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PYRAMID PROPHECIES AND EGYPTIAN EVENTS.

Such is the title of a paper contributed to the *Gentleman's Magazine* for October, 1882, by Mr. Richard A. Proctor, a contribution marked throughout by the characteristic weakness of that writer whenever he attemps to discuss the subject of the Great Pyramid. The paper in question might perhaps be more properly headed "An attack on the Astronomer Royal of Scotland." So obviously is it such that a dispassionate reader might be driven to the conclusion that its inspiration was derived rather from an envious vanity than from the reflections of calm philosophy. But then it must be remembered that Mr. Proctor is one of those men who, as Froude felicitously remarked of Anthony Trollope, bangs through life very successfully. He is deservedly popular as a writer and lecturer on those intangible subjects which lend a fascinating charm to his tongue and pen; as when he soars into the ether of the infinite, and writes or discourses on the birth and death of worlds—the myths and marvels of astronomy—the mysteries of time and space—our place among the infinities—the expanse of Heaven, ete., etc. In this congenial thought-plane he is unapproachably magnificent, and although originality of conception is not to be

looked for as a prevailing characteristic, still there is a masterful dexterity in adoption which may be considered wholly his own.

The article under consideration opens with the statement that "according to pyramid prophets, this year, 1882, is the one in which some great change—closing the Christian era as such—is either to be brought about or to begin, July, 1882, being the fateful month; and already they find in events in Egypt clear evidence that pyramid prophecies are sound." But for the belief that Mr. Proctor has imperfectly made himself acquainted with the pyramid subject, this opening paragraph might be criticised as containing but a partial, and not the whole, truth. The fact being that the metrological expression of the monument gives 1882 as but the *beginning* of the end of the present dispensation, and gives A. D., 1910 as its termination. If, therefore, Mr. Proctor will continue the floor measure of the grand gallery over the step and on to the south wall, he will be less flippant and more correct in his comment on what the pyramid measure does really show respecting the duration of the Christian dispensation. The article continues with a bang into the thirst for foreknowledge implanted in the human mind, and proceeds with an illustrative disquisition on astrology, dreams, cup-tossing, cards-consultation and palm-reading; ending by the startling assertion that certainly half the educated and probably ninety-nine hundredths of, if not all, the uneducated classes still believe in what science has long since utterly rejected respecting the aforesaid methods of learning what is to happen in the future. Persons who have had "the fortune to visit many lands in the Old and New World, and both in the northern and southern hemisphere"—as Mr. Proctor tells us he has done—may be found to doubt the proportion of educated and uneducated superstitious credulity existing in the many lands of the Old and New World and both in the northern and southern hemisphere as that proportion is stated by Mr. Proctor. This side issue is, of course, to be considered as page-padding, and yet it is curious to observe that the only profitable conclusion which the record furnishes—even if literally true—is left undrawn, viz: that

such an element in the human mind, even in its degradation and darkness, proves that man is compounded of "subtler essence than the trodden clod," and that even the foolish superstition—so properly stigmatized by the writer—demonstrates the existence in man's soul of a faculty whose normal function is the apprehension of those revelations of the future, which the Creator in His infinite wisdom may give to the faithful among the children of men, while the unfaithful are delivered over to strange delusions that they may believe a lie.

Coming more immediately to the subject, Mr. Proctor writes: "There are inherent absurdities in the pyramid faith, as there are in all systems of prophecy; but there is a basis of what looks like real evidence, which many find very firm and solid." Of this passage it is only necessary to observe that Mr. Proctor writes loosely, does not define "systems of prophecy," and therefore leaves it possible to suppose that the prophecies of the Bible are included in his universal term "all," and possess in common with the pyramid's foreshowings "inherent absurdities." If this be Mr. Proctor's contention, conclusion or belief, it would be unquestionably absurd to advance an argument in proof of what has been demonstrated by time.

Mr. Proctor proceeds to state that the testimony of history and tradition agrees as to the Ghizeh pyramids having been built by a monarch or dynasty moved thereto by motives not specially unselfish. Here, as usual, the writer bangs into an irrelevant subject which is not the question at issue. The question being solely whether the Great Pyramid at Gizeh exhibits a metrical, accurate knowledge of astronomical facts which was unknown amongst mankind at the time of its erection, and in the expression of which the architect must have been divinely inspired, and also exhibits a chronometrical foreknowledge of the heathen, Jewish and Christian dispensations, which could only have been derived from the same supernatural source.

Mr. Proctor proceeds characteristically to state that "it was never held by the most ignorant Bedouin that the pyramids contained hidden knowledge of any sort, still less that they concealed prophetic intimations."

Here again Mr. Proctor diffusely speaks of the pyramids as if the pyramids were to be considered, whereas the contention of the pyramidists is that the Great Pyramid alone is the first and only structure of that name containing features such as are demonstrably exhibited by its architect.

In his article contributed to "Belgravia" some time since, Mr. Proctor enumerated the pyramids composing the Ghizeh group as being "*forty* or so in number," whereas there are only *nine* (three large and six small) on the Ghizeh plateau, and of these nine—as of the remaining twenty-nine stretching southward for some fifty geographical miles on the western Nile bank—it may be truly asserted there is but *one* true pyramid—the "Great"—of which all the later tombic structures are but imperfect imitations, totally deficient of scientific design, and meant by their builders to be what they simply are, viz: tombs. Therefore, there is a waste of ability on the part of Mr. Proctor when he names for consideration "the pyramids," the question being whether the Great Pyramid is a monument possessing the scientific and religious features claimed for it by those who have studied its structure?

In the matter of studying the exhibited design of this "Pillar of witness," it is to be feared that Mr. Proctor stands on the same level with the most ignorant Bedouin, but even a superficial reading on the subject would have informed Mr. Proctor of the traditional opinion of oriental people respecting the Great Pyramid at Ghizeh as embodied in the writings of Balkhi, Masoude, Alkokme and others, showing their belief in the mysterious character of the building, as being a religious, astronomical and prophetic monument—a traditional belief so strong as to have moved the caliph Al Mamoun, with a host of followers, to undertake a journey from Bagdad to Ghizeh for the sole purpose of opening the pyramid, and thus testing the traditions and writings regarding it.

Mr. Proctor next takes a bang at Mr. J. Taylor's test-founded hypothesis, as to the scientific truths embodied in the structure of the monument—much as one of the "most ignorant Bedouins" might do—assuring us at the same time, with a proud humility, that he (Mr. Proctor) speaks "with some

knowledge of the subject, though not acquired precisely as *the pyramidists acquired theirs.*" This admission is at least candid —the thing to be regretted is that Mr. Proctor does not say how *he* acquired the "some knowledge of the subject" which he possesses, and which is so absolutely erroneous and so utterly worthless and misleading. But as we know how the pyramidists acquired their knowledge, viz.: by the months-long, minute, laborious, complete exploration and measurement of the Great Pyramid so faithfully performed by Piazzi Smyth, in test and resultant proof—or rather demonstration—of the truth of John Taylor's hypothesis, we may conclude that Mr. Proctor's knowledge was derived, "not exactly" from personal observation, measurement, or even an unbiased study of the work of really able and qualified men, but rather from a superficial reading on the subject, guided by prejudice and recklessly embodied in magazine articles remarkable for the pleonastic features of their expression. Waxing bold, Mr. Proctor proceeds to assert that "There is not a discovery effected during the last thousand years, or which can by any possibility be effected during the next thousand years, which may not be shown by their methods to be embodied in the structure of the Great Pyramid, or of any other pyramid, or in St. Peter's in Rome, or St. Paul's in London." We have no doubt whatever that if Mr. Proctor undertook a task such as he describes he would succeed in accomplishing it to his own entire satisfaction and in the highest style of imaginative word-painting he goes on to show us how he would do it, saying: "Any number you please may be found with a little patience in any one of these buildings, and every scientific selection may be indicated by a number. Then, among numbers so found, many will be repeated in different ways, and so the apparent evidence from coincidence will seemingly be strengthened, though in reality weakened, because every such double or treble coincidence shows that pure coincidence can always be recognized among any numbers taken at random, or from any set however determined. Thus, among the various distances, dimensions, periods, etc., within the solar system, or rather among the numbers representing these, there are multitudes of coinci-

dences purely accidental, though only the astronomer, perhaps, may be able to distinguish those which are accidental from those which are real."

Perhaps few thinkers, or any but an astronomer such as Mr. Proctor is, would venture even to imagine that the multitudes of coincidences found in the numbers representing the distances, dimensions, periods, etc., of the solar system, where the figures are exact, were accidental, but would rather assert that in the divine system such coincidences were not only real, but harmoniously necessary.

Mr. Proctor is so prone to write metonymically that one is somewhat puzzled to know what his idea is in the present instance. We would be quite at a loss to imagine what he means by the term "coincidence" had he not given an illustration or two of what he calls coincidences, to the consideration of which it is as well to devote a brief attention.

The first illustration is superb in conception by supposing a man of sense should read in a newspaper that a certain John Hawkins had been killed in a street row, and on the next page read a biographical sketch of Sir John Hawkins, the great seaman. The man of sense knows there is no marvel or mystery in the coincidence of the names of the two John Hawkins. This sublime verity is worthy the argument of the distinguished writer who uses it, and should be remembered well by any Sergeant Buzfuz who should meditate on ascribing hidden meanings and deep design in any Pickwickian philosopher alluding to a warming pan in correspondence with his widow landlady.

Mr. Proctor's contention is that the significance of pyramid relations are to the man of science no more impressive than the two Hawkins to the man of sense. But it may be asked what the man of sense could by any possibility imagine more than a similarity of names between the Hawkins killed in a street row in 1882 and the Sir John Hawkins of nearly three centuries ago? Taken as an illustration of mathematical coincidences, which Mr. Proctor not only admits, but asserts, "must occur," the reader wonders what Mr. Proctor really does mean when he uses the term "coincidence." Happily, however, we

have not long to wait, as Mr. Proctor asks us "to take such a coincidence as the following," viz: "If (he says) the number of days in a year be multiplied by twenty-five, and the number so obtained be squared, and the square doubled, the resulting number is (*quam proxime*) the square of the number of years in the great precessional period in which the earth accomplishes her mighty reeling movement, as like a gigantic top she 'spinning sleeps on her soft axis as she paces even,'" and then adds triumphantly: "In such a relation as this, science knows certainly that there is nothing but mere coincidence." Here we have something tangible—an assertion that may be tested, but it may perhaps be thought by some that it is scarcely necessary to demand accuracy in Mr. Proctor's statements when such are advanced regarding the Great Pyramid, as when a writer is capable of multiplying the *nine* pyramids in the Gizeh group into "forty or so," or of asserting that the *entrance passage* is in the *central plane* of the northern face of the Great Pyramid, or that the descending and ascending passages were carefully lined with *red granite*, the feat of metonymy respecting the term "coincidence" is comparatively easy and to be looked for.

In lexicon and common usage the term coincidence is held to mean agreement, a meeting of two or more lines, surfaces, bodies or events at the same point—concurrence—agreement.

In Mr. Proctor's illustration, however, the man of science and he of common sense find that a Proctor coincidence means that two numbers differing by no less than *five hundred million, five hunded and two thousand, six hundred and seventy-nine* are *quam proxime, equal,* the one to the other. If permitted to borrow the fine tragic style of Mr. Proctor, one must exclaim when testing and propounding *his* illustrative coincidence, "I am not mad! I but read madness!" But let the test be stated. We multiply 365 by 25. The product is 9,125. We square that number with 83,265,625 as a result, and, doubling the result, we have 166,531,250 as sum of the first part of his submitted computation.

Coming to the second part, we take the precessional period at 25,827, and, squaring it, we have 667,033,929, which sum,

compared with that of the first part, shows a difference, as we have stated, of no less than 500,502,679.

