HARVESTING ICE ON THE HUDSON.

As we promised in our last, we herewith give engravings of the interior of one of the many great ice houses on the banks of the Hudson river, and of the method employed for raising the ice from the river and storing it in these buildings. As the ice accumulates near the shore, being towed thither by horses as described in our former article, it is hoisted as described below. The ice houses are constructed with every regard for atmospheric changes, and are models of simplicity. The large one shown in our illustration contains six rooms, four of which are 75x50 feet in area, and of an altitude sufficient to allow a packing of ice 30 feet high, and an open space of 20 feet for air. The two remaining rooms are 150x50 feet in dimension, and the entire building has a capacity of 48,000 tuns of ice. The walls of the houses are double, and filled in with sawdust and tan. At the end of the houses nearest the canal, the apparatus for raising the blocks is constructed, extending from the water to the roof. From a distance this looks like two heavy ladders laid upon an inclined plane, each furnished with a pair of hand rails. At the base of each are two pairs of wheels, over which pass endless chains, stretching to the summit. To these, bars are attached, at a respective distance of six feet, which with the chains form the "apron." On a level with each floor of the building, a platform connects the plane and door sill, on which the blocks are deposited in order to fill each story in succession.

As the ice reaches the base of the plane, the blocks are pushed one by one close to the lower pairs of wheels. Then the o ffedges are depressed, and, as the chains force the bars along' they catch the blocks—like the safety cars that grasp the passenger trains on the famous switch-back railroad leading to the summit of Mount Pisgah, at Mauch Chunk, Pa.—and carry them up to the second floor, where the removal of several slats, forming the surface of the plane, allows them to fall on the platform before mentioned. A strong staging is built in the interior of the house, extending to the different rooms, on which the blocks are pushed to the apartment intended for their storage. From this staging an incline extends to the highest layer of ice. As the blocks are deposited on the platform, the first is pushed towards the incline in the nearest apartment, the second in the next, and so on, the entire floor filling up evenly.

In order to prevent the blocks crushing against each other, as they slide from the plane, a number of large headed nails called "scatchers" are driven in it, and greatly diminish their velocity and render their "shooting" of short range.

When the first story is thoroughly packed, the slats are replaced in the plane, and those by the second platform removed, when the rooms are filled like those below.

Five per cent of all ice received into the building becomes useless by cracking and scratching. After a layer of blocks is completed, the workmen shovel from the surface all the loose pieces and the snow, and throw them out of the building through the high, narrow air passages, shown on its sides.

Railway Tunnel under the British Channel.

The successful completion and operation of the Mont Cenis railway tunnel through the Alps has given new impetus to the project of establishing railway communication between England and France, by means of a tunnel under the British Channel. The distance is 22 miles. If a railway tunnel can be carried seven miles through the hard schist and quartz of the Alps, why not for three times seven miles, through the softer chalks under the Channel?

A joint stock company has been formed in London for the purpose of solving the problem. It is called the "Channel Tunnel Company," and the tunnel is to extend from Dover, England, to Calais, France. The capital of the company is $150,000, which is being privately subscribed with the immediate object of making a trial shaft and driving a driftway on the English side about half a mile beyond low water mark, with the view of proving the practicability of tunnelling under the Channel. The completion of this work will furnish data for calculating the cost of continuing the driftway from each shore to a junction in mid-channel, and capital will then be subscribed for that purpose, or for enlarging it to the size of an ordinary railway tunnel, as the engineers may deem most expedient. The engineers are Messrs. John Hawkshaw, Thomé de Gamond, James Brunlees, and William Low. The tunnel will be made through the lower or gray chalk, chiefly, if not entirely; and by the adoption of machinery, of which the promoters of this company have recently made practical trials, it is expected the passage can be opened from shore to shore within three years from the time of commencing the work, and at a cost very considerably less than any previous estimates.

COST OF TUNNELLING.

