

The Arches of the Seventh Street Improvement, St. Paul, Minn.

The just completed Seventh Street Improvement, in St. Paul, Minn., is notable as the heaviest piece of public work ever attempted in that city. It consists of an iron bridge 300 feet in length over the Northern Pacific R. R. and the St. Paul, Minneapolis and Manitoba R. R. at Trout Brook Valley; the two oblique or skew arches, illustrated, over the St. Paul & Duluth R. R.; the Phalen Creek Culvert, 320 feet in length; the embankment across

ches to 4 feet 11 inches, most of them being of the latter size. The total number of cut stones is 1764.

Work upon these arches was commenced in September, 1883, by M. O'Brien, contractor, of St. Paul, who completed the abutments and center pier to the springing line in May, 1884. The work was then continued by McArthur Bros., of Chicago, together with other work on the improvement. The centers were erected and the arch-stones laid by October 15, 1884, and the masonry entirely completed

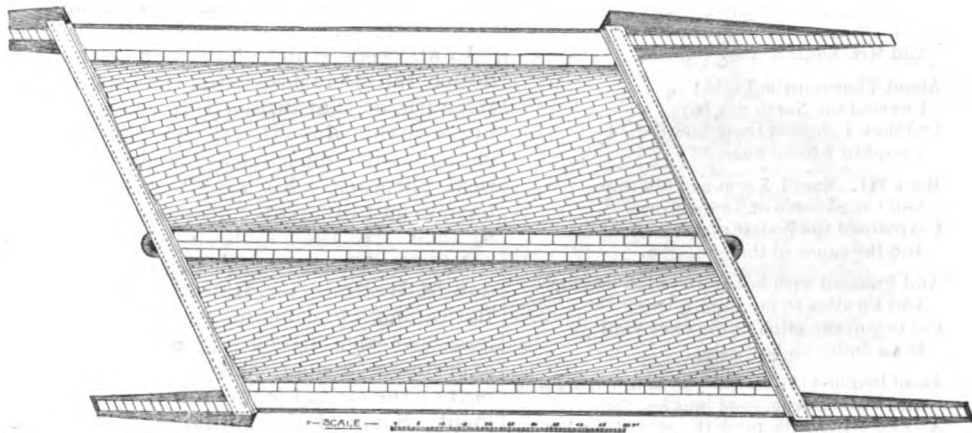
grouted in. On the removal of the centers, the following spring, the voussoirs were found to have fitted remarkably well. The joints were $\frac{1}{4}$ inch, which proved to be the correct size for that kind of work. Utica cement was used, mixed one to one with sand.

John Swinton's Cure for "Hard Times."

"But it appears labor is not needed on farm, in workshop or in factory, because machinery has taken the place of it, and there is *too much*, alas! produced already. Is it not, then, clear to every thoughtful observer that if idle men have any right to life or to a foothold on the earth, their labor must be accepted in other ways than in producing in mill and mine, in field and forest, these primary vital necessities of food, fuel, raiment and shelter?

How? Why, in vast works of public utility and adornment;—in establishing technical schools where young men may receive thorough, practical instruction in the mechanical arts and trades,—quite as important and necessary, one would suppose, as the supporting of military and naval academies where they are taught the arts or warfare and destruction;—in building great national highways and canals;—in bridging and tunneling the rivers;—in tunneling, ay, and removing mountains;—in improving channels and harbors and clearing away obstructions and dangers to navigation; in reclaiming the swamps and waste places of the earth and making the "desert blossom as the rose;"—in having more macadamized roads; —in having cleaner streets, better paved, better sprinkled, better lighted, better policed;—in having more and better docks, more and better sewers and drains, more and better public baths, more and better aqueducts, reservoirs and drinking fountains of clean, cool, wholesome water;—in having more public parks, well-kept breathing spots of beauty and delight;—in having more public schools, libraries and hospitals; in planting trees, vines and flowers by the wayside; in making two blades of grass grow where one grew before;—in short, in doing ten thousand things which might be done if men and women would but think so ("ay, there's the rub"),—to help forward the millennium and make this old earth a paradise.