The astounding audacity which would term the above named sums to be coincident is remarkable, even when coming from Mr. Proctor. But when that statement was advanced the writer either did or did not know it to be immensely untrue. If he did not know it to be false, no reliance can be placed in his mathematical knowledge. The alternative of his knowing the error when stating it, is, of course, not to be supposed. Therefore Mr. Proctor would act more wisely and with more credit to his reputation, if he would confine the capacity of his abilities to the exposition of those vast immeasurable subjects in the treatment of which he is unfettered by mathematics and secure from tests; for it is one thing to bang into the infinite, the mysteries of time and space, etc., etc., but quite another thing to take a bang at mathematics and assert that two numbers are coincident which differ by five hundred million, five hundred and two thousand, six hundred and seventy-nine, referring to which, with oracular dignity, he assures the reader that "in such a relation as this science knows certainly that there is nothing but mere coincidence." Whatever Mr. Proctor may mean by "science" in this connection is a dubious question, but simple arithmetic shows that there is no coincidence whatever in the ordinary sense of the term, although there is, it must be admitted, a brilliant specimen of what may be called a "Proctor coincidence." But, if the second illustration of mere coincidence be a brilliant improvement on the first, the third illustration is superbly superior to either or both. We give it *in extenso.* Referring back to his asserted coincidence, number two in illustration, he adds: "But to argue that therefore any such coincidence as we have indicated could arise, *ex-necessitate,* would be like reasoning that because the number of steps a man takes in walking from Brompton to the bank must depend in some degree on the size of the boots he wears, there must be some real meaning in the circumstance (supposing such a thing observed) that the number of steps he took had been exactly twice the fourth power of the number representing the size of his boots. (Say, for instance, he wore

'eights,' and counted 8,192 steps—*i. e.* twice 8×8×8×8.)"

The foregoing sutorial illustration causes the reader to pause in uncertainty as to whether the author is in any degree serious in propounding it, or only indulging in a stroke of the heavy humor he sometimes condescends to employ. But lest he should be serious, it is as well to ask who, except a bewildered imaginist, could ever think that the number of steps a man may take in walking from Brompton to the bank depended in any degree on the size of the boots he wears, supposing them to fit him. If the length of his legs had been put in the illustration as ruling the length of his step, the Proctor coincidence would not be quite so nonsensical. In the absence of a given distance between Brompton and the bank, from Mr. Proctor's conundrum, and working out the problem on Mr. Proctor's formula, the following amazing results follow, viz: The wearer of sixes (10-inch boots) would cover the distance in 2,592 paces. If booted in "sevens" (10½ inches) he would do it in 4,802 paces; the selected pedestrian who used "eights" (10¾ inches) would reach the goal in 8,192 paces; a wearer of "nines" (11 inches) would enter the band on the 13,122nd pace, and the pedestrian who wore "tens" (11½ inches) would find that 20,000 paces transferred him from point to point.

This is precisely the reverse of what a man of science or a man of sense would predicate, if not enlightened by Mr. Proctor. True, the coincidences are there in each case, as that gentleman might allege, but somehow the distance shows wonderful elasticity.

Let us suppose the pace of each of the boot wearers to be 28 inches, the owner of sixes would make the distance 2,106 yards; he of sevens, 3,734.2+ yards; he of eighths, 6,371.1 + he of nines, 10,206; he of tens, 15,555.1+ yards.

Each of the pedestrians might assert that his particular boots gave the true coincidence, and that all the other boot records were but seeming coincidences. Indeed, the only way to make the matter clear would be to refer the problem to Mr. Proctor, who would doubtless prove the differences to be coincidences. To a reader less gifted than Mr. Proctor, any endeavor to find sense in the sutorial paradox would prove bootless.

It is to be regretted that in this article of Mr. Proctor's he did not confine his abilities to the conception of illustrative mathematics, and should have so far yielded to the impulse of jealous discourtesy as to allude to the Scottish Astronomer Royal in the terms following, viz: "Professor Piazzi Smyth is an astronomer, and in some degree a mathematician, but he shows no power whatever in appreciating the real value of evidence."

The gratuitous impertinence of this passage is perfectly Proctorian; the admission that Professor Smyth "is an astronomer" is replete with dignified condescension. To be sure he is an astronomer, practical, laborious, distinguished, but it is no less true he is not a platform astronomer, whose information is derived rather than acquired, nor does he make the sublime profession he is devoted to subservient to pecuniary ends. Still Mr. Smyth should feel that with the endorsement of his peregrinatory critic his reputation is secure; but, adds the stern censor, the Professor is "in some degree a mathematician," conveying the sly innuendo *only* in some degree, and as well that the unit of comparison is Mr. Proctor himself, *i. e.* Richard A. Proctor is a perfect mathematician, with absolute power of appreciating the real value of evidence, with whom Piazzi Smyth can compare only in some degree.

Many persons knowing both men as writers, would be inclined to believe that the implied doubt of R. P. as to the mathematical qualifications of the Professor is the highest eulogium that could be given to the latter on his mathematical attainments, and those who do not think so need but to revert to the mathematical *coincidence* which has been quoted as showing the profound knowledge of mathematical science which enabled Mr. Proctor to show that two numbers *differing* by 500,502,679, were ("*quam proximo*") *coincident*, or equal.

Proceeding in his lucidly amusing comment, Mr. Proctor remarks, "I will not take in proof of this the pyramid coincidences, though, as I have elsewhere shown, they prove it abundantly." (The abundance of the proof being equal to its error.) "I take, instead," he continues, "his idea that there is some mystical meaning in the prevalence of threes and the small

number of sevens in the number representing the proportion of the circumference to the diameter of the circle." Mr. Proctor is perhaps more thoroughly acquainted with the writings of Professor Smyth than I am, but I confess that at the present moment my memory does not recall the allusion to a "mystical meaning" by Piazzi Smyth, as being connected with the prevalence of threes in the relation of periphery to diameter.

As a matter of fact, I find in the extended relation to seventy-five places, the number 1 occurs six times; 2, eight times; 3, ten times; 4, seven times; 5, six times; 6, seven times; 7, five times; 8, eight times, and 9, eleven times.

Mr. Proctor continues: "No one who understands the laws of numbers could hold such a doctrine for a moment. No one, again, who understands the laws of probability finds such a circumstance even remarkable. It may be shown that, taking the numbers absolutely at random, till some two or three hundred have been obtained, the odds are in favor, rather than the reverse, of any number at least occurring oftener than any other, while one number at least occurs less often than any other, in the degree observed in the threes and sevens in the famous 'circumference number.'" This passage is quoted in illustration of Mr. Proctor's *random* reasoning. For suppose two or three hundred numbers are obtained, not "taken absolutely at random," but resultant from the working out of a mathematical problem, and that there is found to be a prevalence of a certain number in the result over any other number, that prevalence has a significance (explainable or not), as it is and could not be otherwise. But in a random collection of numbers, the absence or prevalence of any number has no significance whatever, for the reason that the numbers have been at random and are not the result of definite mathematical work.

The illustration and argument deduced are alike amusingly instructive as showing what manner of inconclusiveness is considered sufficient and satisfactory to Mr. Proctor when he desires to have a bang at Professor Smyth, but in a note which Mr. Proctor considers utterly crushing and altogether conclusive, he says: "Thus Professor Smyth gives the height of the

pyramid as a certain part of the sun's distance (which it is —about as nearly as is the length of York Minster). He also gives the perimeter of the base as containing as many inches as there are days in a hundred years. And he further gives the perimeter of the base as bearing to the height the proportion which the circumference of a circle bears to a radius. These are three wonderful and mystical coincidences, and here, therefore, is evidence of threefold strength. Yet it is certain (and obvious to the mathematician) that granting any two of the coincidences to be real, the third *must* be accidental."

The reasoning on and the conclusion drawn from the above triple coincidence seems to be rash in the extreme. If *two* be granted to be real, why should the *third* be necessarily accidental without any further proof than Mr. Proctor's assertion? In comparison, let three witnesses testify to three different facts. What would be the value of a judge's opinion which oracularly declared that the testimony of A and B was true, and *for that reason* the evidence of C should be rejected, or what would Mr. Proctor say if three astronomers were named viz.: the Astronomer Royal of England, the Astronomer Royal of Scotland and Mr. R. A. Proctor, and one should say the first two named are true astronomers, *therefore* the last is but accidentally so named? No doubt Mr. Proctor would be indignant, and very properly, at so witless a conclusion; and yet, according to Mr. Proctor's rule of reasoning, the conclusion would be true.

Mr. Proctor next proceeds to quote the following passage from Professor Smyth's work relating to the *intentional* arrangements of the pyramid in typifying or symbolizing various physical facts and relations.

"On such ground," says Professor Smyth, "Mr. Taylor took his stand, and after disobeying the public opinion of profane Egyptian tradition and setting at naught the most time-honored prejudices of the Pagan world so far as to give a full, fair and impartial examination of the case, announced that he had discovered in the arrangements and measures of the Great Pyramid then recently made upon it, or as it now exists, and on these again corrected for dilapidations and injuries of all intervening time so as to arrive at its physical condition, certain scientific results, *which speak of more than, or rather something quite different from, human intelligence.* For besides coming forth suddenly in primeval history without any childhood, or known preparation, or long acknowledged duration, and slowly growing servility afterwards—without any of these human features, I say, the actual results at the Great Pyramid in the shape of numerical knowledge of grand

cosmical phenomena of both earth and heavens, not only rise above and far above, the extremely limited and almost infantine knowledge of science possessed by any of the Gentile nations of 4,000, 3,000, 2,000, nay 1,000 years ago, but they are also, in whatever they chiefly apply to, *very essentially above any scientific knowledge of any man up to our own time as well.* This is indeed a startling assertion, but from its subject admitting of the completest and most positive refutation if untrue. For the exact science of the present day, compared with that of only a few hundred years ago, is a marvel of development, and capable of giving out no uncertain sound both in asserting itself and stating not only the fact but the order and time of the minutest steps of separate discoveries. Much more, then, can it speak with positiveness when comparing our present knowledge against the little that was known to man in those early epochs before physical science had begun, or could have been begun to be seriously cultivated at all."

On this passage follows Mr. Proctor's comment as follows:

All this, granting always the postulate that certain observed numerical coincidences imply knowledge of facts which could not possibly have been known to the pyramid builders except from some extra-human source, involves, of course, very important consequences. If scientific knowledge, divinely communicated, is stored up in the Great Pyramid, other extra-human knowledge may be there also—nay, rather *must* be there. For, merely to store up statistics about discoveries which man was to make himself *before* the pyramid disclosed its secrets, would have been altogether preposterous on the part of the real originator (on this theory) of the pyramid proportions. The evidence of superhuman knowledge of scientific matters *could* only be accumulated in the pyramid to give support to other teachings—to force men of the more thoughtful sort to accept those teachings and to learn from them whatever lesson they were intended to convey.

Those, therefore, are certainly right who say that if the Great Pyramid contains the evidence of superhuman scientific knowledge, it must convey divinely inspired information about religious matters too. It is demonstrably the only conceivable *raison d'etre* for an edifice of this kind. We may put the syllogism thus: The architect of the Great Pyramid was, according to the pyramid faith, superhumanly wise; to hide away scientific knowledge which would have been superhuman when the pyramid was built, till after such knowledge had been humanly acquired, would have been, were it the final object of the architect, superhumanly idiotic; therefore this was not the final object of the architect, or else, which pyramidists reject, he was either not superhumanly wise or the building does not contain evidence of superhuman knowledge, or both.

On the foregoing it may be said that the conclusion drawn by the critic is peculiarly Proctorian, and for this reason, viz: It does not follow that because the architect of the Great Pyramid exhibited in its construction, knowledge which was in his day superhuman in its reach and which was to be verified in the fullness of time and by a later generation, that therefore the exhibition of such knowledge in his design and measurements was "superhumanly idiotic." All truth is divinely inspired and is revealed to man when—and *only when*—its revelation is deemed essential to the good of our race, and that in the decrees of the eternal and all-wise God the fullness of time of its being made known has come. Even a shallow reflection on the

history of knowledge development will force this conviction on the mind of an unbiased thinker and needs not to be dwelt on by illustration. In the instance of the Great Pyramid, we find in this, our day, when the world is flooded with skepticism regarding the revealed religion of the Bible, when materialism, agnosticism and manifold forms of infidelity abound, when

> "The frets and fumes of sect and skeptic,
> And all that reason grown dyspeptic
> By swallowing forced and noxious creeds,
> From downright indigestion breeds,"

that the Great Pyramid shows forth the ideas of eternal truth, not in words, but by the only infallible and irrefragable science of mathematics, regarding to, and testifying of, the incarnate mercy of God, the cosmical relations of earth, and the just weights and measures to be used among men. Against its testimony the word jugglery is of no avail; and hence it is that the revelations of the pyramid have been and are opposed with such malignant virulence by the enemies of Christian truth.

