NEW BRIDGE AT PITTSBURG, PA.

Our engraving represents the new bridge lately completed at Pittsburg, Pa., over the Monongahela River. Our picture is made from an excellent photograph by S. V. Albee, for a copy of which we are indebted to Mr. Alex. Y. Lee, C.E., of Pittsburg; and the engineer of the bridge has favored us with the following particulars, which were originally published in the *Sunday Traveler:*

The new Monongahela bridge, stretching from Smithfield Street on the north shore of the river to Carson Street on the south, by its graceful curves, solid stone supports, and light yet powerful steel cables and girders, challenges alike the admiration and wonder of the spectator—for wonderful it is that so much solid strength can be contained in a structure that appears almost fairy-like in its ethereal grace and slenderness. Herein is shown the triumph of architectural skill over the gross bulkiness that in the past was considered inseparable from an adequate amount of strength.

The need of a bridge connecting central Pittsburg with the South Side at this point was recognized early in the history of the city. A ferry accommodated the travel over the Monongahela River for a long time. In 1810 a charter for a bridge was obtained, and a covered wooden bridge of eight spans, each 188 feet in length, was built in 1816. The structure consisted of wooden trusses, re-enforced with wooden arches, and for those days was a remarkable engineering success. In 1845 the superstructure was destroyed by fire, and was replaced by a wire suspension bridge, under the direction of Mr. John A. Roebling. the builder of the great East River bridge, connecting the cities of New York and Brooklyn. This Pittsburg work was W. Roebling's first road bridge. In the course of time it became very shaky and loose, and its continuous swaying and creaking convinced every one that it was becoming unsafe for travel.

In the summer of 1880 it was decided to build a new one in its place. After a good deal of discussion as to the kind of bridge that should be built, Mr. G. Lindenthal, the well known engineer, was invited to prepare plans for a bridge that would not be subject to undulations and would be capable of enduring the constantly increasing traffic without limitation of load or speed.

His plans were accepted, and in 1881 the work was commenced.

The Lindenthal bridge is of the kind known as the Pauli truss. It rests on seven stone piers, and has two cast iron towers, 123 feet from low water, very massive and elaborately ornamented. The full length of the bridge is 1,221 feet. The two main spans are each 360 feet; the north approach is 320 feet from Water Street to the first large span; and from the toll house to the span, 208 feet. On the south end the distance from the toll house to the first large span is 290 feet, and from Carson Street 515 feet. From the roadway of the center span to the river at low water it is a distance of 61·08 feet, and from the under side of the floor, 57·08 feet. The old bridge left only 36·03 feet clear between the water and its lower side.

The roadway at present is 22 feet 10 inches wide in the clear, and the two sidewalks are each 10 feet in the clear. The full width of the bridge on the deck span approaches is 43 feet 6 inches, and on the channel spans, which are through spans, 48 feet. The bridge can be widened out, should it ever prove necessary, to 64 feet. The use of steel instead of iron wherever possible was based on the grounds of economy as much as anything, especially in the trusses, $21,600 being saved by taking that course. The flooring of the roadway and sidewalk is preserved wood, viz., gumwood and white pine, submitted to the zinc tannin process. The ornamental cast iron towers are roofed with wrought iron.

The masonry of the piers and approaches consists of a gray, hard, durable sandstone, free from admixture of clay or iron oxide particles. The dimensions of the stones used are from 24 to 16 inches in thickness, 7 to 4 feet in length, and from 3 to 1¾ feet in width, with beds and joints dressed regularly and true. The quantities of material used in the construction of the bridge were as follows: For foundations—lumber, 594,000 feet, board measure; piles, 10,800 lineal feet; concrete, 1,280 cubic yards; iron, 322 tons; stone masonry, 10,500 cubic yards. For superstructure—iron, 1,070 tons; steel, 740 tons; cast iron of towers, pedestals, etc, 196 tons; preserved lumber for floor, 358,000 feet, board measure; steel rails, 134 tons. For approaches—filling, 10,000 cubic yards; sidewalk pavements, 1,400 square yards; street pavements, 2,200 square yards.

The total cost of the bridge is $458,000. The bridge is strong enough for a double track railroad bridge of modern standards.

