SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. L.—No. 11. [NEW SERIES.] NEW YORK, MARCH 15, 1884. [$3.20 per Annum. [POSTAGE PREPAID.]

THE VIADUCT AT THE FALLS OF ST. ANTHONY.

BY H. C. HOVEY.

When Father Hennepin, in July, 1680, came in sight of the cataract whose curling waters he named after his patron saint, he little realized the transformations that were to be made in the interests of commerce and manufacture. Natural changes have also taken place, by the recession of the falls, so that his glowing description would not now be recognized in its main particulars, although probably correct at the time. The hard Trenton limestone which underlies the district around St. Paul and Minneapolis forms the brink of the falls, resting, however, on a bed of white, friable, sandstone.

The washing away of this crumbling substance has of late years been so rapid as to threaten the degeneration of the cataract into a foaming rapid. The height has thus been reduced from the fifty or sixty feet given to it by Hennepin to thirty feet, as measured by Jonathan Carver a century later, and finally to fifteen feet in modern times. At an expense of nearly a million dollars, the Government came to the help of the millers, and in 1876 constructed an immense dike of concrete, to support the natural limestone ledge. This dike is four feet thick, thirty feet high, and 1,875 feet long. Canals have been cut to supply the great flouring mills that stand, like so many castles, on the bluffs overhanging the Mississippi River. By this means some of them now command a fall of fifty feet, and by better economy of the water privilege it is thought they might get a fall of seventy feet.

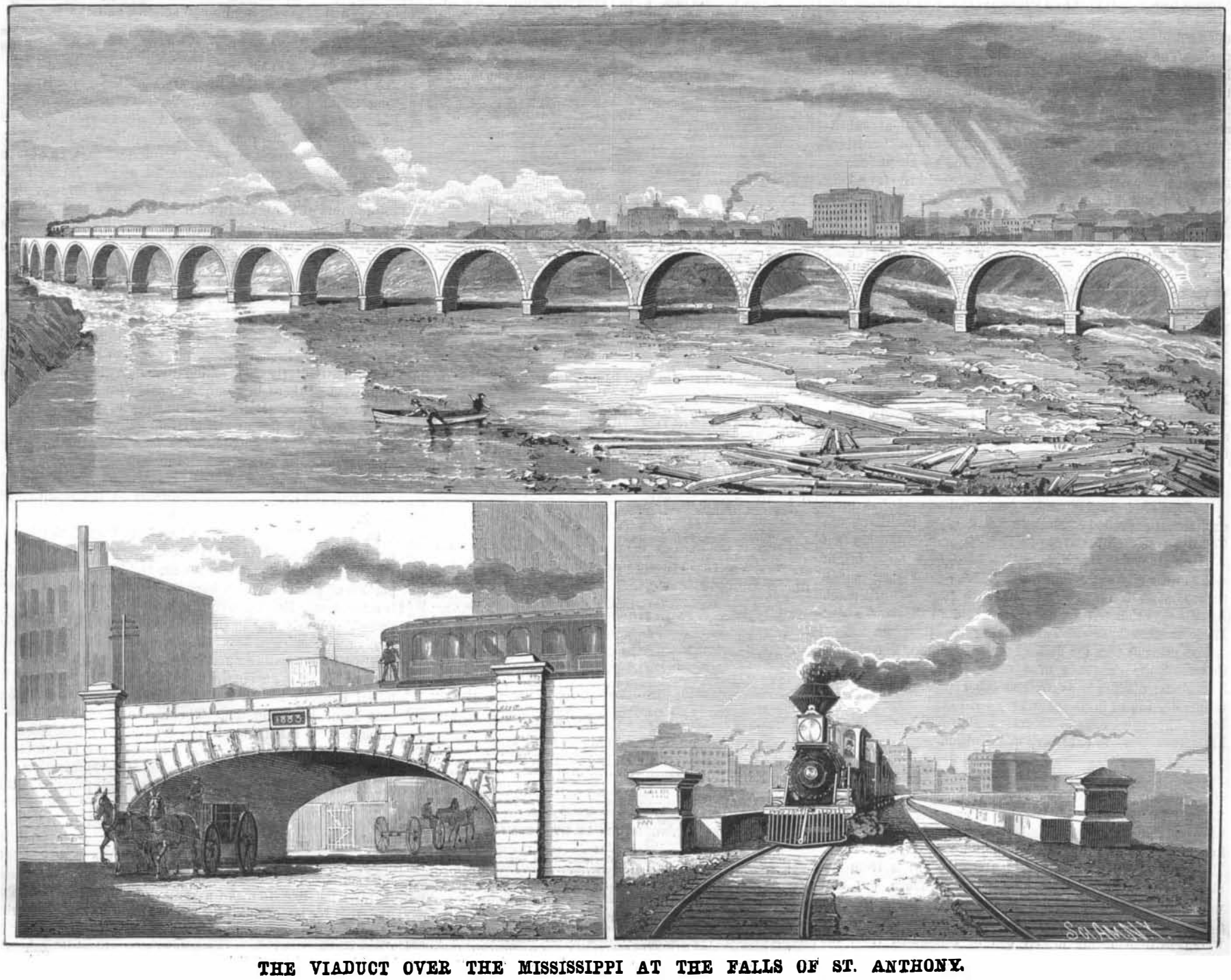
And now, spanning the whole assemblage of cascades, dikes, islands, canals, mills, and other objects of historical, scientific, and commercial interest, stretches, from bluff to bluff, the noble viaduct which it is my intention to describe.

