Dana, American marble should. The analysis gave but traces of impurities.

Under the microscope the exterior of the crystals was opaque, while the center was translucent and hard. I judged that there was partial calcination, either of the outside of each crystal or of the group of crystals, and perhaps that might account for the flexibility. Or, perhaps a part of the lime, rendered soluble by the calcining, was dissolved out while lying a year exposed to water almost constantly.

One thing is certain, that while the slab retains almost precisely the appearance of a piece of marble that has not endured such exposure, it is easily penetrated by a penknife blade to the depth of nearly half an inch. Considering the inutility of the thing, and the somewhat exaggerated accounts of its flexibility, I think ink enough has been shed over it.

E. E. WORTHEN.

Wheeling, W. Va.

[Professor James Orton, of Vassar College, states that a specimen of flexible marble was once in the cabinet of Williams College, about 6 feet by 8 inches wide. It is quite flexible for marble. It was soon broken by rough handling. He does not think a knife would penetrate it, as in this case. He conjectures that the Wheeling specimen owes its flexibility to a disintegrating process which has proceeded just far enough to allow some freedom of motion among the crystalline particles.—EDS.

[Reported for the Scientific American.]

SOCIETY OF ARTS OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

MEETING HELD AT THE INSTITUTE IN BOSTON, FEB. 8, 1872.

The President, J. D. Runkle, in the chair.

Mr. Edmund H. Hewins read a communication, well illustrated by photographs projected upon a screen by the calcium light, on European and American bridges, and compared the cost and methods of building bridges in the two countries.

It is now generally acknowledged that the "truss" is the form which admits of the greatest economy in the use of material; and yet there are some engineers who cling tenaciously to the old plate or box girder. A few years since an engineer of wide reputation and large experience condemned a truss bridge, giving as a reason that the peculiar construction would cause the iron to crystallize from the trotting of horses over it. The bridge was consequently built as a plate girder, and the cost was more than fifty per cent greater than it would have been for a truss bridge.

The days of tubulars, girders, etc., have substantially passed away; there will be no more Britannia or Victoria bridges; they stand as vast monuments of indomitable will and energy. All honor is due to Stephenson for building the bridge over the Menai Straits; considering the then limited knowledge of the use of iron in bridge building, it is a monument worthy to make his name famous for ages to come.

Brunel has done even more; the Saltash is a conception more gigantic, and as much a flight of genius—a work which will remain when the other is destroyed by time.

Truss and lattice bridges now predominate, the latter being but a form of the first.

THE BRIDGES OF EUROPE

are secured together by almost innumerable rivets; the various parts being usually composed of plate and angle iron riveted into box and other forms best calculated to resist the storms to which they may be subjected. The building of parts in this manner requires much care and is very expensive. The rivet holes deduct a considerable amount from the strength without reducing the weight.

A strut or tie composed of several pieces riveted together has not an effective strength proportioned to its section, for it is impossible to bring the different pieces to an equal strain at the same time. The engineer has here to make an allowance which is a very variable quantity. The ties and struts are rigidly connected with the chords.

Whenever a load comes upon a bridge, there must be some deflection; this causes a distortion of the form of each panel, and as the ties and struts are rigidly connected to the upper and lower members, a powerful leverage to bend them is the result, and there is at the same time an increased strain upon the rivets.

In the crossing of a railway train or other partial load, the counters, necessarily, not being in readiness to receive their proper strains at the proper moment, allow an undulation which materially increases the bending strains upon the ties and struts. This occurs every time a train or locomotive crosses the bridge.

The trusses used in American and European bridges are very similar; the essential difference being in details of construction, which in the European bridge are very expensive, as so much hand labor and fitting is required. A large amount of material is used which is mere dead weight, being of no use in sustaining the load or itself. The action of such a bridge is necessarily unsatisfactory from the fact that certain portions receive strains in practice which are not legitimate, and consequently must tend to shorten its life.

The following data were collected in Europe by Mr. David Buck. The viaduct of Fribourg, on the Orleans Railroad in France, is composed of eight spans of 160 feet each, and has a hight of 250 feet above mean low water of the Sarine The piers have a masonry foundation 89 feet high, with a metallic superstructure of 142 feet. The total length of the viaduct is 1299·88 feet, and cost, above the masonry, $366,000 in gold, or $282 per lineal foot. The figures for three other viaducts on the Orleans railroad are as follows:

THE VIADUCT OF THE BOUBLE.