Mr. Proctor next proceeds to criticise the discovery of Robert Menzies, and in doing so girds at that solemn-minded writer in a manner exhibiting Proctorian, rather than gentlemanly spirit. Were Robert Menzies alive, and should condescend to notice Mr. Proctor, the latter might rest in the assurance of being effectively replied to by a scholar and a gentleman. Of my dead friend I only feel it necessary to say, that he was a ripe scholar who for many years bent the energy of his mind to a study of the Hebrew prophecies, who was a Christian from conviction, and who devoted thirteen years to the study of the Great Pyramid. I feel it would be an insult to the memory of Robert Menzies were I to follow the flippant insanity of a critic who states that Mr. Menzies' thesis expressed the years of Christ's earthly life, "*at the rate of a pyramid* to a year"—(Mr. Proctor must be held responsible for having read the proof sheets of his article, and cannot plead validly, printers' error). In a rambling descant on the chronological mensuration of Robert Menzies, Mr. Proctor strikes the tragic attitude and exclaims: "I am not mad; I do but read madness"—which fine burst of indignant eloquence he means to be argument, and then—to relieve the nerve tension of his

readers—becomes lethally humorous with Dickens' Mr. Dick and Miss Trotwood, which humor may be utilized by any anti-pyramidist who finds the facts of the monument puzzling, in the reflection that Mr. Dick, or Richard, sets us all right."

In the concluding paragraphs of his article, Mr. Proctor verges on the impious, but I am convinced not intending to do so—his thought being of that crude and dangerous kind, which questions the ways of Providence—and thinks that infinitely more impressive and simple ways of conveying foreknowledge to man were open to God than those which have been chosen by Him. Voltaire thought he could, had he the power, create a better world than Jehovah has done; and the folly of questioning the ways of Providence, and the means used by the Creator, has existed, now exists, and will continue until the end of time, among those who set up their finite knowledge against eternal wisdom. CHARLES CASEY.

November, 1882.

As an illustration, which may be interesting to Mr. Proctor, as showing the estimate of his ability to lecture on the Great Pyramid, I subjoin an extract from a letter written by a hearer of his at Manchester, in December last:

"The lecture was much the same as one he delivered here some four years ago, except that he now advocates the tomb theory in addition to its (the pyramid) being a sort of astrological apparatus. This lecture throughout displayed considerable ignorance, as I thought, either through forgetfulness, or insufficient care in reading up the minor details of the process, such as giving out more than once during his address that the descending and ascending passages were all carefully lined with *red granite;* also a very vague description of the Queen's chamber and well chamber. But there was a large audience, and on a subject about which the general public knows so little, a lecturer can often make many absurdities pass muster."

The second extract, relating to his book as well as his lecture, is as follows:

"Have you seen R. A. Proctor's last efforts on the pyramid subject, entitled, 'The Great Pyramid Observatory, Tomb and Temple?' If 'Our Inheritance in the Great Pyramid' stood in need of a strong recommendation, or needed any cofirmation of its reasonableness and truth, R. A. Proctor has amply supplied it in his book.

"The one thing that surprises me is that a man, otherwise so clever, cannot perceive the absolute non-sequitur of his reasoning, nor the utter absurdity of his own elucidations.

"I should like to see his judgment upon any man who wrote as boldly against some

nice points in astronomy, as he himself writes against the only true and sensible account that has been given of the Great Pyramid.

"R. A. P. has just been lecturing in Manchester on the Great Pyramid. I wonder those shrewd Lancashire folk do not see through and through his nonsense.

"Pollerton Castle, Carlow, Ireland. CHARLES CASEY."

THE ALTAR AND PILLAR TO JEHOVAH.

I.

The above caption refers to the 19th and part of the 20th verse of the nineteenth chapter of Isaiah: "In that day there shall be an altar to Jehovah in the midst of the land of Egypt, and a pillar at the border thereof to Jehovah; and it shall be for a sign and for a witness to Jehovah of hosts in the land of Egyyt." The subject of this prophecy is supposed by most readers of the *International Standard* to be the Great Pyramid of Jeezeh, and is of sufficient importance and extent to require a series of articles for its elucidation, under the following heads: 1st, The Altar to Jehovah; 2d, The Midst of the Land of Egypt; 3d, The Pillar at the Border Thereof; 4th, The Purpose and Significance; 5th, The Being to Whom Dedicated. This may have the appearance of a rather formidable programme; but there is no occasion for alarm on account of it, each succeeding article being subject to acceptance or rejection by the editor, making it possible that the first will be the last.

Of course, people who study the Great Pyramid for nothing but mathematics or astronomy are very likely to think that it has nothing whatever to do with the Bible, and such readers of the *International Standard* will be inclined to regard the Scripture expositions as a sort of impertinent intrusion. In view of this very natural prejudice on their part, I humbly beg their indulgence, for the sake of the large number of readers who believe the Great Pyramid to be not only the subject of the above devout prophecy of Isaiah, but to be alluded to as a symbol of the church and kingdom of God in the epistles of Peter and Paul, and to be mathematically outlined in the cosmic

inquiry of the 4th and 7th verses inclusive of the thirty-eighth chapter of Job. Trusting to their generosity, I proceed to the first part of my subject:

THE ALTAR TO JEHOVAH.

What evidence can be adduced in favor of the idea that the Great Pyramid was "an altar," and not only "an altar" but "an altar to Jehovah?" The pyramids of ancient America, the teocallis, were altars, but altars on which human victims, and hearts plucked from their breasts, were offered up in unquenchable fire, to the great fountain of light and heat and to the hosts of heaven. They were sad perversions of those primeval altars on which were sacrificed clean breasts, as symbols of human affections purified by the divinest of self-sacrifices for the good of mankind, and from which arose the incense of burnt offerings, in token of the ascension of heart-felt gratitude and devotion to the self-existent fountain of truth and love. Considering the nearness of the Great Pyramid to the City of the Sun, Heliopolis, and considering the special mention of this city as one of the "five cities in the land of Egypt speaking the language of Canaan" in the day of the "altar to Jehovah in the midst of the land of Egypt," we see how easily the worship of Jehovah degenerated into that of his most natural and perfect symbol, and how possible it is for the worship of the sun to be regenerated into that of the Being whom Malachi calls "the Sun of Righteousness," and of whom Isaiah says to Israel: "Thy sun shall no more go down, neither shall thy moon withdraw itself; for Jehovah shall be thy everlasting light, and the days of thy mourning shall be ended;" (LX: 20.) The transition appears to be of the nature of that which is now-a-days experienced in the degeneracy of Christianity from its life and soul into their mere forms and ceremonies, and in its regeneration into the Divine image and likeness, as it were the reinvestment and revival of the dry bones of Israel, through the divinely appointed means of grace and an inspiration of the Breath of Lives.

But that the Great Pyramid is "an altar to Jehovah," independent of conversion from an altar to Osiris, may be seen by comparison with the altars to Jehovah in the land of Canaan.

The comparison will reveal the fact that these altars, when constructed of stone, and perhaps also when made of earth, or even of wood, with an overlaying of brass, were truncated pyramids, or perfect pyramids lacking the top-stone, or minus the apex, of whatever material the altar was composed.

The first example to which I will call your attention was the altar constructed by Elijah in connection with his famous "prayer test," by which it was to be decided who was worthy the worship and service of the children of Israel, Baal or Jehovah. Elijah said to the prophets of Baal, "Call ye on the name of your gods and I will call on the name of Jehovah; and the God that answereth by fire, let him be God." After they had prayed, "O, Baal, hear us," crying and cutting themselves with stones, and leaping upon the altar which they had made, from the morning until the evening sacrifice, "Elijah took twelve stones, according to the number of the tribes of the sons of Jacob, unto whom the word of Jehovah came, saying, Israel shall be thy name; and with the stones he built an altar in the name of Jehovah." 1 Kings XVIII:31, 32.

Now what was the form of this altar to Jehovah? We are not told in so many words, but we may infer it to a certainty by the number of stones made use of in the construction, and by the kind of stones required for such a purpose by the law of Moses. Therefore, what says God to Moses and the children of Israel on this subject? He says, "And if thou wilt make me an altar of stone, thou shalt not build it of hewn stone; for if thou lift up thy tool upon it, thou hast polluted it." (Ex. XX:25.)

In the 27th of Deuteronomy he calls these unhewn stones "whole stones;" and wholeness, we know, is characteristic of the globular form, in distinction from the angular. Moreover, globular stones, or bowlders, are the only stones found on the surface of the earth sufficiently numerous within a convenient distance, and sufficiently uniform in form and size, to be built into the orderly structure which we must suppose the altar to have been, without the necessity of breaking and rough-hewing them into conformity with its architectural design. And in what manner would you dispose twelve bowlders if you were going to lay them up into a shapely and substantial structure?

You would make a square of nine stones for a foundation, and on the upper interspaces of these, save one, you would place the remaining three of the twelve, would you not? You would then have a perfect truncated pyramid, lacking a stone for one of the corners of the second tier. What could Elijah do for the want of the thirteenth stone, consistently with the necessity of representing "the number of the tribes of the sons of Jacob" in the stones of the altar on which they were to offer their sacrifices to Jehovah? The difficulty had been provided for in the accustomed division of the tribe of Joseph into the tribes of Ephraim and Manasseh.

The significance of this provision appears to have lain in the microcosmic relation of the twelve tribes of Israel to the twelve signs of the Zodiac, as anticipated in the dream that provoked Joseph's brothers to sell him into Egypt. (Gen. xxxvii:9.) Those twelve signs represented twelve months in the year, in some way quite consistently with the fact that the absolute number of months or moons in the year was thirteen. In like manner the tribes of the children of Israel were ideally twelve and really thirteen, or twelve in one sense and thirteen in another. Each one of the "whole stones" of the altar may be said to have represented, not only a tribe, but a moon *(mensis)*, in relation to the function by which "the sons of God" are to "fill the earth with fruit."

But the Great Pyramid of Jeezeh was not an altar of sacrifice, like that built of twelve stones by Elijah on Mount Carmel; it was rather an altar "for a memorial unto the children of Israel forever," like that built of twelve stones by Joshua in Gilgal, as described in the 3d and 4th chapters of Joshua. In other words, the "altar to Jehovah in the midst of the land of Egypt," beside the Nile, was erected by a pious descendant of Adam for a shrine sacred to the memory of "the tree of life in the midst of the garden," beside the River of Eden, awaiting its reappearance "in the midst of the Paradise of God," beside "the river of the water of life," as described in the Revelation. Joshua's twelve-stoned altar of whole stones was built by him and the children of Israel in commemoration of their miraculous passage of the Jordan. Of necessity, on the principles

already explained, it was of the shape of the ordinary pyramidal tent of the patriarchs, which, like the Great Pyramid of Jeezeh, bore a correspondential relation, not only to the terrestrial sphere, but to the celestial also, as expressed in the 22d verse of the 40th chapter of Isaiah. It was, therefore, said to be "pitched in the place where they lodged that night." It was "pitched in Gilgal," that is to say, in the midst of a "circle," the immediate surrounding country, like the Great Pyramid in the midst of that circle which is partly formed by the shore line of the delta, or like "the tree of life in the midst" of a garden bounded by the circle of the horizon, which would naturally suggest the zodiacal signs of "the circle of the heavens." Moreover, the situation of Joshua's memorial altar was on the west bank of the Jordan; that of the Great Pyramid is on the west bank of the Nile; and, as the eastern and western sides of the Great Pyramid are parallel with the course of the Nile, so the much smaller memorial altar is likely to have been placed with two of its faces parallel with the course of the Jordan, adjusting it, like the other, to the four points of the compass, whether there was any deeper significance in this relationship or not.