The urgent necessity for some such structure became evident more than three years ago, or about the time when Minnesota entered on its new era of extraordinary prosperity. Nineteen railroads now send out from Minneapolis over one hundred passenger trains daily; and more than 230,000 car loads of freight were shipped from here last year. The daily grist of the flour mills is enough to fill a train a mile long. Such an immense traffic demands corresponding facilities. Hence, although two of the railroads had already built bridges of their own, one below Meeker Island, and the other at Nicollet Island, the associated roads decided to build this viaduct, and also a grand union depot, to which all the roads should, by the charter of the Union Company, have equal rights and privileges. The estimated expense of this great work was $3,000,000, which large sum was guaranteed by the Manitoba Railroad, under whose auspices it was begun and carried on.

Several plans were suggested, but the one adopted was that offered by Col. Charles C. Smith, chief engineer of the Manitoba Railroad, who also advised that the most durable materials obtainable should be used. Accordingly the piers, whose foundations rest on the ledges forming the river bed, are built of the gray St. Cloud granite, which is extremely hard and enduring. The material used above the springing line, which is four feet above the high water mark, is the magnesian limestone, known as Kasota stone, and that hardens by exposure to the atmosphere. There are 30,554 cubic yards of solid masonry and 18,000 cubic yards of stone filling, chiefly the common blue limestone from the local quarries in the vicinity.

The viaduct crosses the river below the Falls, partly in order that the piers might have a more solid foundation than could be readily secured above; and also—a fact to be appreciated by the traveling public—in order to enable tourists to enjoy the remarkably fine view, which is much better from below than from above. The total height of the structure is 82 feet, and the height above high water is 65 feet. The top is 38 feet wide, giving room for a double, stone ballasted track, which is guarded by a strong stone coping. About 800 feet of the viaduct are built on a curve of six degrees, of 966 feet radius, at its west end; the object of this curved diagonal being to exempt it as much as possible from danger by reason of the masses of ice that tumble over the Falls during the spring floods. Besides the iron bridge near the depot, there are 23 stone arches, resting on granite piers rising from the bed of the river. Four of these spans measure 100 feet each, sixteen measure 80 feet each, and three but 40 feet each; and the total length of the viaduct is 2,100 feet, making it one of the longest structures of the kind in the world. The cost of the stone portion is $650,000, to which may be added $50,000 for the iron terminal bridge, making a total of $700,000. This does not include the approaches nor the right of way, which must add considerably to the expense, as the western terminus is among the mills, as represented in one of the accompanying cuts. The eastern approach is through more open ground, crossing the campus of the University of Minnesota, and following the bluff line along the river.

Work was begun on the viaduct in February, 1881, and it was completed November 22, 1883, without any special demonstration, beyond the crossing of a single train with the officials of the railroad and a few invited guests. After having crossed, these gentlemen then walked back to the center of the bridge, while the engine was driven past them at a speed of twenty miles an hour, as a partial test of the firmness of the structure. The ends of the viadact were then fenced up, and no further tests will be made nor any crossings allowed until next summer, when the union depot hav-



THE VIADUCT OVER THE MISSISSIPPI AT THE FALLS OF ST. ANTHONY.

ing been completed, both will be thrown open to the general traffic as agreed. It should be added that the union depot will stand on the western bank adjacent to the elegant suspension bridge now joining together the two halves of Minneapolis, and of which its citizens are so justly proud. It will be arranged so that most of the tracks will run under the streets, instead of crossing at grade, with the exception of those that may still run to the several depots now in use. When these improvements shall have been completed, in the near future, it is doubtful if any other city can boast of finer approaches than these, or that will give strangers, on their arrival, a more favorable impression as to the attractions and commercial importance of the locality.

