The Great Canal Reward.

Last year, it will be remembered that, the State of New York offered a reward of one hundred thousand dollars for the invention of any form for the application of motive power to the canal boats by which they could be economically propelled, as cheaply as by horses. The law was published in full in the SCIENTIFIC AMERICAN in May, 1871.

The Canal Commissioners have recently published a report, in which they say that they have received over 700 communications from all parts of the world in reference to power on canals; many models have been sent, some being the productions of women; some are valuable, but many are the results of inexperience, or are visionary. The Commission does not advise any change in the law, of the kind desired by such persons as think its objects cannot be secured as it now stands and is construed by the Attorney General. On the contrary, the Commission is of the opinion that compliance with all the present requisitions of the law should be insisted upon before the money should be awarded. All the time allowed by the law will be given to the competitors; but the Commission will adhere to the determination expressed at its first meeting, that boats in actual service, and not drawings or models, will be considered as competing for the money offered by the State.

The reward still holds good, and any person who desires further information upon the subject may address Henry A. Petrie, Secretary of the Canal Commission, Albany, N. Y.

THE COMBA SCURA BRIDGE---MONT CENIS RAILWAY.

We are indebted to *Engineering* for a view of one of the numerous bridges which convey the Mont Cenis Railway across the ravines and streams that interrupt its course. The Comba Scura bridge spans a singularly picturesque ravine in a spur of the Piedmontese Alps, and it crosses at a hight of 395 feet above the bottom of the valley.

The following are the principal dimensions of the structure:

Clear span between abutments	185 feet 2 inches.
Width	14 " 9 "
Depth of girders	18 " $0\frac{1}{4}$ "

It was constructed to carry and sustain a test load of 4·5 tuns per lineal yard, with a deflection of $\frac{2}{3}\frac{7}{2}$ inch at a calculated strain on the iron of about 4 tuns per square inch. The weight of iron in the bridge is 201 tuns.

The Comba Scura bridge, as well as that of the Serre-de-la-Voûte, situated about $6\frac{1}{2}$ miles further up the valley, was contracted for by Messrs. Kreeft, Howard & Co., of London and Turin, and both were constructed, from designs prepared by the Italian Government engineers, by Messrs. Fleet & Newey, Crown Boiler Works, West Bromwich, London, England.

MINING IN COLORADO.

A correspondent of the New York *Evening Post*, writing from Central City, Colorado, gives the following interesting ticulars:

ORE RAISED FROM THE VEINS.