The Mont Cenis Tunnel cost $975 per linear yard. The three most costly tunnels made in England have been the Kilsby, the Saltwood, and the Bletchingley, each of which was executed in treacherous strata, giving out large quantities of water. The Kilsby tunnel cost $725 per yard. The Saltwood tunnel cost $590 per yard, and the Bletchingley, $360. The cost of the railway tunnels in France has varied from $150 per yard, being that of Terre Noire, on the Paris, Lyons, and Mediterranean Railway, to $475 per yard, that of Batignolles, near Paris, on the Chemin de Fer de l'Ouest. In Belgium, Braine le Compte tunnel cost $230 per meter, and the tunnels on the Liège and Verviers line $250 per meter. In Switzerland, the very difficult Hauenstein tunnel, between Basle and Berne, cost $400 a yard. In America, the Hoosac tunnel in Massachusetts, through mica slate mixed with quartz, has up to this time cost $900 per yard, and the Moorhouse tunnel, in New Zealand, through lava streams and beds of tufa, intersected by vertical dykes of phonolite, cost $345 per yard. It will be a convenient standard of comparison for these amounts if we remember that $125 per yard would represent very nearly $5,000,000 for the 22 miles. Any estimate for the Channel tunnel must at present be purely conjectural, and an estimate professing to embrace contingencies must be more conjectural than any other; but it is reckoned that the work, if practicable at all, could be completed within five years of time and for $25,000,000.

Caliber Compass.

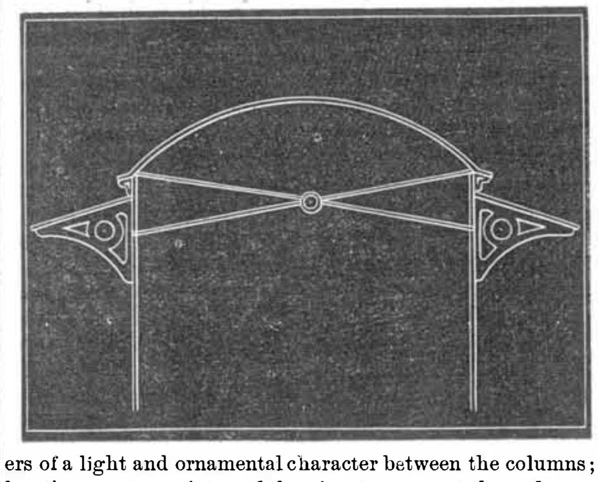
M. J. Koch explains the construction of his caliber compass, illustrated, as follows: The distance of the lower points is 3·1416 times as great as that of the upper points. (This number is the well known π used in the mathematical calculations of circles.) Hence, if the upper points are adjusted to any circular bar or other object, so as to measure its diameter, the distance of the lower points gives the circumference without any further calculation.

FALL OF THE ROOF OF THE RAILROAD DEPOT AT SARATOGA SPRINGS.

We are indebted to our old friend E. J. Huling for the sketch and brief account of the destruction of the new passenger depot, at Saratoga Springs, N. Y., on December 18, 1871.

The iron depot of the Rensselaer and Saratoga railroad, at Saratoga Springs, was a beautiful structure; but, in planning it, the builder seems to have sacrificed everything to make it airy in appearance and beautiful to the eye, neglecting plain rules which the architect of a common shed should have borne in mind. Because the materials used were iron, the builder seemed to think that such ordinary things as internal bracings were unnecessary.

The following is an illustration of one bent of the structure as it stood. The structure was an open arcade, supported by cast iron columns, four inches in diameter, standing fifteen feet apart on the sides, and thirty feet apart across the building. The roof was of corrugated iron, arched, the base of the arch resting on the top of the columns. The columns were tied together crosswise by iron rods five eighths of an inch in diameter, crossed as shown in the engraving. On the sides, or lengthwise of the building, there were cast iron girders of a light and ornamental character between the columns;



but there was no internal bracing to prevent the columns from falling in, unless the five-eighth tie rods were considered as such. Along the side of the building was a shed ten feet wide, supported by light cast iron brackets fastened to the columns; these brackets extended ten feet from the side of the column, and their bearing on the column was about six feet ten inches, or, in some cases, three feet ten inches below where the lower ends of the cross tie rods were fastened into the columns. These brackets are reported to have been tested to sustain over ten tuns; and by their combined weight, with the iron roof which they sustained, they must have exerted a heavy and continuous pressure inwards on the sides of the iron columns. The iron columns were anchored at their foot into square blocks of stone. There was a solid rock, underlying the whole depot and parts surrounding, only a few feet below the surface. The railroad track ran along beside the structure, partially beneath the piazza or shed, supported by the brackets.