Messrs. Kloman, of the Superior Mill, furnished the forged steel bars for the chains; Shoenberger & Co., and the Spang Steel Company, of Sharpsburg, all the steel required; Graff, Bennett & Company, the iron; and Jones & Laughlin, the cast iron pedestals, steel pins, and other thousand and one articles of metal used in the great work. The lumber was from the St. Louis Wood Preserving Works. The masonry was put in by Jacob Friday. Kellogg & Maurice, of Athens, Pa., built the two large spans. C. J. Schultz, of the Iron City Bridge Works, was contractor for the approaches. Morris & Marshall erected the portals or towers that are such prominent and beautiful objects on the roadway of the bridge, and make triumphant entrances to the main portion of the structure. Booth & Flinn took care of the brick and block stone paving, as well as the curbs and sidewalks. The entire work was done under the immediate supervision and from the plans of the chief engineer, Mr. Gustavus Lindenthal Mr. J. R. Meredith superintended the construction of the work after the erection of the channel spans.

Many people have wondered how the work was arranged so that there was no stoppage of travel over the old bridge, while the new one was in course of erection. It was only by the exercise of considerable skill and thorough knowledge of engineering possibilities that this was successfully accomplished. The first of the old bridge that was removed was the north anchorage. To hold up the suspension bridge a temporary anchorage had to be constructed at the second pair of towers. This was done by means of cable grapplers and adjustable anchor chains, so as to transfer the strain to the same gradually, while travel on the bridge was going on as usual. The erection of the new bridge having been planned to be effected without interfering with travel on the old one, the superstructure was designed accordingly.

The bridge is owned by a stock company, of which Dr. D. Hostetter is president.

Some Hitherto Undeveloped Properties of Squares.*

BY O. S. WESTCOTT, OF CHICAGO, ILL.

The paper began by ascribing due credit to a method for obtaining squares and square roots, described by Samuel Emerson in 1865. The principles and details of that method were briefly summarized. Mr. Westcott then stated the general principles of his own method, which is very expeditious. He first shows that the tens and units figures of all perfect squares of numbers, from 26 to 49 inclusive, are the same as the tens and units figures of perfect squares of numbers from 24 to 1 inclusive. A table is presented as follows:

$$(24)^2 = 576,\ \text{add } 100,\ = 676 = (26)^2$$
$$(23)^2 = 529,\ \text{add } 200,\ = 729 = (27)^2$$
$$(22)_2 = 484,\ \text{add } 300,\ = 784 = (28)^2$$

and so on, to

$$(1)^2 = 1,\ \text{add } 2400,\ = 2401 = (49)^2$$

To determine the square of any number between 25 and 50 find the corresponding number below 25, and augment its square by the number of hundreds indicated by its remoteness from 25. Or, more conveniently, take the excess above 25 as hundreds, and augment by the square of what the number lacks of 50.

Thus:

$$(43)^2 = (43 - 25) \,.\, 100 + (50 - 43)^2$$
$$= \quad 1800 \quad + \quad 49 = 1849.$$

Conversely: To obtain the square root of 1764. The root is plainly between 25 and 50. The tens and units figures indicate 8. Therefore the square root of 1764 is 50 − 8 = 42.

It is further observable that the tens and units figures of perfect squares of numbers from 51 to 99 inclusive are the same as the tens and units figures of the squares of numbers from 49 to 1 inclusive. Since 4× any number of hundreds + 25, 50, or 75 gives an exact number of hundreds, it follows that the tens and units figures of the squares of numbers less than 25 represent all the possible combinations of figures in those orders of units for *all* square numbers. The terminations of all perfect square numbers are 22 in all: viz., 00, 01, 04, 09, 16, 21, 24, 25, 29, 36, 41, 44, 49, 56, 61, 64, 69, 76, 81, 84, 89, 96.

The following rule is then deduced: To square any number from 50 to 100, take twice the excess above 50 as hundreds, and augment by the square of what the number lacks of 100.

Thus:

$$(89)^2 = 200\,(89 - 50) + (100 - 89)^2$$
$$= \quad 7800 \quad + \quad 121 \quad = 7921.$$

Conversely, $\sqrt{3249}$: The root is plainly between 50 and 60; the tens and units figures indicate 7; therefore $\sqrt{3249} = 50 + 7 = 57$.

For greater convenience it is noted that in such a case as $\sqrt{7921}$ the root is 50 + 39 or 100 − 11, and it is easier to use the latter form. That is, if the root is in the fourth quarter of the hundred, subtract the number indicated by the tens and units from 100, and the difference is the root. Thus $\sqrt{8281} = 100 - 9 = 91$.

To square any number from 100 to 200, take four times the excess above 100 as hundreds and augment by the square of what the number lacks of 200.

To square any number from 125 to 250, take one-half the excess above 125 as thousands and augment by what the number lacks of 250.