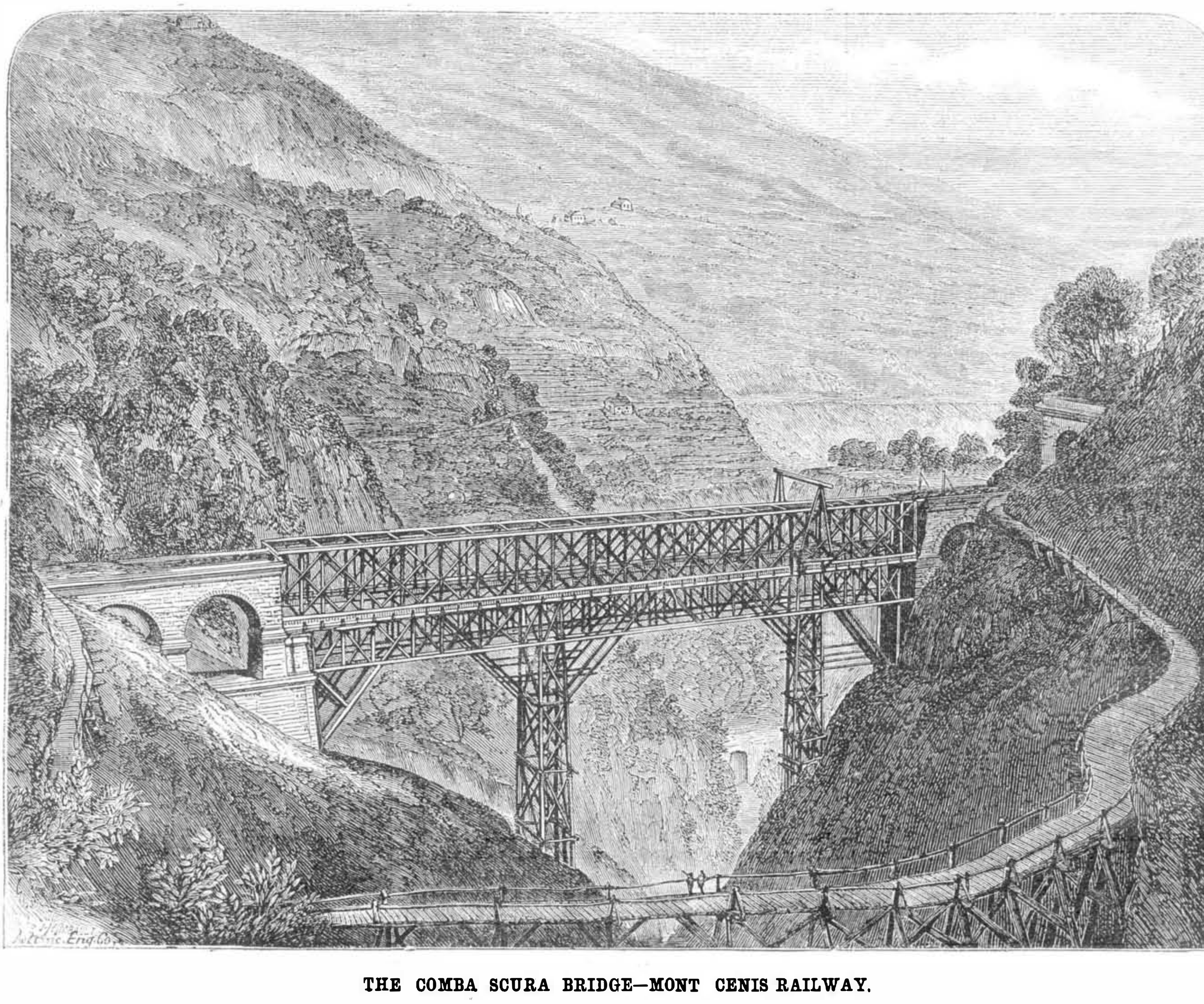
From the veins of Gilpin county alone nearly 600 tuns of ore are raised daily, or a total of 180,000 tuns annually. Nearly 500 lodes have been assayed or mapped in a circle of three miles in diameter; fully a thousand lodes have been recorded, and more or less work performed upon each. From fifteen to twenty miles of reputable lodes are known to exist, upon which there is not less than eight miles of shafting, the deepest shaft going eight hundred feet into the bowels of the earth. There is not less than twenty miles of drifting on these veins, following the ore deposit in the crevices. The assays of the territorial assayer amount to thousands, from samples of those leads. Averaging three hundred of these assays, samples of mill ore alone, taken as they were set down in the official register one year ago, would show this species of ore to be worth nearly $40 per tun. Averaging over two hundred assays of select ore, as they were made during the same time, the result shows a value of $130 per tun for such stuff. Then turning to the tailings, the refuse of ore put through the stamps, we find the average to be over $20 per tun, notwithstanding from ten to twenty per cent of the precious metals have passed away down the stream. Taking samples of this lost material in the streams coursing down to the plains, over $30 to the tun is found to be the average. Notwithstanding this extraordinary waste, the average shipment of bullion from this county trenches on $2,600,000 yearly, a production of $500 per year for each man, woman and child in this county.

MILLING GOLD ORES.