Simple Home Remedies.

The following remedies for many simple ailments we find recommended in *Hall's Journal of Health*. And while the remedies may not be new to many of our readers, they will be found useful to all. We now publish them that they may be at hand for ready reference.

Half a teaspoonful of common table salt dissolved in a little cold water and drank will instantly relieve "heart burn" or dyspepsia. If taken every morning before breakfast, increasing the quantity gradually to a teaspoonful of salt and a tumbler of water, it will in a few days cure any ordinary case of dyspepsia, if at the same time due attention is paid to the diet. There is no better remedy than the above for constipation. As a gargle for sore throat it is equal to chlorate of potash and is entirely safe. It may be used as often as desired, and if a little is swallowed each time, it will have a beneficial effect on the throat by cleansing it and allaying the irritation. In doses of one to four teaspoonfuls in half a pint to a pint of tepid water it acts promptly as an emetic, and, in cases of poisoning, is always on hand. It is an excellent remedy for bites and stings of insects. It is a valuable astringent in hemorrhages, particularly for bleeding after the extracting of teeth. It has both cleansing and healing properties, and is therefore a most excellent application for superficial ulcerations. Mustard is another valuable remedy. No family should be without it. Two or three teaspoonfuls of ground mustard stirred into half a pint of water acts as an emetic very promptly, and is milder and easier to take than salt and water. Equal parts of ground mustard and flour or meal made into a paste with warm water and spread on a thin piece of muslin, with another piece of muslin laid over it, forms the indispensable "mustard plaster." It is almost a specific for colic when applied for a few minutes over the "pit of the stomach." For all internal pains and congestions there is no remedy of such general utility. It acts as a counter-irritant by drawing the blood to the surface; hence in severe cases of croup a small mustard plaster should be applied to the back of the child's neck. The same treatment will relieve almost any case of headache. A mustard plaster should be moved about over the spot to be acted upon, for if left in one place it is liable to blister. A mustard plaster acts as well when at considerable distance from the affected part. An excellent substitute for mustard plasters is what is known as "mustard leaves." They come a dozen in a box, and are about four by five inches. They are perfectly dry, and will keep for a long time. For use it is only necessary to dip one in a dish of water for a minute and then apply it. Common baking soda is the best of all remedies in cases of scalds and burns. It may be used on the surface of the burned place either dry or wet. When applied promptly, the sense of relief is magical. It seems to withdraw the heat and with it the pain, and the healing process soon commences. It is the best application for eruptions caused by poisonous ivy and other poisonous plants, as also for bites and stings of insects. Owing to colds, over-fatigue, anxiety, and various other causes, the urine is often scanty, highly colored, and more or less loaded with phosphates which settle to the bottom of the vessel on cooling. As much soda as can be dipped up with a ten cent piece, dissolved in half a glass of cold water and drank every three hours, will soon remedy the trouble.

A Diamond Mine in Wisconsin.

A dispatch from Milwaukee lately announced that great excitement prevailed at Eagle, a small place in Waukesha County, over the discovery of a rich diamond "find" in that village. It seems that a lady had brought a large bright stone to the city and sold it to a jeweler for $1, and which turned out to be a rough diamond worth $800. The dispatch further says that parties have purchased all the land about Eagle at large figures and are making investigations.

Accepting as true the finding of the diamond, to conclude therefrom the existence of a diamond field is decidedly hazardous; diamonds as well as other precious stones are frequently found in places where a diligent search fails to bring other specimens to light, and we would advise intending "investors" to exercise some caution.

Test for Glue.

The following simple and easy test for glue is given in the *Tischler Zeitung:* A weighed piece of glue (say one-third of an ounce) is suspended in water for twenty-four hours, the temperature of which is not above 50° Fahr. The coloring material sinks, and the glue swells from the absorption of water. The glue is then taken out and weighed; the greater the increase in weight the better the glue. If it then be dried perfectly and weighed again, the weight of the coloring matter can be calculated from the difference between this and the original weight.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 261 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included..... $3 20
One copy, six months postage included 1 60

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The Scientific American Supplement

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NEW YORK, SATURDAY, MARCH 15, 1884.