6 spans of 164 feet each, total length	984 ft.
Hight above masonry, average	138·76 ft.
Cost per lineal foot	$167.00

THE VIADUCT OF BELLOU.

3 spans, average length 140 feet, total	420 ft.
Hight above masonry	137·76 ft.
Cost per lineal foot	$123.00

THE VIADUCT OF NEUVILLE.

2 spans of 161·13 feet each, total length	322·26 ft.
Hight above masonry	136·18 ft.
Cost per lineal foot	$112.00
1 span	77·08 ft.
Cost per lineal foot	$108.00

THE AMERICAN TRUSS BRIDGE,

instead of being bound together in one solid mass, is composed of various members, each independent of its neighbor, so far as its own work is concerned, each having a specific and defined duty to perform, and proportioned accordingly. By no change of temperature, or variety of load in amount or position, can any but legitimate strains be imposed upon any part. The joints are made with pin connections so that a deflection can bring no twisting or bending strain upon any of the parts—and though the form of each panel be very much distorted by an approximation to the breaking load, no excess over the proper strain can be brought to bear on the bridge. Each part is known to receive its proper strain at the proper time, as they are made adjustable in all directions, and by this means the vibration and undulation are reduced to a minimum. American bridges have astonished the world that such light structures should have so little deflection and undulation.

American bridges are cheap to build. Most of the work is done by machinery instead of hand labor, and but little skilled labor is required.

Work done by machinery does not cost one half as much per pound as work done by hand. Considerable expense is also saved in handling and erection.

It is sometimes necessary to erect bridges over streams which are liable to rise suddenly and sweep away the temporary works. In such a case, the loss would be incalculable in time and money, if the bridge should be carried away.

Our bridges—built as they are in parts which are seldom too heavy for two or three men to handle—can be erected in a very short time.

A 200 feet span could be swung clear of the staging in three or four days, while the plate girder, lattice, or European truss would require as many weeks. The average cost of railroad bridges in America is about one half as much in currency as European bridges cost in gold.

ANCIENT BRIDGES.

Professor Watson made a few remarks concerning ancient bridges.

The Sublicius Bridge across the Tiber at Rome was the first of which we have drawings and descriptions. It was built B. C. 616, and was of wood. It was replaced by a stone bridge and this subsequently by a marble bridge.

The Senator's bridge, now called Ponte Rotto, was built by Scipio in the year 127 B. C., and reconstructed by Gregory XIII in 1575.

The bridge of Trajan across the Danube, built in 104 A. D., had piers of stone with a wooden superstructure.

The bridge over the Elbe at Dresden has eighteen arches of sixty-three feet span. It was built in the year 1200 and restored in 1731.

Michael Angelo built the Rialto at Venice in 1578. The order of "*Frères Pontifes*" was instituted in 1189, for the purpose of building bridges in Italy and France. This order existed for about five centuries.

"MINERAL WOOL."

Professor Pickering exhibited two novelties he had received from Dr. Wm. Wahl, of Philadelphia. The first is a white fibrous substance, resembling asbestos, which is made by forcing high pressure steam through melted slag.

This mineral wool, as it is called, is a good non conductor of heat and is, of course, incombustible. It seems well adapted for steam packing and a variety of uses. The second novelty was a plate of glass on which an engraving has been made by the sand blast. A photograph was first taken on the glass, which was then covered with a film of gelatin and bichromate of potash, and exposed to the light. The light renders the film insoluble; and after washing off the portion unacted on by the light, the plate is ready to be subjected to the sand blast; the remaining insoluble portion of the film protects the parts of the glass which it is not desirable to cut.

He then made a few remarks about the various methods of photographic engraving.

With the earlier processes, it is necessary that the printing be done on a lithographic press and that the object be entirely in black and white.

The New York Lithographing and Engraving Company have succeeded in printing the photographs on a common printing press. To do this, it is necessary that the dark portions of the photographs should be raised above the white. This object is secured by means of the film of gelatin and bichromate of potash, as above described.

Specimens of Woodburytypes, Albertypes, heliotypes and autotypes were exhibited, and their peculiarities and different applications pointed out.