There are 83 stamp mills in this county, 185 engines in place, 4,367 horse power, and 1,597 stamps, of which there are over 800 in use, requiring 1,703 horse power. There are 39 engines used at the shafts of mines for raising ore from the veins and keeping them free of water; 12,000,000 pounds of freight, general merchandise, consumed in the county, and nearly 3,000,000 pounds of flour, all brought there to sustain the mining industry of the region, the product of which is mainly derived from milling the ores regardless of the waste alluded to. These mills are various in size, containing as high as fifty stamps and down to five, mostly driven by steam. The ore, broken into small fragments, is fed into a battery in which the stamps are raised and allowed to fall, crushing the ore fine enough to flow through a screen placed in front. Mercury is fed in this battery, and the pulverized ore, mixed with sufficient water, is then made to flow over wide plates of copper fastened upon wooden platforms, and the copper amalgamated with quicksilver. The gold, or part of it, adheres, forming an amalgam with the mercury, which is afterwards scraped off, squeezed hard, and the lump retorted in a closed retort of iron for the purpose of vaporizing the mercury and getting the gold almost pure. The banks of Central buy these retorts and ship them to the East for minting. Each stamp is calculated to do from one half to three quarters of a tun in twenty-four hours, requiring about one horse power to each stamp head. Most of the ore is reduced in leased mills abandoned by companies, but there are several names famous for good results in custom work. These mill men charge their customers between three and four dollars per tun for doing this work and returning the retort of gold. The tailings are partially caught in the best mills on blankets, and reworked at a profit; the bulk, however, passes outside, a portion stopping to be shovelled into a pile, the balance going on to the stream. The waste is nearly or quite equal to the gross yield in bullion.

SMELTING FOR GOLD.

The most profitable branch of vein mining and reduction was undertaken by Professor Hill in 1867, in connection with some Boston and Providence capitalists. This is a close corporation, managed with rare ability in the executive as well as the metallurgical department. Large profits are made, but kept very jealously from the public eye. As you reach Black Hawk, the sulphurous vapors of these works arrest your attention. From the roadside, you see from twenty to thirty piles of ore, each vieing with the other in sending stifling vapors of sulphur into the atmosphere. These piles are first started on a layer of wood and are run up in a pyramid form some five or six feet, with a diameter at base from sixteen to twenty feet, and then fired, the sulphur affording the only fuel, after the exhaustion of the wood, to keep the fire going from four to six weeks. This ore has passed through the sampling works and been paid for, the amount lying thus in piles at one time amounting to, perhaps, $80,000. After roasting sufficiently to drive off sulphur and oxidize a portion of the iron, these piles are cooled and the ore carried to the smelting furnaces, where, under a heavy heat, more sulphur is driven off, and the silica or *gangue* matter is made to unite with the oxide of iron to form a slag. At the end of the smelting, some eight or ten tuns are thus reduced to one called "matte," containing from $1,500 to $2,000 in the precious metals, and from forty to sixty per cent of copper. This product is then shipped in bags to Swansea, England, for separation into the several metals contained. The establishment contains three smelting furnaces and three



THE COMBA SCURA BRIDGE—MONT CENIS RAILWAY.

calcining furnaces, capable of reducing from twenty to twenty-five tuns of ore per day. The tailings, which are concentrated along the streams, and are also sold to this establishment, of which there are now on hand possibly 1,500 to 2,000 tuns, average from $35 to $40 per tun. These works are, doubtless, the most profitable of the kind known in the world. The field of Colorado has been open to them without competition since their start, and right shrewdly has the monopoly been maintained. As an evidence of success in treating the gold ores of Colorado it is pre-eminent, and in this respect a great step in the progress of mining industry.

New Method for Platinum Black.

I prefer taking platin-chloride of potassium, and were it not that rubidium and cæsium are too expensive, these would be even better, for their atomic weights are higher than that of the potassium, and consequently the particles of platinum are more widely separated. After the platin-chloride is completely reduced, the mass is treated with water to wash out the chlorides of the alkalies thoroughly, and the residue dried at a temperature not exceeding 220° Fahr., when it is ready for use. The operation can be readily conducted in a capsule of porcelain or platinum. The platin-chloride is introduced and covered with a circular piece of mica, a little smaller than the wide diameter of the capsule, with a hole in the center, through which the tube conducting the gas is introduced, The capsule is then heated by any convenient arrangement by which a temperature not exceeding 400° or 500° Fahr. can be maintained with a little management; a small Bunsen burner with a rosette can be used. If the temperature be too high, the platinum black will not be as good as that made at a lower temperature. Washing the platinum black, after the chloride is taken out, with a solution of caustic potash or soda and subsequently washing with distilled water may improve the product.—*American Chemist.*

Butter in Sacks.