The representation of the twelve tribes of Israel in the number of stones of the altar to Jehovah in commemoration of their miraculous passage of the Jordan, and also the proofs of the spherical figure of these stones, and of the consequent pyramidal form of the structure into which they were builded, are much more strikingly set forth in the story of the events in which these masonic particulars are involved than in that of the building of the altar of sacrifice by Elijah on Mount Carmel. By Divine command Joshua chose out and "prepared" twelve men, from each tribe a man, to take up twelve stones, each man a stone, from the bed of the Jordan, where stood the feet of the priests that bore the ark of the covenant, and to carry them to the place where the people were to lodge that night, and to lay them down where Joshua might be said to build them into an altar to Jehovah "for a memorial to the children of Israel forever." This is according to the most literal understanding of the narrative. The only dissatisfac-

tion with it is that though the dozen stones of which the monument was built were "a baker's dozen," and though the porters might reasonably be supposed to have been chosen and prepared with a view to a uniformity of Atlantian strength, and though each stone was as large as the most muscular man of his tribe could carry on his brawny shoulder, the architectural result was still far inferior to our conception of what it ought to have been in solidity and grandeur to worthily commemorate so memorable an event. The only escape from this adverse conclusion is to suppose that the men chosen by Joshua as representatives of the twelve tribes of Israel were his cabinet officers, appointed to superintend the execution of a work of which he himself was chosen by God to be the executive head. The builder of the Great Pyramid had more arms than Briareus, and no doubt Joshua had as many "hands" as he needed in the tent-like disposal of the stones which he is said to have "pitched in Gilgal." It is equally reasonable to suppose that the men chosen by Joshua as representatives of the twelve tribes of Israel to take up from the bed of Jordan as many stones as there were tribes, each man a stone, were chosen for their intellectual and moral, rather than for their muscular superiority, as men worthy of such a distinguished post of honor and trust, and that together they made a selection of thirteen huge bowlders of uniform size and sphericity, and detailed as many "hands" from their several tribes as they required for the accomplishment of the important work assigned them. For this idea I am indebted to a practical engineer, Mr. W. H. Searles, and I doubt not most readers of the *International Standard* will heartily endorse it.

If it be said that the words addressed to the chosen twelve, "take you up every man of you a stone upon his shoulder," forbids the idea of delegated labor, it may be replied that the man upon whose shoulders a superior lays the *responsibility* of a burden may be said to shoulder *the burden itself*, though he really imposes it upon the shoulders of a host of more common laborers, just as what they do with their hands by his direction he may be said to do with his own. The representatives of God's people Israel were their servants in the sphere of the

intellectual and moral, and the people were the servants of their representatives in the sphere of labor and execution, and the function of each was ascribed to the other, just as now in the United States of America. Indeed, I hardly see how this idea could be much more clearly expressed than in these words, ascribing to the children of Israel the execution of Joshua's command to his chosen representatives of the twelve tribes: "And the children of Israel did as Joshua commanded, and took up twelve stones out of the midst of Jordan, as Jehovah spake unto Joshua, according to the number of the tribes of the children of Israel, and carried them over with them into the place where they lodged, and laid them down there." Nine tribes laid down nine great bowlders for the square foundation or ground tier, and the remaining four tribes laid down four great bowlders upon the top of the nine for the upper tier, under the direction of Joshua, making a huge truncated pyramid, of which Joshua was the builder, for an enduring memorial of the miraculous passage, not only of the Jordan, but also of the Red Sea. (Josh. IV: 23, 24.)

You say that the Great Pyramid, as it came from the hand of the architect, was complete, with its capstone and casing-stones in place; and that, to represent this, the stones of the whole-stoned pyramid should be fourteen, and that these should represent fourteen tribes instead of thirteen. Well, Providence has provided for this also; and, if the Great Pyramid is to be restored to its pristine perfection, as proposed by L'Abbe Moigno, the number of the tribes of Israel is to be restored to its original completeness. Perhaps I should say, rather, that to the thirteen tribes of Israel is to be added a fourteenth, in accordance with a design mapped out on the soil of Egypt four thousand years ago. The name of Joseph (*addition*) signifies the addition of the first-born son of the chosen wife to the number of the sons of Jacob; but not so much this as the future addition of his two oldest sons, Ephraim and Manasseh, to the number of the patriarchs of the tribes of Israel; and not so much this as the ultimate addition of the long lost tribe of Joseph itself, in distinction from the tribes of Ephraim and Manasseh, to the tribes of Israel, making four-

teen tribes, instead of twelve, representable by the fourteen whole stones of the perfect pyramid, in place of the twelve of an unfinished pyramid, or of the thirteen of a pyramidal altar. My authority for this statement is the 48th chapter of Genesis, where Jacob says to Joseph:

"And now thy two sons, Ephraim and Manasseh, which were born unto thee in the land of Egypt before I came unto thee into Egypt, are mine; as Reuben and Simeon, they shall be mine. And thy issue which thou begettest after them shall be thine, and shall be called after the name of their brethren in their inheritance. For when I came from Padan, Rachel died by me in the land of Canaan, in the way, when yet there was but a little way to come unto Ephrath, and I buried her there in the way of Ephrath; the same is Bethlehem."

The reason here assigned by Jacob for adopting Ephraim and Manasseh for his own sons, (for such it is according to the true translation), implies that but for the death of Rachel in giving birth to Benjamin she should have borne him two more sons, making the full complement of fourteen sons in all. Saying that the two oldest sons of the first born of Rachel should be his, even as the two oldest sons of Leah were his, made their adoption as sons of Jacob unequivocal; and Moses seems to have confirmed this intention by assigning to the tribes of Ephraim and Manasseh a position on the west side of the tabernacle corresponding to that of Reuben and Simeon on the south side. Also, Jacob's saying, after the above, that the children to be born to Joseph after Ephraim and Manasseh should be Joseph's, and should be "called after the name of their brethren in their inheritance," made it quite certain that he intended the tribe of Joseph to be distinguished from the tribes of Ephraim and Manasseh, and equally with these to be included in the number of the tribes of Israel, though at what time they were to be called after that name we are not told. In my opinion, the time for this inclusion will be the second coming, as intimated by the Good Shepherd "that leadeth Joseph like a flock" when he said to his chosen twelve of the lost sheep of the house of Israel: "Other sheep I have which are not of this fold; them also I must bring, and they shall hear my voice;

and there shall be one fold and one Shepherd." (John x:16).

How then comes it that no other sons of Joseph than Ephraim and Manasseh are spoken of in the Bible as actually born to him, and that in the Land of Canaan the tribes of Ephraim and Manasseh were regarded as representing the tribe of Joseph, making it invariably proper to speak of the thirteen tribes in that land as twelve? It will not do to say that Joseph had no children after the two adopted by Jacob, and that therefore there was no separate tribe of Joseph; for Jacob's blessings were inspired utterances, and could not have referred to a posterity of Joseph never to have an existence. My explanation of the mystery is this: That the sons of Joseph not Jacob's were to be regarded for a certain length of time as of the same race with their mother; that they were therefore to reside with their father and mother in Memphis, in the neighborhood of the palace and the Great Pyramid, and after their father's death were to reside in Heliopolis, the city of their mother's relatives, in the neighborhood of the Temple of the Sun and the oldest of the obelisks, while the other descendants of Jacob continued to reside in Goshen, on the eastern bank of "the River of Egypt," the westernmost boundary of the Promised Land; also that for the same reason they remained in Egypt, respected as descendants of Potapheri, priest of On, and as worshippers of Isis and Osiris, while the recognized children of Israel were partly thrust out and partly suffered to escape as troublesome bondservants, to worship "the Gods of their fathers" in the Land of Canaan. Joseph was "separate from his brethren" as a tribe no less than as an individual, and the best part of the blessing pronounced upon his head by Jacob, and also by Moses, is yet to be fulfilled. His tribe remained in Egypt in offices of trust and responsibility similar to those with which he himself had been honored;—that is to say, they remained in the capacity of stewards, deputies, agents, trustees, superintendents, clerks, scribes, accountants, mathematicians, designers, artisans; and by inheritance from both father and mother, they were highly virtuous and religious. In short, they were *the Copts*, the ancestors of the most noted devotees and celibates of the early

Christian church, of such men as Cyril, Clement, Origen, Athanasius, Dionysius, Macarius and Anthony; and if the Copts of to-day are the only existing representatives of the ancient Egyptians, as they are said to be, it is because the superior blood of the Israelite was destined to assimilate and appropriate to itself all other blood, in fulfillment of the promise of God to Jacob at Bethel: "In thee and in thy seed shall all the families of the earth be blessed." (Genesis xxviii: 14.) Israel was the "little leaven hidden in three measures of meal until the whole was leavened;" and of these hidings the first was in Egypt, the second was in Assyria and the third was in Europe. The secrecy in the matter is like that attending the hiding of seed in the earth, in the midst of the materials which it is intended to appropriate, and out of which it is destined to arise in forms of transcendent beauty and utility; and the mystery surrounding the Egyptian descendants of "Zaphnath Paaneah," as they called his Pharaonic name, is a part of that which surrounds his marvelous work, the Great Pyramid of Jeezeh.*

A very natural objection to the idea that the Copts are the tribe of Joseph is this: That in the wars of the Pharaohs with the kings of Israel and Judah, these Coptic Iraelites, if they were such, were liable to be brought into unwelcome conflict with their brethren, and that this could hardly have been without the Bible saying something about it. But it is more natural to believe that they were entirely exempt from such unnatural warfare, for the simple reason that the characteristics inherited from Joseph as totally unfitted them for war as for common

*—This familiar allusion to Joseph as the builder of the Great Pyramid makes it necessary to inform the distant reader of the *International Standard* that it follows certain papers entitled "The Great Pyramid Built by Joseph, to Commemorate the Lost Paradise, and to Prophesy its Return," read before the Ohio Auxiliary of the International Institute for Preserving and Perfecting Weights and Measures, by the author of this article, less than a year ago. In view of the difficult choice between the upper and nether culminations of *a Draconis* as the pole star date of the foundation of the Great Pyramid, or else in view of a provable mistake of the Usher Chronology, by which it may be shown that Joseph's elevation to the vicegerency of Egypt was B. C. 2160, as well as in view of the fact that this unlimited discretionary power was conferred on Joseph on account of his divinely inspired wisdom and prudence, the reader is respectfully requested to defer his final choice between Melchisedec, Shem, Job, and Joseph, as the architect of the Great Pyramid, until the papers referred to can be published.

labor, and it was the policy of their Pharaonic as it is of their Mahomedan rulers, to keep them outside of all incentives and means to the attainment of national independence. They are nevertheless destined to take their place with the tribes of Israel as of the number of the people of God, making tribe No. 14, to be represented by the topstone of the pyramid of whole stones, invisible no longer, even as Joseph, the prototypal "Shepherd, the Stone of Israel," was represented by the top-stone of the pyramid built and dedicated by him to the Most High; and to this end, in answer to their "cry unto Jehovah because of the oppressors," Jehovah "shall send them a saviour, and a great one, and shall deliver them." Their "oppressors" —the "fierce king" and the "cruel lord"—are the Sultan of Turkey and the Khedive of Egypt, are they not? And the "saviour and great one," by whom Jehovah is to deliver them, are they not the tribes of Ephraim and Dan, omitted from the catalogue of the tribes of Israel in the Revelation because of being the executors of the judgments from which the seal that is put upon these tribes is the sign of exemption? I incline to think so, and to believe that the tribes of Ephraim and Dan are the "two witnesses," now lying lifeless "in the street of the great city which is called Sodom and Egypt, where also our Lord was crucified," but about to rise from the dead, as our Lord arose, to put an end to the 1,260 years' dominion of the beast and false prophet over the heritage of God's people. For not only the Egyptians, but the Assyrians also, that is to say, the Assyrianized Armenians, the ancient Arameans, whose history shows them to have been largely impregnated with Hebrew blood, and who include the descendants of "Laban the Syrian," cousins-german to the descendants of his son-in-law, Jacob the Syrian (Deut. xxvi: 5.), are to be associated with the tribes of Israel in the final inheritance of the promised blessings. "In that day shall Israel be the third with Egypt and with Assyria, even a blessing in the midst of the land; whom Jehovah of hosts shall bless, saying, Blessed be Egypt my people, and Assyria the work of my hands, and Israel mine inheritance." In this glorious consummation, the purpose of the altar and pillar to Jehovah in the land of Egypt will be

fully realized. In the fulfillment of His covenant with Israel, God will have fulfilled His covenant with Noah, in behalf of his three-fold posterity, Shem, Ham and Japheth. It will be the final restitution of all things, paradise regained, the new Jerusalem, heaven on earth. J. W. REDFIELD.