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AMERICA A HUGE "JELLY FISH."

Rear-Admiral Rogers, in a letter read in the U. S. Senate February 28, makes the above comparison. He says we have not a single breech-loading gun in any of our ships nor upon any of our forts, nor can we make one of more than six inches caliber in the country. Therefore, with our 7,000 miles of seacoast, we make a very prominent mark, but would be powerless to strike back if assailed. The letter was brought out by the proposition to build seven new steel cruisers, which has passed the Senate. It provides for one cruiser of 4,500 tons; one of 3,000 tons; a dispatch vessel of 1,500 tons; two heavily armed gunboats of 1,500 tons; one gunboat of 750 tons, and one of 900 tons; a steel ram; a cruising torpedo boat, and two harbor torpedo boats.

The cost of these seven cruisers, with the four ordered in 1882, of which the Chicago is the most prominent, and the completion of the double-turreted monitors, will be less than that of two of the first-class iron-clads of England or Italy. While our Government is thus proceeding with such close economy, England, France, and Germany are steadily enlarging their gunmaking and steel shipbuilding facilities, and Krupp is now constructing a gigantic steam hammer, to cost $2,500,000.

If it were entirely clear in what direction the nation could with the most wisdom proceed for the efficient strengthening of the navy, there can be little doubt but that the public sentiment would not only sanction a much larger expenditure than the completion of these new cruisers calls for, but would earnestly impose upon Congress the duty of prompt action. As it is, however, the cruisers now under way have been so severely criticised as to awaken a feeling of public distrust concerning the advisability of proceeding further in the same way. The vessels now building were said to be only experimental, but the question arises whether the new ones in contemplation are also of the same character, and, if so, whether we need have so many experiments under way at the same time.

VALUE OF INVENTIONS TO THE WORLD.

While the time-servers and place-seekers, who now constitute the majority in our national Congress, are seeking in every way to destroy the value of patent rights, and to take away the material incentives to invention afforded by the Constitution and by former statutes, it may be well to call the public attention to a pregnant paragraph written by Lord Bacon two hundred and fifty years ago. If it was almost prophetic then, there is no man of intelligence now living who can fail to see how wonderfully the truth of its every word has been realized:

"The introduction of great inventions appears to hold by far the first place among human actions, and it was considered so in former ages; for to the authors of inventions they awarded divine honors, but only heroic honors to those who did good service in the State (such as the founders of cities and empires, legislators, deliverers of their country from long endured misfortunes, quellers of tyrannies, and the like). And certainly, if any one rightly compare the two, he will find that this judgment of antiquity was just, for the benefits of inventions may extend to the whole race of man, but civil benefits only to particular places; the latter, moreover, last not beyond a few ages, the former forever. The reformation of the State in civil matters is seldom brought about without violence and confusion, while inventions carry blessings with them, and confer benefits without causing harm or sorrow to any."

PROGRESS IN EXACTNESS.

Since the introduction of absolute fixed gauges of exact sizes into the machine shop, in place of the universal calipers, there has been a steady improvement in the quality of work, particularly of machine tools. Accompanying this improvement there has unquestionably been another—that of the workman. Both are evidences of progress in the right direction; the use of straight edges, surface plates, solid hardened steel gauges, rings for external and plugs for internal diameter measuring, end measure pieces, and thread gauges demand the practice of exactness on the part of the workman and tend to insure exactness in the result of his work.

But the machine tools themselves have been faulty in the most vital parts. Probably there are very few lathes in use which have perfect leading screws, and if this is so the proportion of planers which have twin elevating screws alike is much less. Reference to this lack of exactness and to its probable remedy was made in these columns (date of December 8, 1883, page 352), but since then the enterprise—advertised in succeeding numbers—has grown by the demands upon it, so that an enlargement to more than double its initial capacity has to be immediately made, within four months of its beginning. The reason is that the closest mathematical calculation is allied with the employment of the most scientific means and the use of the best tools to produce results. Four establishments, representing the most advanced stages of improved machinist practice in this country, have sent in orders for lathe leading screws and planer elevating screws to such an amount as to require a very great enlargement of facilities.

This statement shows how needful was the want which is thus supplied; our best machinery was faulty. It has been scarcely possible to make a screw of any pitch, coarse or fine, that for twenty-four inches would preserve its integrity of pitch; the variations from the true standard being at times so great as almost to produce a fractional thread.