pletely within the cage of the greater girders before the bridge fell. In fact the wreck of the train lies almost entirely between the fourth and fifth piers. The train, therefore, passed over the 227-feet girders, and also over two of the 245-feet girders. It seems most probable that, at the time the train entered the high girders, the bridge was struggling with, and well-nigh conquered by the wind, and that the extra resistance offered to the wind by the train turned the scale. As throwing some light on this view, we will give the best approximation of figures available. In November, 1876, Mr. Edgar Gilkes, the contractor, who finished the bridge, laid the following figures before the Cleveland Institution of Engineers:—"The exposed surface of one large pier is about 800 square feet, and of the superstructure—the girder—about 800 more." In this calculation, Mr. Gilkes only takes the windward girder into consideration. This is evidently fallacious, as no one can for a moment maintain that the leeward girder would be completely sheltered by the windward one. It also assumes that the effect of the wind on a lattice girder is only equal to its calculated pressure on the net surface of the ironwork, if concentrated into a plate of equal area; but it is well-known that the wind would exercise a considerable effect by mere drag in passing through the lattice work. We believe we are within the mark in reckoning the pressure on the lee girder and the drag, as equal to one half the net pressure on the windward girder. We should then have 800 + 800 + 400=2,000 square feet. Assuming that the pressure of the wind in the squalls rose to 50 lbs. per square foot, we should have a lateral force of 100,000 lbs., on each of the great girder spans, tending to overthrow the bridge sideways. And when the train came on to the bridge we should have an addition of about 1,600 square feet, which would give an addition of 80,000 lbs. pressure. There would thus be a total pressure of 180,000 lbs. acting sideways against one span of the bridge.* To counteract this pressure, there would be the weight of the train, and that of the girders, with a part of the weight of the piers. This brings us to the point where the weakness appears to have been. The upper portion of the piers, from about five feet above high-water line, consisted of very slender cast-iron cylinders, braced with diagonal ties. These were so slender as to almost merit the name of tubes, and the bolts fastening their flanges together appear to have been only 1⅛ inch in diameter. In the downfall of the bridge, these slender cast-iron piers have been almost completely destroyed. There is no doubt, whatever, that the girders were of ample strength for any possible load; and these piers would also have withstood the downward pressure of such a load; but we believe that their excessive slenderness as compared with their great height, the brittle material, and the absence of any fastenings to counteract lateral swaying of the bridge under great wind pressure, only too easily account for the catastrophe.† It is well-known that tall chimney shafts sway visibly in high winds. In the case of this bridge we have something analogous to a line of tall shafts at intervals of 245 feet, with girders 27 feet deep reaching from top to top, and opposing immense resistance to the wind. Then we have the added resistance of the train, and the overstrained piers give way, tumbling girders and train into the torrent beneath.

We are indebted to *Martineau & Smith's Hardware Circular*, published in Birmingham, England, for much of the valuable information contained in this article.

* The total lateral pressure of the wind against the thirteen spans of girders constituting the elevated portion of the bridge—making the deduction for two of those spans being only 227 feet—would be 1,103,300 lbs., without the resistance of the train.

† We will publish in our next number the statement of some of the workmen who were employed in the construction of the bridge. Their evidence, if uncontradicted, would show that the cast iron was extremely imperfect.

INCOMBUSTIBLE WOOD.

M. M. P. Folbarri claims that he has discovered a method by which wood of any kind can be rendered incombustible. It becomes, as it were, petrified, without any alteration in appearance. When intense heat is applied to wood so prepared it chars the surface slowly and without flame, but does not penetrate to any extent, and leaves the fibre intact, whereby in case of fire, the firemen would have no occasion to fear that the materials on which they tread would give way beneath them, if this operation had been undergone by the wood composing the staircases, floors, etc. The following chemical compound is said to produce the result: Sulphate of zinc 55 lbs.; potash, 22 lbs.; alum, 44 lbs.; oxide of manganese, 22 lbs.; sulphuric acid of 60°, 22 lbs.; water, 54 lbs. All the solids are to be poured into an iron boiler containing the water at a temperature of 45 degrees C., or 113 F. As soon as the substances are dissolved, the sulphuric acid is to be poured in little by little, until all the substances are completely saturated. For the preparation of the wood it should be placed in a suitable apparatus, and arranged in various sizes' (according to the purposes for which it is intended) on iron gratings, care being taken that there is a space of about half an inch between every two pieces of wood. The chemical compound is then pumped into the apparatus, and as soon as the vacant spaces are filled up, it is boiled for three hours. The wood is then taken out and laid on a wooden grating in the open air, to be rendered solid, after which it is fit for uses of all kinds, as ship-building, house-building, railway carriages and trucks, fence-posts, wood-paving—in short for any kind of work where there is any liability to destruction.

BARE BRICK WALLS—THEIR INFLUENCE ON HEALTH.

The New York *Times* of January 14th has the following: "At the meeting of the Board of Health, yesterday, a report was received from Dr. E. H. Janes, Assistant Sanitary Superintendent, in relation to an inspection of the recent additions to the new Court House. Dr. Janes says: 'I found that the interior walls consist of brick uncovered by plaster or paint, and thereby present an absorbing and evaporating surface, which in my opinion, is detrimental to the health of those who daily occupy these apartments. From its porous quality, brick readily absorbs not only air and moisture from the ground and atmosphere, but animal vapors and impurities constantly escaping from the lungs and skin of those confined between brick walls are also absorbed and exhaled in turn with the regular changes and purifications of the in-door atmosphere.

"I am aware that the experiments of Pettenkofer are cited as an argument in favour of bare brick walls, on the ground that air readily passes through them; but persons holding these views forget that animal impurities do not possess the diffusible power of gaseous bodies, but on the other hand, adhere to porous structures; and while it may be claimed that foul air will, to some extent, escape through the brick walls from an unventilated apartment, the fact remains that air in finding its way through the wall leaves most of it foulness behind. Bricks so exposed become in time exceedingly filthy, and cannot be thoroughly cleaned by any amount of scrubbing. I would, therefore, recommend that the interior walls of these rooms be covered with some material that will prevent the absorption and subsequent exhalation of moisture and atmospheric impurities.' The report of Dr. Janes was transmitted to the Surrogate, whose clerks occupy the rooms referred to in the document."

Immense Wagons.—Three immense wagons, to be used in the mines of Colorado, are being made in Chicago. The back wheels are six feet three inches in diameter, and the tire is five inches wide. The wagons, including box, are nine feet high. They are each to be drawn by twenty yoke of oxen, and are capable of carrying ten tons each.