THE GRANITE LEAF.

Judging by all our experience in the construction of buildings in modern times, we naturally conclude that so large and intricate a structure as the Great Pyramid was not built without carefully prepared plans and diagrams worked out to scale. Upon some of these plans must have been delineated the shape, size and position of the several passages and chambers and their general relation to the whole Pyramid; on others, the details of each part with the mathematical and astronomical proportions of its design. A large amount of labor must have been bestowed upon these drawings, not only by the draftsmen who executed them but also by the architect in whose fertile brain were elaborated the many and complex problems that find expression in this enduring monument.

Would these plans have been preserved or destroyed upon the completion of the structure? It is true they would have then served their immediate purpose, yet in view of their intrinsic value as works of art, and their far greater value in the relation they bore to the noble edifice constructed after them, it is altogether probable that they would be carefully preserved. If it be urged that the Great Pyramid was meant to be a stupendous secret, standing unsolved through the ages, and that it would be essential to the keeping of that secret that all explanations of it should be destroyed, we reply that the Pyramid itself formed a safe depository for the plans—so safe, with its vastness and its unbroken exterior when completed, showing neither doorway nor window, and conveying no hint to the beholder as to how access might be gained, that its architect

might confide to its keeping in some hidden and appropriate receptacle the precious plans of his work, with the assurance that they would not be disturbed through the succeeding ages. But if the Pyramid was designed to be, not a secret forever, but a revelation and a witness to man in the last times, then it was important that the plans which explain it should indeed be hidden and forgotten for ages, yet capable of rediscovery by that generation of men for whom they were intended.

Now, if this be so in fact, and to us it appears highly reasonable and probable, we may inquire in the next place, do we know of any portion of the Pyramid to-day that would form a suitable place of deposit? As to its material it must not be the porous limestone of which the Pyramid is largely composed, for this absorbs moisture and gives off exfoliations, as seen in the Queen's Chamber, which would speedily ruin the articles deposited. No stone less hard and durable than granite would be trustworthy. As to position, the stone of deposit must be accessible after the erection of the Pyramid, so that the plans might be placed within it when no longer needed by the builder, yet so well secured as to preclude the possibility of its being disturbed by any casual visitor.

The corner stone, as in modern usage, is here naturally suggested to the mind, but a moment's reflection will convince us that the corners of the Pyramid were not suited to the purpose we are considering. They were far more exposed than are the corners of any vertical wall, and, as the event has proved, were susceptible of entire removal without endangering the stability of the rest of the structure, though not without greatly marring its beauty. The Great Pyramid has lost all four of its foundation corners, yet stands as firm and solid as ever. But those corners would not have proved to be places of safe deposit.

Turning, then, our thoughts to the interior, we reflect that the casket we are seeking, in addition to the qualifications already named, must have its real purpose concealed so far as possible, so that it may not tempt the curious either to open or destroy it. The renowned coffer of the King's Chamber would not have been a suitable depository on this account. It

stands conspicuously at the further end of the innermost room. The curious traveler here finds his steps arrested, and his attention is at once drawn to the coffer and to its possible contents. Its lid, if it ever had any, has entirely disappeared, and its sides are fast disappearing under the constant attacks of relic hunters. Whatever its contents may have been originally, we have now no evidence of their nature, and history is silent on the subject.

While continuing our search, we reflect, further, that if the plans were preserved at all they were preserved for the benefit of those who would appreciate them and be instructed by them—that is to say, for the benefit of those possessing scientific learning and mechanical skill. Hence, in order that the plans might, in the then remote future, fall into proper hands, their place of deposit ought to be able to resist the work of rude depredators and destroyers, and yet yield readily to the well directed efforts of the scientific explorer, and this, too, without injury to either the casket or to any part of the beautiful interior. Now, what portion of the whole structure, as known to us, will fulfill these several conditions other than the great Granite Leaf, so called, of the ante-chamber?

Its material is the enduring granite. Its position renders it perfectly accessible along the now open passages. By its size and method of suspension right across the ante-chamber from east to west, the ends being inserted in slots cut down vertically through the wainscots on either side of the room, it has been secured from molestation and injury at the hands of the many thousands who have passed it. Its purpose as a place of deposit is effectually concealed by its ostensible office of barrier to the King's Chamber. It is often called the portcullis, although it cannot be lowered from its position, 3 feet 7.7 inches above the floor. Its name of "Leaf," given by Prof. Greaves, was suggested by its resemblance to the sliding leaf or valve in a water gate. Its height from the floor is such that it can only be passed by stooping, and its apparent use as a barrier has whetted the curiosity of the visitors to pass beyond it rather than to stay and examine it. Its evident strength seems to have protected it from attempts to break it; its ends are so shielded

by the massive granite wainscots that no one has tried to dislodge it; its apparent solidity has protected it from any attempt to penetrate its interior. Finally, it is the only stone in the Pyramid, with the exception of the coffer, that was designed to be movable. The coffer may be shoved about horizontally on the floor of the King's Chamber; the Leaf is free to move vertically upward in the slots or guides prepared for it. It thus fulfills all the conditions which we have seen to be essential to a secure place of deposit.

The Leaf consists of two stones perfectly jointed together, the one placed upon the other. Both are just four feet long and about fifteen inches wide. The lower stone is perfectly squared and hammer-dressed; its vertical thickness is given as 27.5 inches at one end and 28 inches at the other. The upper stone is hammer-dressed on its vertical faces, but its upper surface has been left in its original and boulder-like condition, and is rounded up like the top of a "Saratoga" trunk. Its vertical thickness varies from 18 to 23.5 inches. The slots in which the Leaf is held are 16¼ inches wide, but the difference between this and 15 inches is partly made up by the increased width of the Leaf within the slots. There is nearly half an inch of clearance between the end of the Leaf and the back of the slot in either wainscot.

A writer in a recent number of "*British Israel*" (Sept. 6th) argues from the apparent construction of the parts, as understood by him, that the Granite Leaf is a horizontal strut or brace which serves to hold the wainscot stones against the walls. He thinks it probable that these stones conceal passages leading to other parts of the Pyramid. He suggests that the Leaf be raised to clear the wainscots, and that the latter be taken down in hopes of finding these supposed passages. Col. Howard Vyse, who suspected there might be openings behind the wainscot, bored through it in 1837, and found nothing but solid masonry.

But the Leaf does not act as a strut; it is free from end pressure, being a little shorter than the distance between the backs of the grooves in which its ends are inserted. The wainscot stands firmly on its own base without the aid of the Leaf. The

Leaf is as free to move upwards in its grooves as a window sash in its casing. Gravity alone keeps the Leaf in its place. The grooves, which are 3¼ inches deep, extend to the top of the wainscot on either side. The wainscots are 11.7 inches thick. That on the east side of the room is 103.1 inches high; that on the west side is 111.8 inches high from the floor. The height of the room is 149.3 inches. It is evident that the stones composing the Leaf were lowered to their place in the grooves, and that by a suitable application of power they may be raised again.

But the Leaf cannot be removed entire from the grooves because the combined height of the two stones is 51.5 inches while the spaces from the top of the wainscots to the ceiling are but 37.5 and 46.5 inches respectively. Hence the stones would require to be separated before they could be removed. The "boss," which is a solid projection near the middle of one side of the upper stone, suggests by its flat under edge, its bevelled sides and rounded top, the proper point of application of an upward force. Being only on the upper stone, it suggests that that one only is to be lifted; but if both were raised together the height of the wainscots would soon compel their separation. Does not the whole arrangement say with the expressiveness of a tableau, this stone is intended to be raised, this cover is to be lifted? Then comes the irresistible conclusion that the Leaf is hollow, and that something of value is stored within it. Why may not the plans of the pyramid be found here?

Suppose the cover of this great stone trunk to be lifted, and its interior found to contain the tablets or plates of the original plans of the Pyramid in all its parts, how greatly would this discovery transcend all others hitherto made at the Pyramid? Supposing these documents now to lie concealed in the Granite Leaf, how easily they may be obtained by the use of proper appliances without doing the least damage to the Leaf or the chamber. How readily, with the perfect clue thus obtained, could we direct our efforts to open up those other chambers believed by many to exist, but of whose position in the Pyramid no one at present has the least knowledge. How much

building; how much labor and expense; how much disappointment might have been saved those explorers of half a century ago and in earlier times had they only made the examination here suggested! Instead of which by brute force and gunpowder, and guided only by a blind fancy, they tore up a part of the floor in the King's Chamber, they made an ugly hole in the corner of the ante-chamber, they dug over the entire floor of the Queen's Chamber, they destroyed the exquisite finish and form of the niche, and penetrated the solid masonry to a considerable distance behind it; they went outside and from the south face tunnelled a ragged hole, everywhere doing irreparable mischief, and all without accomplishing the least good or adding a single valuable item to our stock of information.

Returning to our consideration of the Granite Leaf, we find from its dimensions that it would contain, if solid, a little over 18 cubic feet, and that its weight would be about 3,000 pounds. The upper stone alone, if solid, contains about 6.5 cubic feet and would weigh about 1,100 pounds—no very great matter to raise with proper appliances. According to our theory, however, the Leaf is not solid, but contains a large space for storage. If we suppose the sides of the lower stone to be 3½ inches thick, the ends 6 inches and the bottom 4 inches, we have left an interior capacity 3 feet by 8 inches wide by 2 feet deep or just 4 cubic feet. In the upper stone we may have a corresponding cavity 3 feet long, 1½ feet deep and 8 inches wide, giving 3 cubic feet. The total space would then be 3 feet by 3½ feet by 8 inches, the two parts closing together like a backgammon board. What wealth of information might not be packed into these seven cubic feet? The remaining solid part of the Leaf would weigh about 1,850 pounds, of the upper stone only about 580 pounds. It is truly remarkable that this trifling weight has never been lifted in modern times.

It is, of course, mere conjecture that the plans and diagrams of the Pyramid are contained in the Granite Leaf, but though these should not prove to be the exact nature of its contents, yet a proper investigation of this peculiar pair of stones is almost sure to reveal some record of the greatest interest to the world. The absence of all engraving or picture or legend in

all parts of the Pyramid thus far explored leads us to believe that in some securer place were deposited the records that will reveal the motive for the construction of the Pyramid and the clue that will unravel all its mysteries. What place is more likely to have been selected for this purpose than the massive Granite Leaf which is the principal feature of the ante-chamber, even as the coffer is the principal feature of the King's Chamber? The coffer has been opened none can tell how long, but who will open to us now the leaves of this stone book, sealed as it has been for more than four thousand years?

WM. H. SEARLES.

METRIC ANALOGUES.—CONCLUDED.

In the present state of the debate it is unnecessary to exhibit historical and existing dimensions much further in detail. From the nature of the case, the adjustment of the measures of weight and capacity will have to await the determination of the scale and method of linear measure.

Just here, those who may have the curiosity to consult the authorities, with the foregoing compilation before them, will be struck with the following facts:

Of all the known dimensions definable under the generic name cubit, ranging from the purest form of the Egyptian cubit,= 17.5104 English inches, as derived from the schœnus, and tolerably transmitted in the Nahud cubit and present Egyptian fathom, up to the 30 inch geometric cubit of Abyssinia, about 65 per cent, reckoning the quotations numerically, represent Ezekiel's cubit within the limits assigned by Sir Isaac Newton. This includes the familiar 24 inch builder's gauge, probably diffused, along with other joktanic dimensions, by the artificers and merchants of Tyre.

Of the major perch, for measuring land, over 85 per cent are fair approximations to the perch proper of 250 inches, 10 Ezekiel's cubits, 1-10 of the side of a square acre, and of the old arpent of France.

Of the minor perch or rod, ranging from 10 Egyptian to 10 Mosaic cubits, about 98 per cent fairly approach a perfect rod of 200 inches, 1-50 of the boundary of a square acre = 8 great cubits.