How business would boom! No grumbling about hard times then, whatever else we might find to grumble at."—*John Swinton's Paper.*



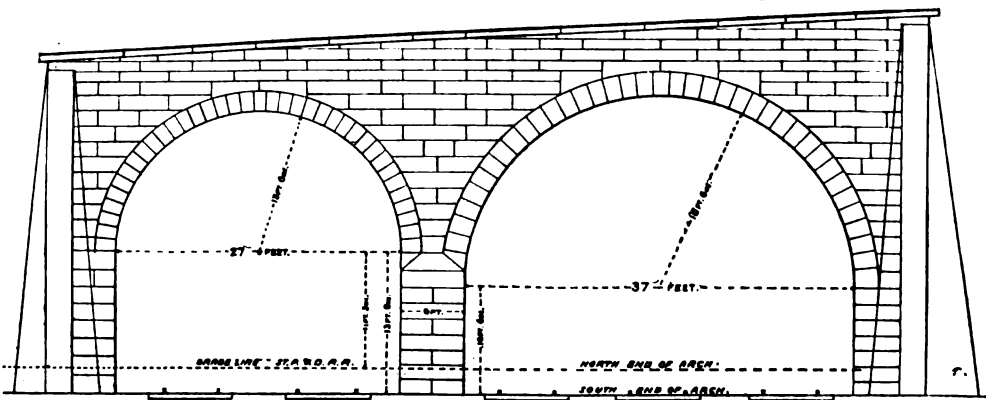
PLAN: SEVENTH ST. OBLIQUE ARCHES, ST. PAUL, MINN.

Phalen Valley, 640 feet long and 80 feet high, built to the full width of the street—66 feet—and containing 196,000 cubic yards of earth, and the grading of Seventh street, with the cross streets, making a total of 235,000 cubic yards of excavation.

In the iron bridge, 220 feet were built by the Northern Pacific R. R. Co., the remainder of the work was done by the city within the last two years. The embankment was made with material brought in dump-cars from a distance of one-half to three-quarters of a mile

in November, and the Phalen creek embankment at once carried over so that traffic could cross by the middle of December. In constructing the centers over 100,000 feet B. M. of timber were consumed.

Both arches were built without interrupting the continuous railroad traffic beneath them. The centers remained in place all the last winter and were removed in May, 1885. The abutments, center pier and wing-walls were built of St. Paul limestone, and the remainder of the work of magnesian limestone from



END-VIEW: SEVENTH ST. OBLIQUE ARCHES.

down a descending grade of 5 feet per 100 feet; it was excavated by an Osgood & McNaughton steam excavator of the largest size.

The most interesting part of this improvement, to engineers, lies in the double oblique arches over the St. Paul and Duluth R. R., which were designed by and erected under the supervision of Mr. W. A. Truesdell, the engineer of the Seventh Street Improvement.

At this point, Seventh street, which is 66 feet wide, crosses the right-of-way of the railroad, 70 feet in width, at an angle of 63° 28'. The tracks are 47 feet below the street grade. The smaller arch is 27 feet direct span, and the larger 37 feet, and each one is 124½ feet in length with wing-walls at the ends, from 47 to 58 feet long. Both arches are "full center," and are built on the helicoidal method with spiral courses. The smaller arch contains 62 impost stones and 754 arch stones. The latter are of uniform size and dimensions, except the ring stones, and are 5 feet 8½ inches long. The large arch has 48 impost stones and 900 voussoirs, varying in length from 39 feet in-

the quarry of W. B. Craig & Co., of Mankato. The 1764 voussoirs and impost stone were quarried, cut and laid in 90 days.

No especial difficulty was experienced in either cutting or laying the arch stones. There was a little trouble at first in impressing upon the stone-cutters the necessity of accurate work with the patterns, but after that was done the work went smoothly. A cutter could dress one stone per day, and though this was the first arch-work of this nature attempted in the Western country, the final cost was little more than that of two similar right-arches. The total cost of the Seventh Street Improvement, exclusive of the part of the iron bridge built by the N. P. R. R., was \$202,000.

The arch stones were laid on the centers without difficulty—in horizontal rows—on both arches simultaneously. The coursing joints were marked on the lagging, which were guides for the masons in bedding the voussoirs. When the last row was reached at the crown of the arch, the stones fitted to their place and were

A USEFUL INSTRUMENT.—An ingenious instrument for ascertaining the distances of accessible and inaccessible points from the observer and from each other has been invented by Dr. Luigi Cerebotani, a Professor of the University of Verona. This apparatus consists mainly of a pair of telescopes mounted on a stand and fixed on a tripod for use. The telescopes are both brought to bear on the object, and a reading is then taken from a graduated scale on the instrument, which, compared with a set of printed tables gives the distance. By this means the inventor obviates the necessity for the base line, which has hitherto had to be laid down in these operations, and he dispenses with all trigonometrical calculations. Distance can be measured between the far-off objects, and by means of a sheet of paper fixed on a drawing board a rough plan of the country under measurement can be sketched. In the same way the distances of ships at sea or of moving objects on land can be determined. The apparatus appears to be well adapted for land surveying, and particularly for military purposes. In fact, it is stated to have been already adopted in the German army in the latter connection, and it is about to be tried by the authorities of our War Department. A practical trial has been made with this instrument on the Thames Embankment, when its varied usefulness was demonstrated,