration into upper air of Nature's softer music. It was squally weather that day, and, as evening approached, the wind grew rough with gathering storm. We were at that time scudding fast over Hertfordshire, where the country was well timbered, and ever as we passed high over woods, then in full foliage, a soft murmur would fill our ears, and it seemed almost incredible that this was but the tossing trees singing to us half a mile below. There were other sounds, of course. Anon would come the bark of a dog from—where? Or the whistle of a train scarcely yet visible in the distance deep down.

Altogether it was firmly impressed upon me from that time onward that a balloon ascent properly arranged would offer an exceptional opportunity for studying many problems in sound which could not fail to repay fresh investigation and experiment; and it is not a little curious that, although acoustics have occupied the special attention of many scientists, no one has come forward to systematically utilize the balloon in the service of that all-important branch of science.

* Once in 1895, in the case of the famous Ham ghost, near Hungerford.

Proposed Memorial to Clerk Maxwell.

It is proposed to place in Corsock parish church, by half-guinea subscriptions, a suitable memorial of the late Prof. James Clerk Maxwell. There is already in the church a memorial to the memory of his revered father, John Clerk Maxwell, by whose influence and exertions the church was originally built. This church is chosen for the memorial, as Maxwell's connection with it through life was very close. He was led to it as a child by his father; taught in its Sabbath school; was ordained an elder within its walls, and acted as such up to the time of his death; gave liberally toward its endowment, and the first and largest subscription toward the manse; was a trustee of the church and properties, and otherwise interested himself in its behalf.