Of the builder's reed, a little over half are represented by a length of 100 inches or 4 great cubits, a decimal of the entire boundary of a square acre, and nearly equivalent to the Hebrew kaneh.

Of all forms of the fathom, about 57 per cent are referable to a dimension of 3 Mosaic cubits, an even decimal of the hour-angle applied to the *mean* circumference of the earth. Several forms of the vara in Spain, South America and Mexico, and of like measures in other countries, are half such a fathom, very closely.

The board standard of Great Britain, the joktan of Guinea, the jumba of Malacca, and the tung of Sumatra agree exactly in length. This seems to be due rather to the commercial ascendancy of ancient Tyre than to any inherent merit in the dimension itself, or in the duodecimal reckoning. The vulgar fathom, the yard, the Indian cubit, the palmo (established as the standard foot in China 1,600 years ago), the 4½ inch tempoh of Sumatra and the wiswūsa of Malwah, and the 2¼ inch nail of England descend from it by bisection. In Japan the fathom and foot are about 1-96 short of the standard, while in several Oriental and European localities the fathom and yard seem to be derived by bisection from Ezekiel's reed, and even from a dimension of 10 Egyptian cubits, and so are longer than the British dimension.

Six-cubit reeds upon all the cubits mentioned are found throughout Europe and the East. As to this group, France and the Mediterranean countries exhibit them all; Germany and the Low Countries, the Babylonian and Ezekiel's; Spain and Portugal, the Babylonian and Mosaic; Switzerland and Annam, the Egyptian and Babylonian; Sardinia and Turin, the Babylonian; Denmark, Hindostan, Egypt and Arabia, Ezekiel's; and China, the Mosaic and Ezekiel's. Double and quadruples of such reeds also occur; the Scottish chain was six

Ezekiel's reeds, and a measure of ten Ezekiel's reeds appears in Bohemia, Dantzic, Poland and Siam.

The foot, under various names, ranges all the way from the palmo and quarta of Arragon and Saragossa, = 7.5888 inches, up to the Hebrew foot, so-called, about 14.4 inches, really 1-10 of the joktan. In central Europe a large portion are clearly, like the Arabian foot, bisections of Ezekiel's cubit, rather than versions of the real duodecimal foot of Babylon and Tyre. In some localities it is divided duodecimally, in others by 8 or 16—the Syrian method. The Japanese foot, and the Chinese in all its forms, are divided decimally. The same practice prevails latterly in some parts of Europe and among engineers in this country and Great Britain.

The inch, therefore, to use the word generically, varies all the way from the Egyptian finger, 1-24 of their cubit, = 0.7296, up to the Russian verschock, = 1¾ English inches. It is not apparent, either from the authorities consulted or from the traditions of the Hebrews so far as ascertained, that the 12-inch foot, in any of its forms as a dimension in linear or square measure, was ever used among them as a part of their system. But the examination of both ancient and modern measures shows conclusively that, for minor uses, some form of the inch is and always has been demanded by the common sense and convenience of men. A very eligible one is 1-100 part of a dimension like the Hebrew kaneh or ordinary builder's reed, quoted by Alexander as = 103.2462 English inches, a little more than the length of the granite floor in the ante-chamber of the Pyramid, or than 5 Memphis cubits, or than 4 great cubits as derivable from the Arabian mile, and nearly 1 82-100 inches less than 6 Egyptian cubits. The antiquity of the Turin and Nilometer or Memphis cubits is as yet by no means proved. For reasons which will, I think, sufficiently appear in due time, I prefer to regard the length of the granite floor and of the entire ante-chamber, when considered together, as designedly indicating a *ratio*, rather than precise dimensions. And, indeed, it would not be surprising if the Egyptian priests, or whoever undertook the adjustment of the royal cubit—whether it was done after the Persian invasion or not—or even Al-Mamoun him-

self, if his idea was to seek in the Pyramid for the true length of the sacred cubit, made a mistake in this very particular.

It has been well said by contributors to this Magazine, that by whatever linear scale we measure the Pyramid, the *ratios* come out the same. This is in consequence of a general law which may be thus expressed:

All quantities and dimensions are so related that if we take any number of them, chosen at will, and arranged in any order of sequence we please (say around a circle, for simplicity), the *difference* between any two of them is the *algebraic sum of all the intervening differences*, and the *ratio* between any two is the *product of all the intervening ratios*. It is a corollary from this that, given the π ratio, we may frame an analytical unit upon any chosen division of the circle, and by means of it, the proportions of any geometric structure like the Pyramid, in which that ratio is a dominant idea, will be perfectly revealed in simple expressions. And yet, in the hands of such investigators as J. Ralston Skinner, Mr. Latimer and J. H. Dow, whether we adopt the analytical unit they have used as the best one that can be devised or not, how potent an implement has it been in disclosing most important relations and astounding facts that otherwise might have remained buried for ages!

Now it is impossible to regard the remarkable correlations brought out in the compiltation of itineraries, without being strongly impressed that it has always been the demand of philosophy that the measures of men should be earth-commensurable. And, aside from the Pyramid, the dimensions of the ancient measures, as they are handed down by the best authorities, the Egyptian, Phenician and Persian cubit, and the agrarian schœnus, even decimals of the earth's circumference divided into 9 parts; their fathom, mile and great schœnus into 3, and the parasang into 6; the Mosaic cubit, a decimal of the division into 72, monumented by the number and arrangement of the Sanhedrim and by the fractional division of the capacity unit, and the itinerary into 18, all agreeing with the mean circumference to within at most an inch and a half in a mile; and the Philetairic or Syrian mile, a decimal of the division into 16, conclusively show that at or before the dispersion,

not only the π ratio and the properties of the circle, but the figure and mean radius of the earth were known with a precision which modern research, seeking to recover the lost heirlooms of pre-historic time, has failed to impeach.

And it is too much to believe that the best thinkers, among men so far advanced in mathematics and astronomy, would fail to recognize, not only that the radius rather than the circumference is the sole foundation upon which a system of geometry can be created and circular relations ascertained, but the finer proposition that a curve line cannot logically apply to direct or square measure.

The compilation shows also, in strong relief, the confusion that has resulted from founding the cubit upon different divisions of the circumference, and from departures from the decimal system. It also shows that not Babylon (perhaps aided in the start by Joktan himself) with her elaborate and costly culture stilted upon a mixed foundation of logic and empiricism, her circle divided into 360 degrees with sexagesimal subdivision, her cubit the subtense of 1° on a radius of 1200 inches; nor Tyre, "wiser than Daniel," alone among the sons of Joktan to hug and propagate the duodecimal method; nor Syria with her octonary system; nor plagiarizing Greece and Rome, nor all the astute reasoners on the relations of direct and circular measure and the mystic properties of numbers, have succeeded in deranging, to any great extent, the decimal arithmetic. Fractional relations have always tended to gravitate within the unit, and beyond a term or two men have reckoned decimally from the beginning, and will so reckon to the end of time.

THE MEASURE OF HUMANITY.

Measures, their dimensions and methods, are for man, not man for them; and not alone for the gifted few—the Saffords, the Colburns and the Bernouillis, who grasp and solve the most complex relations with the speed and directness of the Cherubim, but for the many, the slower toilers upon the plane of earth. And they should be every way meet for the bodily as well as for the intellectual needs of humanity at large. Their

relations and methods should be the simplest, most easily comprehended and severely logical that can be devised. It was for this that the sacred cubit was an even decimal of the radius, or else of the half axis of the earth. True, it is denied by many, and not a few well informed Jews to this day, that the Hebrews ever had a greater cubit than the Mosaic. And the learned translator of Josephus (Whiston), or at least his annotator (Burder), following Cumberland's "weights and measures," argues from a large but rudely averaged array of historical measures that the utmost dimension was 21 inches. And even the Lord Bishop of Peterborough, whose version of the Mosaic cubit is universally adopted, failed to distinguish it from the "cubit and a hand breadth" of Ezekiel, and so misinterpreted Ezekiel's reed. This is easily explained. From the days of the prophet till now the opposers of innovation and sticklers for the finality of the very letter of Moses could deceive themselves and delude others into the belief that the dimension to which a hand-breadth must be added was but the Egyptian and Persian or else the Tyrian cubit, or both, introduced among the people, with other abominations, by idolatrous kings; and that the object of the legislator in that particular was simply to restore the sacred measures of Moses.

But if the astonishing development of the greater cubit—the full arm-length—and its products, along ethnological lines which clearly radiate from about the head of the Mediterranean and the Euphrates, and from Arabia, and ranging in time from Cyrus the Great down to the expulsion of the Moors from Spain, be not a sufficient refutation of the error, and proof of the force with which the logic and convenience of the measure appealed to thinkers and people alike, surely it should suffice to say that the great reformer, the most advanced thinker and dauntless Hebrew of his time, wrote as a *Hebrew*, spoke of the *Hebrew* cubit only, and treated all the institutes, both of Moses and of the old temple, as largely provisional and liable to be displaced by more salutary forms in the fullness of time. And it can scarcely affect this point of the argument if we assume or admit that the dimension was already, to some extent, in use among peoples who may have derived it from earlier sources.

It may yet prove to be true that in some cases it rests on underlying lines pointing to the lost Atlantis. But Ezekiel was legislating for his *own people.*

A further crowning proof is suggested by a mathematical idea which seems to be involved in the vision by the river of Chebar. (Ezek. i: 4-22, and x: 7-22.) The vision coming as in a "whirlwind"—"a fire infolding itself" (vortex—revolving system)—the attributes and motion of the "four living creatures"—imbued with divine life and light throughout, motion in all directions; in a straight line, "they turned not when they went; they went every one straight forward," (v. 9, emphasized by repetition in v. 12 and 17;); their going and coming "as a flash of lightning," (instantaneous and simultaneous); the "wheel in the middle of a wheel," (as representing the logical system under which the Cosmos and the Divine are to be apprehended), animated with the spirit of the cherubim and inseparable from it; under infinite relations, the boundaries "so high that they were dreadful," (overwhelming and inconceivable in extent); "the firmament * * * * as the colour of the terrible crystal" (fathomless and transparent to infinite bounds);—all suggest the cherubim—the Living Thought—as in the manner of an all-pervading and ubiquitous *ray* of Infinite Life, Light and Power. And it surely is the simplest matter of human experience that in contemplating the Infinite, the Divine and the Absolute, the intelligence is always at the center, and the measure is not the circumference nor any of its parts, but the *radius of the conception.*

The older Hebrew system, like the Egyptian, was an intinerary, with the fathom so divided as to give a tolerably convenient manual cubit for other purposes. This dimension, considered with reference to the human organism, between the Egyptian cubit or fore-arm and the full arm length, is an index of its transitional, provisional place and character.* It is not a

* The entire Mosaic system was, on the face of it, a compromise. So far as yet known, it may have developed by the commercial necessities of the times, at or after the Nimrodic dispersion. This is proved, not only by the dimension of the cubit and the relation which the intinerary bears to the Babylonian degree, but by the capacity unit, which was a cubic duodecimal or the Joktanic foot, subdivided decimally, but with fractional divisions also, according to circular measure, such that each one of these was even

natural measure; *i. e.* it is nowhere directly contained or suggested in the human organism.

With the Egyptian cubit it is different. Taking the average height of a full-sized man at 70 inches, the length from the elbow to the tip of the middle finger is its ¼ part. And from the hip joint to the knee, and from the knee to the ground, it is fairly represented twice. But above the hip joint it does not appear, unless we may take the space occupied by the head alone at half a cubit. This is the division of some sculptors and painters, who, for their work, divide the human height into 8 parts, of which the head occupies one. Others divide by 7½. But with this cubit, the fore-arm, it is not easy to strike a circle.

The resort, for a tolerably large circle, must be to Ezekiel's cubit, from the shoulder with the full arm. A circle of about the same diameter, 25 inches, can be struck with the feet on the ground, the legs in easy position as a compass. The same dimension is the natural easy step in ordinary business. It is one of the most natural *human* measures to be found.

