and the same weight placed at one-fourth from the low tower, we find the calculated and the actual displacements to be respectively as follows:—

	Theory. inch.	Experiment. inch.
At loaded quarter-span, . . .	— 1·108	— 0·855
At half-span, . . .	+ 0·138	+ 0·160
At opposite quarter-span, . . .	+ 0·971	+ 0·780

The result of the experiments in this instance is very diverse from those of the preceding experiments, especially in the proportionate largeness of the wave of elevation, which in fact seems anomalous.

On the whole, the comparison of these experiments with the results of calculation considerably confirms the accuracy of the theoretical formula, as applied to the small actual displacements of a full-sized bridge. It must, however, be remembered, that it has been assumed that the flexibility of the girder is everywhere uniform, and the same for upward as for downward pressure—conditions not always found in a plank, such as took the place of a girder in Mr. Barlow's model; and assumed, further, that the girder is not continued nor weighted for any distance beyond the face of the piers.

According to the calculated co-efficients, a concentrated load at quarter-span from one tower will cause a depression of 0·0666, or $\frac{1}{15}$ th the deflection which the same load without the chains would cause if placed at the centre of the girder. This depression will be accompanied by a rise at the opposite quarter-span of 0·0584. The depression will be increased, and the rise diminished, by the stretching of the chains. The sum, which will not be affected by the stretching of the chains, is 0·1250, or $\frac{1}{8}$ th.

(To be Continued.)

MECHANICS, PHYSICS, AND CHEMISTRY.

Ancient Standard of the British Inch. By JOHN TAYLOR.

From the Lond. Athenæum, June, 1860.

Sir John Herschel remarks, in the *Athenæum* of April 28th, that the British inch puts us in easy possession of “a modular system, which might be decimalized, and which, abstractedly considered, is more scientific in its origin, and, numerically, very far more accurate than the metrical system of our French neighbors.”

I rejoice at this communication. It has saved our country from the introduction of the French metre, and from the admission of its superiority to our own measures, which, there is reason to believe, have been preserved, without any deviation from the standard, for about four thousand years.

The British inch had its origin, as I contend, in the measurement of the earth made by the founders of the Great Pyramid. They determined, with great exactness, the proportion which the diameter of a

circle bears to its circumference, and having ascertained the measure of the circumference of the earth, supposing it to be a perfect sphere, they divided the diameter into 500,000,000 of units, which we call inches. This appears to have been the origin of our inch. The *polar* diameter of the earth, according to Mr. Airy's calculation, is equal to 500,491,440 of these inches, which measure so little exceeds the mean diameter of the earth, according to the ancients, as to require the addition of only one-thousandth part, to render it, with all but mathematical precision, the 500-millionth part of the earth's axis of rotation.

Sir John Herschel says, that his attention was drawn in the first instance to this *rapprochement* by my statement, that the diameter of the earth, in the latitude of the Pyramid, is 500,000,000 of English inches; "which it is not:" and he adds, "It is singular that the reduction of Mr. Airy's polar axis from feet to inches, in p. 87, which is rightly performed, does not appear to have suggested the least misgiving as to the correctness of the statement." It appears to me that Sir John has misapprehended my meaning. My reference is to the *ancient* measure, and not to the *modern*—to the *mean* diameter, as it was then supposed, and not to the *polar*, as it is now estimated. I fear, however, that by my inadvertence in writing "average" for "polar," at p. 87, when I was comparing the modern diameter with the ancient, I have caused this misapprehension. He is surprised also that I did not "notice the important practical facility of reduction from the parliamentary to the modular standard." But this was not within my province. The proposal of a modular inch comes with great propriety from Sir John Herschel; and, having his recommendation, it will no doubt be adopted by scientific men, in those cases which require its use. The parliamentary inch will still be our measure for all practical purposes.

I agree with Sir John Herschel, that the founders of the Great Pyramid were not likely to be in possession of any *calculus* by which they could determine the true ratio which the circumference of a circle bears to its diameter, so as to be able to represent it with mathematical accuracy, in the proportion which the periphery of the base of the Great Pyramid bears to its radius. They were guided probably in their proceedings, by those general principles which would influence men of common sense. Hence, they may have supposed that if a Pyramid of a certain angle ($51^{\circ} 51' 14''$) had the property of representing the proportion which the radius of a circle bears to its circumference; and a Pyramid of another angle ($51^{\circ} 49' 46''$) had the property of representing the proportion which the square of its height bears to the content of one of its triangular faces; then a Pyramid of an angle between the two ($51^{\circ} 50'$ for instance) might combine the two properties so nearly, as to make them think they could embody both results in one structure. They were completely mistaken in this conclusion, since what may be affirmed of the one angle cannot be affirmed of the other; but for want of a calculus they might not be aware of this impossibility.

An evident error in Herodotus led me to observe, with a view to its

correction, that the *square* of the height (though not the *height*) would be so nearly equal to the content of one of the sloping triangles, as to render it probable that the true reading of the passage might be found in this correction. Sir John Herschel approves of the suggestion. He says, "This is the characteristic relation which Herodotus distinctly tells us it was the intention of its builders that it should embody, and which we now know that it did embody, in a manner quite as creditable to their workmanship as the solution of such a problem was to their geometry. This problem, however, has no relation to that of the rectification of the circle." Certainly not. It is gratifying to me, that my conjectural emendation should be allowed to have restored the true reading with so much apparent certainty, after it had been so long lost to the world.

At the close of his communication, Sir John Herschel does me the favor to notice "another curious and novel relation" which I had pointed out at page 37 of "The Great Pyramid," and which "is interesting," he says, "as offering the only tolerable approach in round numbers to an arithmetical relation between any of the dimensions of this Pyramid and those of the earth." But in the *Athenæum* of May 5, he observes, "There is another and a remarkable one which I do not find noticed by Mr. Taylor." If he will refer to pp. 26 and 27, he will see that I have not overlooked it. In correcting the error of Eratosthenes (that the circumference of the earth is equal to 31,500 Roman miles), I say that it is equal to 27,000 miles, and that the tenth of a Roman mile is the height of the Pyramid, including the casing, and supposed to terminate in a point. Thus it is one-270,000th part of the earth's circumference, as Sir John Herschel has stated.

Leonard Place, Kensington, May 29.

The use of Ozone for Cleaning Books, Removing Ink, &c.

From the *Lond. Mechanics' Magazine*, July, 1861.

Gorup-Besanez* recommends the use of ozone for cleaning and restoring the coloring of old spotted and soiled books and prints. Ozone completely removes writing ink; but printing ink is not attacked by it, at any rate to no perceptible extent; grease spots and mineral colors also remain unchanged, but vegetable colors are completely removed. The method used is as follows:—The air in a sulphuric acid carboy is ozonized by Schönbein's method, which consists in placing in it a piece of phosphorus three inches long and half an inch thick, and pouring into the carboy as much water at 30° C. as will half cover the phosphorus; the carboy is loosely corked and allowed to stand in a moderately warm place until the air is charged with ozone, which generally requires from twelve to eighteen hours. Without removing the phosphorus and water, the article to be bleached is uniformly moistened with distilled water, and after being rolled up is suspended by a platinum wire in about the centre of the carboy. The roll of paper is soon seen to be continually surrounded by the

* Liebig's *Annalen*, May, 1861.