The dairymen of Washington Territory, for want of tubs and jars, have adopted a method of putting up and keeping butter which presents some features that are worthy the attention of those having butter packed for family use or for retail trade. The packing is thus described by the *Illustrated Journal of Agriculture* :

"All butter is packed in muslin sacks, made in such form that the package, when complete, is a cylinder three or four inches in diameter and from half a foot to a foot in length. The butter goes from the churn, as soon as worked over, into the cylindrical bags, made of fine bleached muslin. The packages are then put into large casks, containing strong brine with a slight admixture of saltpeter, and, by means of weights, kept always below the surface. The cloth integument always protects the butter from any impurities that chance to come in contact with the package; and being always buried in brine it is protected it from the action of the air; and it has been ascertained by trial, that butter put up in this way will keep sweet longer than in any other way.

"Besides, it is found easier and cheaper for the manufacturer than to pack either in jars or firkins. And for the retailer there is no telling the advantage on the score of safety and convenience. These rolls of butter can lie upon his counter as safe from injury, from dust or other contact, as bars of lead; can be rolled up for his customer in a sheet of paper with as much propriety as a bundle of matches. If the consumer, when he gets home, discovers specks of dust upon the outside of the sack, he can throw it into a pail of pure cold water and take it out clean and white. As he uses the butter from day to day, with a sharp knife he cuts it off from the end of the roll in slices of thickness suited to his want, and peels off the cloth from the end of the slice, leaving it in tidy form to place upon the table.

HISTORY OF GAS LIGHT IN BRIEF.—In 1792, in England, Wm. Murdoch lighted his own dwelling with gas; in 1803, a machine shop, and in 1805, a cotton factory were similarly lighted. He began to lecture upon the subject, but not until 1810 could a company get a charter for its manufacture. In 1813, Westminster bridge was lighted, and in 1815, Guildhall. Still there was great opposition even from scientific men, and there were also great difficulties from want of machinery to make and use the gas. Gun barrels screwed together were used to convey it from place to place. Finally, however, every obstacle was surmounted, and now there is not a city of any size in the civilized world which is not lighted by gas.

COOKING FOOD BELOW 212° F.—From a series of experiments, it appears that food (meat as well as vegetables) boiled at 200° is more nutritious and of better flavor than when boiled at or above 212°. The author illustrates this point by what takes place in mountain localities (every 100 meters rise above the sea level makes a difference of 0·6° less in the boiling point of water); as, for instance, at Potosi (Bolivia), at 4,061 meters above sea level, with an average barometer reading of 454 m.m., the water boils at 187°; at Mexico, 2,277 meters above sea level, 568 m.m. barometer, water boils at 198°; at Briançon (France), 1,321 meters above sea level, 643 m.m. barometer, at 184°; and he further cites the action of the so-called Norwegian cooking apparatus.—*Dr. Jeanel.*

THE great pyramid, which is seven hundred feet square and five hundred high, and weighs 12,760,000,000 tuns, required, according to Herodotus, the labor of 100,000 men for twenty years to build it; but Dr. Lardner affirmed that 480 tuns of coal with an engine and hoisting machine would have raised every stone to its position.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

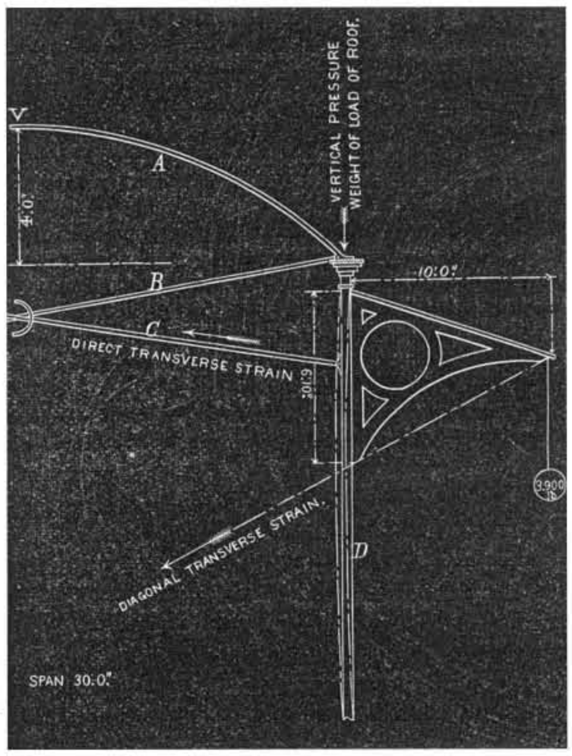
Fall of the Roof of the Depot, Saratoga Springs.