By a series of steps of this character the author gives methods for squaring higher numbers and conversely for obtaining their square roots. A choice of methods is also indicated. The facility which was obtained by such means was deftly illustrated on the blackboard by the author, who in a few seconds performed such exploits as raising 5 to the 16th power, and then showed in detail the processes which he had mentally executed. The paper sets forth the reason for each rule, deducing it from the usual binomial theorem, with almost obvious simplicity

The demonstrations were received by the section with hearty applause. In response to an inquiry, Mr. Westcott stated that he had been very successful in teaching this method in classes, about a tenth of his pupils becoming rapid experts in the methods of solution, which were especially useful in handling quadratic equations, and determining at a glance whether a given number is or is not a perfect square.

*Read at the recent meeting of the American Association.

Metallic Cars.

Since the close of the Chicago Exposition certain of our contemporaries have been blaming master car builders for their conservatism or lack of enterprise in not having exhibited for public inspection cars made of iron or steel. The Master Car Builders' Association also comes in for a share of reprehension in not urging forward with energy and zeal the change from wood to metal. The claim is advanced that iron or steel will be used in car construction at no distant day, even from the humble coal car to the luxurious drawing room coach. When the interests or prejudices of people lead them to desire a change in any practice or principle, they do not generally search long before finding plausible reasons for demanding what will satisfy their wishes. The iron and steel advocates are at this time solicitous for the safety of passengers, and they cannot perceive any means whereby travel can be rendered safe except by the employment of steel cars.

There are two sides to this question. Lumber dealers are probably interested in retaining the present practice, and it may be that those who take the lead in pressing upon railroad companies the desirability of abandoning wood as a building material may be biased in favor of steel or iron by self-interest. But if there is any class concerned in this matter which ought to be neutral, it is the master car builders employed by the various railroad companies. Their interest is in the best, the safest, and consequently the cheapest material for cars, irrespective of whence it may come and of what it may be composed. Nothing that has yet been accomplished by iron or steel in the way of car building indicates any superiority over wood or even paper for general utility; and we certainly think the Car Builders' Association acted wisely in refraining from pledging their influence in favor of a change which is yet experimental. There will be nothing lost by waiting till investigation and experiment prove what is really most suitable as a substitute for wood when that material becomes so scarce that it can no longer be used economically in car construction.

Only in one respect can the friends of steel make a decided point for that material over wood, and that is its immunity from taking fire in case of accident. We believe this danger from fire has been exaggerated, for where the floors of a car are filled with a non-combustible substance and safety stoves and lamps are used the chances of a car taking fire are very remote. Metallic cars would not be absolutely free from this danger, as the lining would necessarily be of wood. As a car building material, iron or steel has certain objectionable features which must not be overlooked. In summer metallic cars would have a tendency to be intolerably hot, for no amount of non-conducting material could prevent the heat of the sheets from being conveyed inside the car. In winter, on the other hand, the temperature of the metal would always be lower than the air inside the car, and continual "sweating" would ensue with all the discomforts of dampness and water-saturated lining. This condition of affairs would be calculated to reduce the life of a steel car considerably below the period usually calculated on. There is another objection to metallic cars which will occur to any one who has traveled on an empty tender. That is, the noise produced by the vibration of the iron sheets. Means of deadening this discomforting sound could probably be devised; but years of patient labor and experiment to overcome this and other objectionable attributes are required before the metallic car can be considered ready to fulfill its promised mission of superseding the wooden car.

We do not believe that there will be any sudden revolution in car building. As lumber becomes scarcer and more expensive, metal, and perhaps paper, may be worked in gradually, the tools and building appliances being changed by degrees to meet the new conditions. Iron and steel have already worked into favor for trucks, but the adoption of metal has been a slow process, every step being accomplished after experiments made to ascertain the best methods of using it. Iron or steel sills may be the next step in progress, and other parts will follow on the metallic base when that becomes the cheapest medium; but we do not anticipate seeing the body of passenger coaches made of a material other than wood, iron or steel.

—*National Car Builder.*

Medicated Gelatine in Skin Diseases.