As to the inch, both the Egyptian and Mosaic cubits were divided into 24 fingers, a departure from the decimal method. This was convenient enough, fractionally, but not in calculations for more general or finer purposes. We are again reminded that the mystic builders, in their symbolic system of edification (see Mason's Monitor) explain that the division of the 24-inch gauge refers to *time*. It is a *witness* to the circle, but not a *measure*, except provisionally, for neophytes. Both the Egyptian and Mosaic cubits, by their derivation and subdivision, suggest the same thought.

Dr. Epstein shows (the key to the Tabernacle, the 47th of Euclid, note, p. 39) that in the Hebrew language, the expressions for "a cubit of Eden," "a righteous cubit," "an Israelitish cubit," "a Hebrew cubit," and "the cubit of the people," according to the numerical value of the Hebrew letters in

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inches. The unit of weight was 1—2000 of the weight of the capacity unit in water—the shekel; this, in silver, was the money unit. It was equal to ½ oz. avoirdupois. Unless an earlier date can be assigned to it, the main facts are consistent with the theory that it was the work of Peleg and Almodad. (Genesis x: 25-29).

integers, are all 25. This novel and astonishing coincidence is in strict harmony with the inductive theory that the ancient mathematicians divided the sacred cubit into 25 inches,* so that the inch becomes a pure decimal of the double axis or cross within the circle—the Atlantean cross. This oldest symbol of the cherubim marks the indispensable division of the horizon by the cardinal points, of the habitable earth into four quarters upon the site of the Pyramid, of the year, the month and the day. The geometers of the chosen race, after devising the compromise before spoken of, with astonishing foresight, seem to have reserved the sacred cubit for purposes of arbitration till the proper time for its restoration.

In this way the inch, as its name imports (Saxon, ince, from *Gr. oncos*, a hook), became aptly represented by the first joint of the middle finger. This restores the natural foot, 10 inches, to its proper decimal relation. And taking 70 inches as the normal height of a man, the head, to its natural division from the trunk, occupies 1-7. The 10-inch foot, then, is a unit. The foundation and the capstone are at one.

The plane which divides the outer from the inner court of this living temple—the vital and nutritive functions from the rest—is through the navel, tangent to the top of the pelvic cavity. The division is as 3 to 4. Here are two convenient collateral measures for special and limited use, not units, but composed of units—above, the 30-inch cubit of Abyssinia; below, the 40-inch ell. And the half reed is the proper cord measure, 50 inches instead of 48. These three, taken together, represent the 47th problem of Euclid, and so do the rod, the perch and Ezekiel's reed. And the cord, a double cube, measured by the cubit, gives the diagonals:

$$2\times\begin{cases}\sqrt{2}\\ \sqrt{3}\\ \sqrt{5}\\ \sqrt{6}.\end{cases}$$

*Keeping in view the proclivity of geometers to confound circular with direct measure, it is easy to understand the error of Eratosthenes. By a sort of inversion of this division of the sacred cubit, the royal cubit became so adjusted in his hands that, by a 3-cubit fathom, his itinerary was a decimal of 1-25 part of the terrestrial circle, consequently of the entire surface reduced to a square. Steering by a Babylonian chart to avoid the Scylla of his time, he seems to have plunged into Charybdis.

Another natural measure is "the invisible straight line" from the end of the thumb to the tip of the middle finger, with which Dr. Epstein (*International Standard*, May, p. 92) endows the primitive inventor, as a radius wherewith to unfold the mysteries of geometry and letters. It is the natural span for itinerary, practically 6.56 Pyramid inches, 3-8 of the Egyptian, = 3-10 of the Mosaic cubit. From the end of the thumb across the entire hand, and again from the outside of the hand to the tip of the middle finger, the distance is the same, so that we have the equilatetal triangle. And oddly enough, if we draw a line from the tip of the finger to where the opposite chord crosses the "line of life," it divides the angle as 2 to 3. Ten such are a natural fathom, fairly represented by the arms moderately extended. It is a decimal of the hour-angle upon the terrestrial circle.

Neither the 12 inch foot nor the yard are represented in the human organism, unless we take the latter, as its name imports, as a *girdle*.

The sacred cubit being taken as 10, the Egyptian is 7—the sabbatical division. And the full stature, reckoned by the 10 inch foot, is also 7, and the sanctum sanctorum is the crowning unit. And by the inch and by his allotted term of years, man's measure is three score and ten. And as 7 is to 10, so is his height to the arithmetical reed. Lay the line, "according to the measure of a man," around the mighty finish-base of Ghizeh. Its circuit is a year, the four seasons hand in hand, and the reed is a day. It marks the *time*.

Why man is so framed that the natural measures of his living tabernacle and the stages by which his movements and very thoughts proceed, are thus related to the earth whereon he dwells and to the circling hours of endless time; why this body embraces the entire system of geometry; why all this under *decimal* relations; and why the toiling multitudes built these very relations and dimensions into the Pyramid upon the lines of indefinite endurance, ask as we may, who can tell?

In fact the decimal method is established by the law of the circle. The smallest commensurable arcs which have commensurable functions are the 1-8 and 1-12, and their common

measure is the 1-24. By the method of extreme and mean ratio we obtain the 1-5 and 1-10, and by comparison with the 1-6, the 1-15. Extreme and mean ratio is obtained by means of an incommensurable arc, whose tangent is ½ radius. Add another whose tangent is ⅓ and we obtain the ⅛. For this reason we resort to the general method of bisection for the first time in this remarkable arc, and obtain the 1-16. The common measure of all is the 1-240. This exhausts the resources and satisfies the demand of strict geometry, and at the same time emphasizes the relations of the round bodies. From the cylinder upon the diameter down to the cone upon radius the relations are expressed by integer hour-angles.

Ezekiel's silence as to itinerary is construed as a recognition of the distinction between circular and direct measure. The sacred numbers, strictly speaking, are 2, 3, 5 and 7; 2 is the universal number of assurance; 3 is the celestial number, peculiar to circular division—its function is exhausted in the ascertainment of the hour-angle; 5 is the scientific number, and 7 the sanctuary number set apart—it cannot enter as a factor into the modulus of arithmetic. And we see at once that in the circle only two geometric divisors, 2 and 5, subsist between the 1-24 and the 1-240. Below the latter there is but one, that is the general divisor 2. And the only practicable modulus of arithmetic which shall embrace a prime number and contain no factor twice, and at the same time be comprehensive in its application to the circle, is 10.

The incommensurability of the circle, and the inapplicability of direct or square measure to the periphery or surface of a sphere, seems to be intimated in the 47th chapter of Ezekiel, where the measuring angel applies his line along the drainage of the sanctuary. At the distance of 1,000, 2,000, 3,000, and 4,000 cubits, respectively, the depths are to the ankles, the knees, the loins, and overhead. They are as the squares of the distance, the ordinates of a circle (the arc being small) from its tangent. Singularly, the *diameter* of this circle is the *radius* of the earth. The allusion must be to the "wheel in the midst of a wheel." It is not easy to express the full scope of the symbol by a diagram, or more than feebly hint it in words. How-

ever, if we conceive a circle to roll as a wheel upon the interior of the periphery of a circle of twice its diameter, the epicycloid described by each point of the circumference of the interior circle is a *straight line* passing tnrough the center of the greater circle. And the two ends of any one diameter of the minor circle continually describe the great cross of Atlantis, and define upon it the sines and cosines of the angle of progress. The same is true if the two circles are developed into spheres. And the idea seems again to have been involved that the Logos —the Reason—darts everyway in straight lines, and the measure is *radius*—a ray. Otherwise, at the fourth term the difficulties are unfordable.

In the prophet's day the correlation of leading systems of itinerary was simple and easily understood. It might have been sound policy not to push the reform in that direction too far at the time. Perhaps "the full reed of six great cubits" indicates a preference for the Persian method over others. Yet, in the vision by Chebar, the wings of the cherubim seem to divide the circle by 16, the foundation of the Syriac mile. And at the close of the book, the circumference of the city, 18,000 measures, is consonant with the Mosaic. The gates divide the circuit into 12 parts, with intervals divisible by 15.

ANGELS' MEASURE.

There is little risk of over-rating the calibre and range of the major Hebrew prophets. In the treatment by Isaiah of the complex malady of King Hezekiah, and the rectification of the dial of Ahaz, we have a glimpse of a wise adaptation of means to ends, and a command of resources, founded on a knowledge of nature more comprehensive and just than existed in his own day among the sages of Babylon, or was afterwards reached even by Aristotle. And the work of Ezekiel reveals a statesman, mathematician, architect and engineer of unsurpassed purity and attainments. As an instance, the Dead Sea and the river Jordan are below the sea level. And in the 47th chapter, before referred to (verses 6–12), along with the mathematical lesson and the charming moral conveyed, there seems to be a distinct prevision of a scheme of internal improvement, lately

revived in English circles, no less than to make this valley a means of inland navigation by connecting it with the Arabian (or possibly the Persian) Gulf.

In this and the other prophetic writings, and so of the Apocalypse, the demonstrator of the vision is a divine messenger or angel. In both Ezekiel and the Apocalypse, the logical structure is on the same model—that of the Pyramid—a circle revealed in a square—the edifice erected on the most enduring foundation and upon the stablest and simplest lines, with the apex heavenward. Yet there are notable differences both in method and scope, representing an important total advance, or rather recovery, along the lines of human thought and aspiration during the intervening lapse of nearly 700 years.

Out of the typical city and temple of Ezekiel has risen a pure and more expanded archetype, lifted from earth,in the economy of which the individual man is immortal. And yet the application of the purest and simplest logic of geometry to the earthly wants of humanity seems, as a part of the groundwork of the vision, to be fully maintained.

The widely diffused, but mistaken projection of Ezekiel's measures into itinerary, along with the capricious subdivision of the Greeks upon geographic measures borrowed from Syria, Judea and elsewhere, had,in the course of events, by confusing the old correlations, opened the way for a purer division of the circle. It was probably in recognition of this, that the Greek astronomer, Posidonias, instituted in Egypt his itinerary of 240,000 stadia to the circumference of the earth, close upon the dawn of the Augustan age.

And in the framework of the vision, the revelator, departing from the method of Ezekiel (Rev. iv: 4.), divides the *firmament*, as a symbol of the Divine, into 24 parts, by the four and twenty elders. And after the *seven* lamps comes a remarkable emphasis of this division by 24, in endowing each of the *four* living ones—the seraphims of Isaiah—with *six* wings (verses 6-8). But for all general purposes and grand relations the decimal enumeration is adhered to throughout the book. And the stigma or mark affixed to Babylon, as an ideal without symmetry or rational geometric symbol—a recurrent number or rep-

etend—"six hundred three score and six" (ch. xiii: v. 16-18), is the most intense mathematical sarcasm on record.

It is impossible to read the unfolding of the New Jerusalem from the ideal city of Ezekiel squared out upon an earthly plain, expanding from ten miles square to a cube upon twelve thousand stadia, (ch. xxi: v. 10 *et seq.*) without realizing the subtle force of the argument with which the writer draws the mind from finite dimensions towards a conception of the Infinite. And just here comes in the thought, suggested by the very argument of St. John, that the ancient division of the circle by 12, though having a rational foundation, is short of perfection. It is attached to a finite figure—Plato's cube. And the same as to the division by 36, which can only be inferred by adding together three substantively distinct groups, the foundations, the gates and the angels. Indeed this very symbol, the cube, presents in its most complete group the number 24, the number of right or perfect angles which make up its 8 solid angles. But as infinity comes into view, the finite lines and determinate directions of Plato* vanish. The idea is every way from the center. What then is the "golden reed," precious and incorruptible, which the measuring angel bears, withal to span this infinitely precious, boundless and everlasting domain? It is the measure of the reason—the logos—the light—the ray—the *radius* of the conception.

St. John's definition is obscured by a singular redundancy in the translation.

"And he measured the wall thereof, a hundred *and* forty *and* four cubits, *according to* the measure of *a* man, that is, of [the] angel." (ch. xxi: v. 7).

The conjunctive in the numeral is unimportant. But in the original the terms 'man' and 'angel' are both used in the abstract and generic sense. The real translation is, "an hundred forty-four cubits, man's measure, which is angel's." They are one and the same.