To the Editor of the Scientific American:

My attention has been directed to your issue of February 17th, in which you gave an account of the destruction, in December last, of the new passenger depot at Saratoga Springs.

The roof was arched, of thirty feet span, and made of corrugated iron, with wrought iron tie rods five eighths inch in diameter, and was supported by round columns four inches diameter, fifteen feet distant from centers. On the inside of each column, about five feet distant down from its top, was attached one end of a wrought iron tie rod, supporting the roof; and, on the opposite side, was a bracket, extending out ten feet, whose bottom exerted a diagonal transverse strain in the same direction as the tie rod. These brackets supported a roof, forming a shed over the gangway beyond the arched roof, making, with the thirty feet span of roof, an entire width of fifty feet. I was induced, after reading the article, to go into a calculation of the strains on the weakest part of this mantrap, namely, the columns and tie rods.

From the dimensions given, I take the diagram to be drawn on a scale of one sixteenth of an inch to the foot, and have made my calculations accordingly, The weight of snow and ice upon the roof, in accordance with the leading authorities, is considered at 40 lbs. per superficial foot as a maximum load in our climate. On the day of the falling of this structure, your article says, there had been a light fall of snow, and the ground was frozen. I question if the weight on the roof, at the time, exceeded 20 lbs. per foot, as snow is ordinarily light. What causes it to become heavy is a subsequent fall of rain, then freezing, and snow again. Forty pounds per foot is considered a maximum load under the most unfavorable circumstances.



The column was four inches in diameter, and, say, one inch in thickness, and about eighteen feet long, considering the diagram to be made on the scale of one sixteenth inch to the foot. Its proportion of vertical pressure would be the weight coming upon half the roof of thirty feet by fifteen feet distance from center to center of columns. Taking the weight of roof alone, exclusive of any contingent weight, at 12 lbs. per foot, we have 52 lbs. per foot for the weight of roof and load upon it.

15×15 feet=225 feet×52 lbs.=11,700 lbs. Weight of girder between columns, 15 feet, say, at 40 lbs. per square foot, =600 lbs. Total, 12,300 lbs., being a vertical load of 6·15 net tuns on columns.

The strain upon the tie rods, which was exerted transversely on the columns, about five feet down from the top, and tending to both break them across and pull them inward, was as follows: Let S=span in feet=30 feet; V=versed sine, say 4 feet; U=uniform load per foot span=780 lbs.; H=horizontal thrust or strain on tie. Then

$H=\frac{US^2}{8V}=21{,}937$ lbs., about 11 net tuns, which was an entirely uncalled for transverse strain on the column, and what caused the accident.

The weight on each bracket was: 10 feet out by 15 feet long=150 feet×52 lbs.=7,800 lbs.; one half weight on end of bracket=3,900 lbs, exerted at $\frac{10}{7}$=5,570 lbs., or 2¾ net tuns diagonal transverse strain on the column, acting in the same direction as that produced by the tie of the arch just above it.

The following is a summary of the strains on the column: Vertical pressure, weight of roof, 6·15 net tuns; unnecessary transverse strain of tie to break the column across, 11 net tuns; diagonal transverse strain at the bottom of the bracket, in the same direction as that exerted by the tie, 2¾ net tuns.

Taking these spindle columns, whose dimensions are about suitable for a summer house or verandah, at a safe weight of one fifth the breaking weight, when subject to a vertical load and then only when the ends are at planes with their axes, we have the safe weight at $8\frac{3}{10}$ tuns. Nothing less than one fifth the breaking weight will do, as at one fourth the breaking weight it was found, by experiment, that incipient crushing took place. This safe weight allows nothing for a lateral blow caused by merchandise falling, in transmission, against the column. For a column where transverse strain is to be exerted, calculation should be made in accordance with the formula for strength of beams, as well as that for the columns.