Prof. Pick, of Prague, has recently advocated a new method of applying remedies to diseased skin. He melts in a water bath some pure white gelatine in twice its weight of distilled water, and while keeping up an incessant agitation adds the quantity of medicinal substance—*e. g.*, chrysarobin, iodoform, salicylic or phenic, and pyrogallic acids, and then allows the mass to cool. For use a portion of this mass is melted in a little receptacle placed in boiling water, and is then applied to the diseased skin by a camel hair brush. It presently sets and compresses the skin; but unless smeared over with a little glycerine, in the proper use of which some little experience is needed, the gelatine is apt to crack and fall off. In this way Pick has obtained good results in psoriasis by the application of a gelatine containing 10 to 20 per cent of pyrogallic acid, or 10 per cent of chrysarobin, after a thorough washing of the parts with potash soap in a warm bath. In severe cases he renews the applications every two days. He has also successfully employed gelatine medicated with 5 to 10 per cent of salicylic acid in the squamous stage of chronic eczema, and some erythematous conditions, and in pruritus. The gelatine is easily removable by washing.

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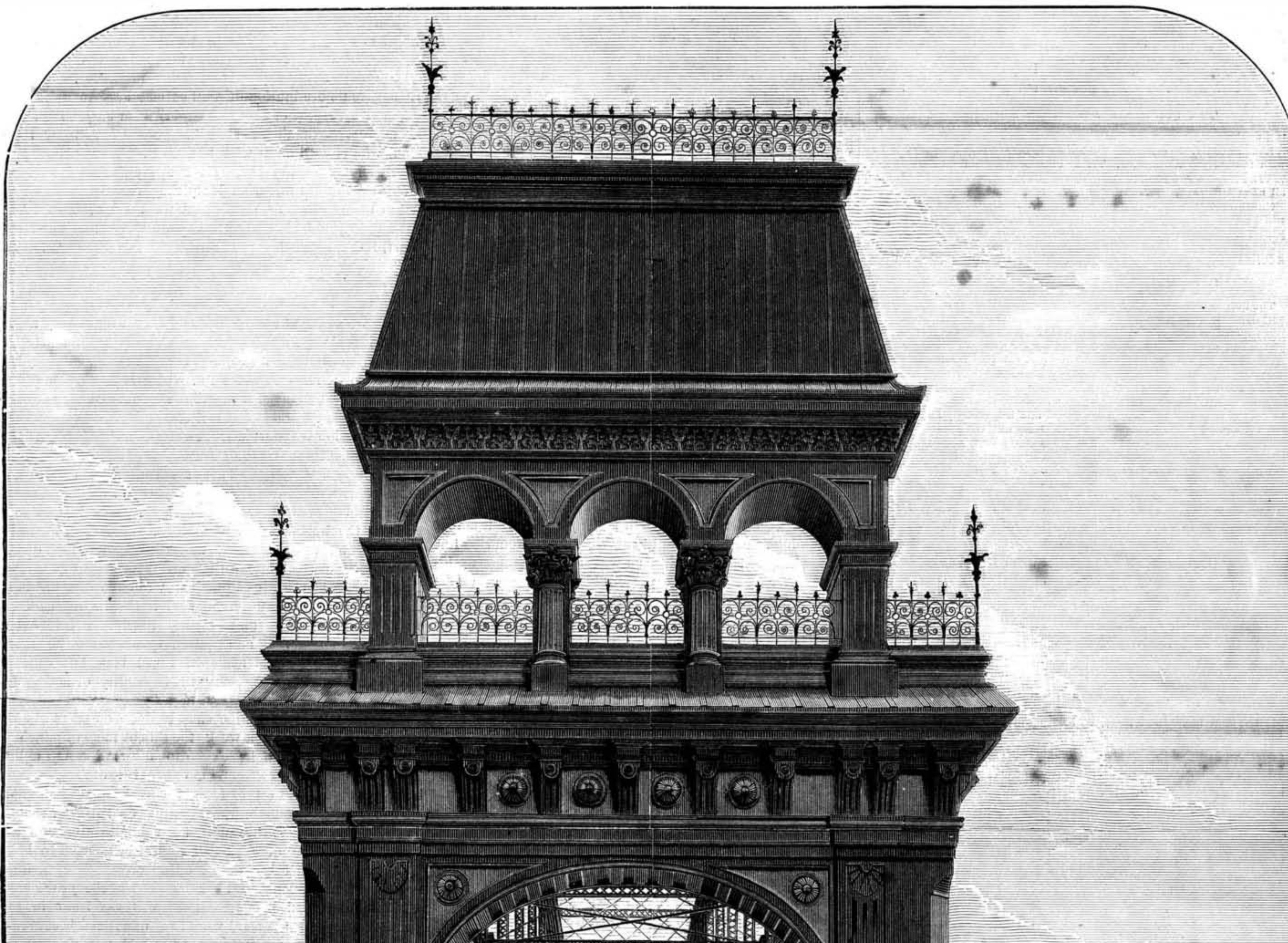

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