Mr. Markoe showed an improved achromatic stereoscope, made by Mr. Beck, of London. It admits of the use of opaque or transparent objects, and can be readily adjusted to suit the focal distances of both eyes, in case they should differ.

W. O. C.

Changing Clothing---Pneumonia.

Pneumonia has prevailed in this city during the past month, to unusual extent and many of our well known business men have fallen a prey to the disease. Our physicians say that they have never before known the disease so difficult to treat successfully. The following from *Hall's Journal of Health* for March is timely and worthy of consideration by all.

In the latitudes of New England and New York, going westward, the month of March is the most disagreeable of the whole year, with its changing temperature, its slosh and mud, its cold, raw, piercing, damp winds; and although not as cold as January and February, it is more prolific of dangerous diseases, greatly promoted by the hurry of the people for lighter clothing; but it would be a great deal better to wear the entire winter suits through March, and even to the middle of April; and even then, until the first week in May, to make no change in the outer clothing, nor any in the inner garments, except to a less heavy woolen next the skin; for it is only for the three hours embracing one o'clock in the afternoon that winter clothing is at all oppressive; while the very warmth of noonday makes the raw dampness of the morning and late afternoons specially felt.

All changes to a lighter or cooler garment should be made at dressing in the morning; and if in any case the change leaves the body chilly, or if soon after it is made the weather changes to be much cooler, by all means promptly, without half an hour's delay, resume the full winter dress. The old, the young, the invalid, in short all persons of feeble constitutions of small vitality, should be especially careful to heed these suggestions; inattention to which gives rise to the very frequent announcements in the morning papers, in the early spring: "Died suddenly, yesterday,——, of pneumonia,"—often, the very friend whom we had met in the street, or at church, within a week, apparently as well and as hearty as ever before.

Softening Frozen Ground for Excavating.

This invention has for its object to reduce the expense of digging the ground during the winter season for building or other purposes; and consists in the application of steam to frozen ground for the purpose stated. At present, with frozen ground, the digging in winter is very expensive and difficult, and consequently the preparation for a commencement of building during the cold season is not generally undertaken on account of the greater expense. The hands are, therefore, mostly idle in winter. All this will be, it is claimed, avoided and a flourishing trade continued throughout the year by the introduction of an inexpensive system of softening the frozen ground.

The inventor, Mr. Andrew Derrom, of Paterson, N. J., claims to have ascertained that a small jet of steam applied underground will take the frost out of a disproportionately large extent of earth. He practically utilizes the discovery by applying steam, under pressure from a boiler or steam generator, which is conveyed under the earth in a suitable pipe. As it is forced cut of the pipe, it interpenetrates the particles of earth, is condensed, parts with its latent heat, and is asserted to thaw an astonishing space of ground in proportion to the quantity of steam employed.

Postal Telegraphy.

In England, all the telegraph lines are now owned by the government, and short messages may be sent to any part of the kingdom for twenty-five cents. The government issues what are called postal telegraph cards, bearing a twenty-five cent postal stamp. On this card you write your telegraph message, and drop it in the lamp post letter box. The letter carrier delivers it to the telegraph department, and the message is promptly forwarded to its destination. The English Government has been petitioned to purchase all the submarine telegraph cables leading from England.

A Queer Case.

Dr. H. Vogel, writing from Germany to the Philadelphia *Photographer*, relates a queer case. A photographer made pictures of two brothers, who refused to take or pay for them on the ground that they were not likenesses. The artist complained, but the judge was of the same opinion as the brothers, and decided that the pictures were not likenesses. Mr. Photographer then went home with his rejected pictures and placed them in his show window, with the label, "The murderers of Mrs. X." The brothers then waited on the artist and alleged that it was a libel to expose their pictures with such a title, and, on his refusal to remove the placard, they entered suit. It remains to be seen how the judge will decide in this new phase of the affair.

PEARLS —Mr. R. Garner lately read a paper before the Linnean Society, London, in which he referred to the theory, now generally adopted, that the production of pearls in oysters and other mollusks is caused by the irritation produced by the attacks of the minute parasite known as *Distoma*, and believed that, by artificial means, this parasite might be greatly increased. British pearls are obtained mostly from species of *Unio*, *Anodon*, and *Mytilis*, but it is probable that all mollusks, whether bivalve or univalve, with a nacreous lining to the shell, might be made to produce pearls.