In regard to the tie rods, they were not nearly up to the standard required for safety; a five eighths inch round rod is equal to about three tenths square inch of cross section. The working strain should not exceed the limit of its elasticity, which is about eight tuns per square inch. The Board of Trade of Great Britain permits, as a maximum working strain, but five gross tuns per square inch of cross section. In this case, the tie rods should have been at least one and a half inches in diameter to resist the thrust of the arch; and the columns seven inches in diameter, and one inch thick, providing the tie rod was not attached to it.

I would ask why it is that more stringent laws should not be enacted, whereby some restraint can be placed upon the construction of such insecure structures, equally so with the laws governing the construction and use of steam boilers? Here is a structure, every part of which, with the exception of the corrugated roofing, is largely deficient, imperiling the lives of hundreds of people under the trap daily.

PETER H. JACKSON,

Inspector of Iron Construction, Department of Buildings.

New York city, March 1, 1872.

Fall of the Roof of the Depot, Saratoga Springs.

To the Editor of the Scientific American:

In reading your number of February 17, in regard to the fall of the Saratoga depot, built of iron with corrugated roof, I was reminded of a paragraph in Achille Cazin's work on "Heat."

From the diagram in your paper, and the description of the case, it occurs to me that the columns, being vertical, were drawn inward by the contraction of the iron roof, aided by the iron cross bars. It seems that the weather was very cold, and there was snow on the roof. Now suppose that when the roof and iron bars were fitted to the vertical columns, the weather was warm, and the iron expanded to its greatest extent; the contraction by change of temperature to intense cold would be, in a distance of one hundred yards, 2½ inches. If the roof and rods of the depot were thus contracted, the vertical columns, having nothing to counteract this inward pressure and having the weight of an iron roof with snow upon them, canted, say two inches from the perpendicular. It occurs to me that these facts may account for the catastrophe at Saratoga.

"The laws of the dilatation of metals," says M. Achille Cazin, "deserve the more careful study seeing that iron especially is now so generally used for building purposes. A serious question might be raised, whether its universal employment is not in some degree censurable, and whether, in fact, our houses and public buildings are not exposed to accidents owing to simple change of temperature—so of iron bridges, so of metal roofs, gutters, etc. A chain of one hundred yards will vary 2½ inches in the course of the year," etc. (Page 145.)

Again, on page 143, Cazin says:

"A very curious application of the force of contraction of solids has been made by the architect Molard, on the building of the *Conservatoire des Arts et Métiers*, in Paris. The walls of a vaulted gallery had been pushed outwards by the weight of the superincumbent masonry, and it was feared the whole would fall. Molard arranged iron bars in a parallel direction, passing through the walls and carrying at both ends a screw thread fitted with screws. He heated the bars throughout their whole length, and having immediately screwed them up tight, allowed them to cool. The contraction of the iron, which proceeded slowly as it cooled, drew the walls nearer together without endangering them; and this was repeated at several trials, until the walls were re-established in a vertical position."

Suppose they had been so at first, would they not have caved in? R. B. M.

Utica, N. Y.

Tubal Cain.

To the Editor of the Scientific American:

In your issue No. 5, current volume, is a very interesting article, "The Antiquity of the Iron Manufacture." I venture to call your attention to an error therein in history.

Tubal Cain is spoken of as the half brother of Noah. In the fourth chapter of Genesis, it is shown that Tubal Cain was the seventh from Adam, through Cain; while Noah was the tenth from Adam, through Seth.

Pickereltown, Ohio. J. H. GREEN.

[Lamech is mentioned, in the chapter quoted by our correspondent, as the father of Tubal Cain, and he is also stated, in the fifth chapter of the same book, to be the father of Noah. There is no reason for our believing that there were two Lamechs. Probably the confusion arises from an inaccuracy in the translation.—EDS.

The Flexible Marble.

To the Editor of the Scientific American:

In your paper of the 17th, I noticed an article on the flexible stone in possession of Mr. Holliday of this city, and having examined the wonder, allow me to say that it is not itacolumite, which is a sandstone and belongs to the talcose series, but a very pure carbonate of lime, the crystals of which exhibit the usual variety of forms that, according to