On the day of the fall of the structure, the ground was hard frozen, and there had been a light fall of snow. A heavy freight train ran up so that the locomotive stood about against the first column, and stuck there, the snow obstructing it so that the wheels turned without going ahead. After some abortive efforts to go along, the engine driver reversed his machine and backed down. He had scarcely got below the corner of the arcade when the column, near which his machine had stood, crumbled inwards, and the whole affair fell nearly together. Three men who were under the roof escaped, but one lad was caught and crushed, his back being broken so that instant death seemed to have occurred. An inquest was held on the boy killed, and, among others, Mr. Cummings, of Troy, the architect employed by the railroad company to supervise the building, was sworn, and testified that he relied upon the experience of the builders, the American Corrugated Iron Company, Springfield, Mass., and did not make the plans or drawings for the building; that he had feared somewhat that the wind might lift the roof, but had not thought that it would fall inwards. The opinion of other builders was that the leverage of the heavy brackets, bearing upon the outside of the columns, without anything inside to counteract them, had caused the columns to break. The locomotive, running up beside the column and stopping there, had seemed to cause a vibration; and, as the train backed down, the first column, where the vibration commenced, was pushed inwardly, and then the others fell nearly together. The coroner's jury censured the builders for not properly doing their work.

Now that the building has fallen, it is considered somewhat wonderful that it stood as long as it did.

Correspondence.

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

The Davenport Tricks.

To the Editor of the Scientific American:

Allow me, in answer to the note of Mr. W. M. Patton, page 84, in No. 6 of this paper, to state that when the Davenports stick their hands and naked arms through the hole of the center door, they are no more tied down by the knots made by persons selected by the spectators, but have got loose, shown this, and then tied themselves again in their own way, as described by me on page 68. The spectators are very apt to overlook this, and not to notice that, ordinarily, very few tricks are performed as long as the brothers are tied down by others, and less in proportion as this has been done more thoroughly.

In regard to the number of hands shown, I have heard persons in the audience who assured me they saw five or six of them, while I am sure there were only four, having carefully watched the whole proceeding; but when four hands and arms are rapidly moving about through a hole, one may be easily mistaken and count five. If there really were more, it would only prove that they had one or more false hands hidden in their sleeves, but I think this improbable, because, when I tied one up, I carefully examined his arms and sleeves, and am sure there was nothing hidden about the individual. The ringing of the bell is not more wonderful than the taking off of their coats, which I explained on page 68.

Mr. Patton asserts they use no teeth in their execution; how does he know? And why should they not use them if expedient? To satisfy himself, let him tie up two school boys, of ordinary intelligence, opposite one another, so that each, by stooping forward, can reach with his teeth the knots wherewith his fellow is tied down, exactly as is the case with the Davenports, and let him see how expertly they will use their teeth for mutual delivery.

On page 100, Mr. Patton gives, as *his explanation*, that the Davenports "have false hands and wrists, made of gum and so closely resembling nature as to mislead by the feeble light," and says further that these are inflated and have hoops or rings imbedded, "so as to prevent a collapse under the pressure of the cords," that these are tied down, and that they slip their real hands out of them to perform the tricks. This explanation is very ingenious, but rather far fetched and unfortunately not in agreement with the facts. When I tied up one of the Davenports, I am sure I was not deceived in such a way, as the hall was fully lighted with some 300 gas jets; and besides I felt the pulse of both of them, before and after the tying up, in order to find if the individuals got excited by my careful watching, and I doubt if even those whose confidence in M.D.s is least, would suppose that I would be so obtuse as to be cheated by a gum arm when feeling the pulse, or not able to distinguish true skin, flesh and bone from gum, extended with hoops and painted flesh color. The sealing up of the knots at the ends of the rope does not amount to anything, as they can slip their hands out of the loop just as well, whether the knots are sealed or not, when only they have tied themselves in the manner described by me on page 68. They do positively not cut the cords, but unfasten every knot, for I used my own hemp ropes, and got all back in the original condition; while finally, in justice to them, I must state that they have no "capacious pockets," and no ropes either whole or cut in them. I have examined also this point.

If Mr. Patton had seen and watched the performance as closely as I have done, he would be satisfied that his hypothesis is untenable.

New York city. P. H. VANDER WEYDE, M.D.

Motion.

To the Editor of the Scientific American:

What is motion? This question might be confronted with another, namely: What is not motion? The latter would be the most difficult to answer. It is certain that we do not know of any condition of matter wherein there is no motion. Until the universe comes to a standstill, everything must be in motion. The idea of cessation of motion is inconceivable, as much so as is a limit to infinity, or similarly, an end to eternity. Motion is universal, so is matter, and motion and matter are inseparable; one cannot exist without the other. Motion is the primordial condition of matter, and Herbert Spencer, in his "First Principles," invests even nebulous matter—that which is sometimes denominated chaotic, such as was "void and without form"—with the function of motion, or that of possessing the power of contraction and expansion.

Physical or mechanical forces can only be the result of a transfer of motion; and this transfer of motion can only be