Immeasurably below the exalted ultimate scope of these books

*—It has been said that Plato regarded the earth as a cube. The truth is that he used the cube simply as a symbol of geometric perfection. Passages in the Phædon and in the Timæus abundantly show that in common with others who had been taught by Socrates, he viewed the earth and the Cosmos under spherical relations.

as this application of their underlying logic to our special line of inquiry may be, still it must be borne in mind that the Divine law is a unit, and the relations which subsist must be universal, from the Cosmos to the atom, and from the Godhead to the monad. This crowning theorem of ancient philosophy, the theme of Newton's incomparable general scholium at the close of his Principia, which excludes pantheism on the one hand and fatalism on he other, and does not admit even the conception of a universe,

"Whose *body* nature is, and God the *soul*,"

except perhaps in a poetic sense, was most fitly formulated by the late Rev. Dr. Joseph Torrey, in immortal words, perhaps never printed. "For God has established all things under strictly mathematical relations."

And it is in perfect keeping with this idea that we find throughout, both in the Great Pyramid and in the sacred books, an insistant expression of mathematical relations which are the simplest and purest possible.

And ultimately a perfect system of weights and measures will bear for its motto the words of St. John,

"*Metron anthropou, ho estin angelou.*"

JACOB M. CLARK.

REMARKS ON MR. DOW'S REPLY TO MY CRITICISMS.

Mr. Dow, in his answer (pp. 101–102 of the *International Standard*) to my criticisms, discards the "length of the mean solar year as a factor in the fundamental formulæ which are to test inspiration," which he says "we must look for elsewhere." Now, this is a very sweeping proceeding, for if the Pyramid is not intended to give us precise information as to the length of the year we cannot expect that it will give any information respecting the distance and diameter of the sun, and other astronomical facts of much less importance to the great bulk of mankind than the length of the year. In this view, then, the

science of astronomy and the higher mathematics are not represented in the Pyramid, and no reliance can be placed upon the astronomical results derived from Pyramid data. I must, however, say that I cannot concur in this view, and that I believe the astronomy of the Pyramid will be found to be very strong evidence in favor of the inspiration theory.

With respect to the grand gallery I would ask whether Mr. Dow can express its length in terms of the granite floor length of the ante-chamber, or the length of the King's Chamber, of course using the British and not the Pyramid inch? And if not, can he explain why the inch which yields the beautiful results given in his highly interesting series of equations will not give equally striking and important results when used in connection with the measures of the grand gallery and the length of the year?

I. LENGTH OF THE SECONDS PENDULUM AND TRUE LENGTH OF THE PYRAMID INCH.

In my communication which the Society did me the honor to print in the first uumber of the "*International Standard,*" I stated that from the relations between the length of the year and that of the King's Chamber, and Professor Piazzi Smyth's measures of the length of the Chamber in British inches, I had found that the Pyramid inch is 1-987th greater that the British. Afterwards it occurred to me that an equation for the length of the seconds pendulum might probably be derived from Pyramid data, and on looking over my papers I found that I had some time ago obtained equations which, with slight and very obvious modifications, at once gave the length of the seconds pendulum and the force of gravity at the equator in Pyramid inches. Thus, for the length of the pendulum we have:

1. $\frac{2170.192}{10\ \pi\ \sqrt{\pi}} = 38.97385$ Pyramid inches.

2. $\frac{365.2423 + \times 56}{30\ \pi^2\ \sqrt{\pi}} = 38.97385$ Pyramid inches.

3. $\frac{412.1318 + \times 28}{30\ \pi^2} = 38.97385$ Pyramid inches.

And for the force of gravity:

1. $\frac{2170.192\ \sqrt{\pi}}{10}$=384.6564 Pyramid inches.

2. $\frac{365.2423+\times 28}{15\ \sqrt{\pi}}$=384.6564 Pyramid inches.

3. $\frac{412.1318+\times 28}{30}$=384.6564 Pyramid inches.

Now numerous and very carefully made observations have shown that the length of the seconds pendulum at the equator is 39.01326 British inches, and the length in Pyramid inches being 38.97385, it follows that the Pyramid inch is 1-989.2th longer than the British, which comes remarkably close to my previous determination from Professor Smyth's measures of the King's Chamber.

2. THE ORIGINAL LENGTH OF THE BRITISH INCH AND ITS RELATION TO THE PYRAMID INCH.

A careful comparison and analysis of the results given by Mr. Dow and Mr. Latimer in their very interesting papers, and some of the results of my own calculations, have led me recently to conclude, notwithstanding its apparent improbability, that two different inches were used by the architect of the Pyramid —one which enables us to trace the relations of all the various parts of the Pyramid, and has special reference to the length of the year and of the Grand Gallery—and the other that which is clearly indicated in Mr. Dow's equations and is related to the divisions of the circumference and diameter of the circle, and which has reference to certain parts only of the Pyramid. This second inch, however, is not the present British inch, since I find that while the Pyramid inch is 1-989th greater than the present British, it is only 1-1036th greater than the inch indicated by Mr. Dow's equations; but there can, I think, be little doubt that the length of the inch thus indicated is the original length of the present British inch. And now the question arises, are the Pyramid and original British inches connected by any simple relation? Looking at the numbers given above, the chance of discovering one seems at first sight rather unpromising; but assuming that the correction for reducing original British to Pyramid inches would be a function

of the length in Pyramid inches of the King's Chamber, I ultimately found that the following equations hold good, P representing any number of Pyramid inches, and B the equivalent number of original British:

$$P = B - \frac{B}{412.1318 + \times \sqrt[5]{100}}$$

$$B = P + \frac{P}{412.1318 + \times \sqrt[5]{100} + 1}$$

By the use of these equations I have obtained for the length of the King's Chamber, 412.131889 Pyramid inches; and for the length of the tropical year 365 d., 5 h., 49 m., 1.26 s., which is nearer to the length calculated from astronomical data for the epoch of the birth of Christ than any other length hitherto derived from Pyramid data.

JOSEPH BAXENDELL.

THE OBSERVATORY, BIRKDALE, SOUTHPORT, August 17, 1883.

A BRIEF REJOINDER TO MR. BAXENDELL.

The preceding article by Mr. Baxendell, which I have examined in manuscript form, seems by some accident to contain an error. He says: "I ultimately found that the following equations hold good, P representing any number of Pyramid inches, and B the equivalent number of original British:

$$P = B - \frac{B}{412.1318 + \times \sqrt[5]{100}}$$ " &c.

Now if P represents *any* number it may represent *one* and the equation would read:

$$1 \text{ Pyr. inch} = 1 \text{ Br. inch} - \frac{1 \text{ Br. inch.}}{412.1318 + \times \sqrt[5]{100}}$$

But this makes a Pyr. inch *shorter* than a Br. inch, which Mr. Baxendell certainly does not mean to affirm.

Did he not mean to say that

P. inches *in a given distance* = B. inches in *same distance* minus $\frac{\text{Same No. Br. inches}}{412.1318 + \times \sqrt[5]{100}}$?

Another point seems to me to be mathematically weak, unless I misunderstand the writer's meaning. Mr. Baxendell "assumes" the length of the King's Chamber in Pyr. inches to be a function in the equation for obtaining Br. inches from Pyr. inches, and then *by the use of these equations* he has "obtained" for the length of the King's Chamber 412.131889 Pyr. inches. How can the "assumed" differ from the "obtained"? Are *two* Pyramid inches used by the architect? If so, what are they? Is one based on the present year length and the other on the length of year at the Christian era? But if present year length is found there, why not also present British inch?

I did not intend so sweeping a proceeding as Mr. Baxendell understands me to make. With him I believe that "the astronomy of the Pyramid will be found to be very strong evidence in favor of the inspiration theory," and that "it will give us precise information as to the length of the year." But the puzzle is how to find the precise year-length there. We certainly cannot assume its value in the base from our present astronomical knowledge, for we do not know the year length *ad infinitum*, as we know π by a process of pure mathematics.

Does it not seem more probable, since π is the all important function in Pyramid science, that primary formulæ will be obtained by some simple, positive calculation, depending mainly upon π, and that complex astronomical data, such as the length of the mean solar year, will be derived as secondary formulæ, by some logical, Pyramid-attested process from the primary equations? And can any objection whatever be offered to the diameter-from-integral-circumference method, except that we are disappointed in not obtaining 365.242+ in the base or in the Grand Gallery? This is, indeed, a great disappointment, yet the evidence of the presence of the British inch (differing possibly a shade, though less than a hair's breadth, from the modern) in the King's Chamber is so conclusive, and the equations obtained by its use are so perfect, that I must accept them though they may cast uncertainty upon the Pyramid inch. If Mr. Baxendell can produce full confirmation of his Pyramid and British inch equations, and can substitute for the 412.1318+ an expression which we may extend to an indefinite number of

decimal places he will have accomplished the grandest discovery made in Pyramid science since the days of John Taylor; for such equations will put the stamp of exactitude upon the astronomical record. J. H. Dow.

BIOGRAPHICAL NOTICE OF MAJOR-GENERAL HOWARD VYSE.

This short notice of Major-General Howard Vyse, the most extensive of all the excavators and explorers of the pyramids of Egypt, ought to have appeared in your previous number of *The International Standard*, along with his likeness; but the MS. seems to have been lost in the postal transmission to America. Having been requested, therefore, to forward another notice for the next number of the Magazine, I again refer, in doing so, to the obliging letter of the present Colonel Howard Vyse for a few particulars of the family of his late father, the major-general. My correspondent had written as follows:

"I am afraid there will not be much to communicate; for except as regards his work in Egypt, my father's life was a very uneventful one. He was born at Stoke Place, in the county of Bucks, 25th July, 1784, his mother (who died at his birth) being Miss Howard, daughter of Field Marshal Sir George Howard, knight of the Bath, colonel of the regiment of the Buffs, governor of the Chelsea Military Hospital; and the Lady Mary Howard, daughter of William, Earl of Stafford, of Wentworte Castle, and one of his co-heiresses. He married in September, 1810, Miss Hesketh, daughter of Mr. Henry Hesketh, of Newton near Chester. He served for some years in the Fifteenth King's Hussars, and afterwards, in 1816, in the Second Life Guards, from which regiments he retired as major and lieutenant-colonel in 1826. He was for many years equerry to His Royal Highness, Ernest Augustus, Duke of Cumberland, afterwards the first King of Hanover. He sat for some years in Parliament for the borough of Honiton, and afterwards for the borough of Windsor. He carried on his work at the pyramids of Gizeh in the spring and summer of 1837. I must add that the portrait of which my brother has sent you photographs, we all consider to be a most *unflattering* one, but my father always had a great dislike to sit for his portrait, and excepting a bad one done by himself, this is the only likeness of his existing."

On application being made to the Rev. Granville Howard Vyse for a photographic copy of the above likeness of his father, he at once most kindly consented, stating that the original "was a crayon sketch taken about fifty years ago by an

artist in Naples." To this gentleman we all owe thanks for enabling you to reproduce a likeness in your Magazine of the worthy man who did so much in excavating and measuring at the Great Pyramid and, unknowingly to himself, helping so largely to lay the foundation (which had been commenced two hundred and fifty years ago by Professor Greaves, and further carried on by the French savants under Napoleon I in the beginning of this century) for a subject so vast and important as the theory of the Great Pyramid has now developed into. John Taylor, of London, adding Howard Vyse's measures to those of his predecessors, and reasoning on them accurately, was the first to announce the Great Pyramid to be no less than a primeval monument of divine inspiration; a momentous conclusion, since then abundantly proved by the three keys required for the opening of its sacred and intellectual treasures—key the first, of pure mathematics; key the second, of applied mathematics; key the third, of positive human history, past, present and future, now to be found collected in the Old and New Testaments. In the Great Pyramid the world now possesses a *monument* of inspiration, as it has long possessed a *Book* of inspiration; one dating altogether, and the other partly, from primeval times. And in the most elevating and encouraging aspect to all the human race, the subject has now at last brought many able intellectualists of the mathematical and Christian, rather than the Egyptological and nationalistic, order into the field for prosecuting the noble inquiry further still.

Had the worthy Major-General Howard Vyse been spared to see the wonderful development of the subject connected with, and depending so much on his measurements at the Great Pyramid, we can well imagine the satisfaction it would have afforded his devout mind to know that he had been instrumental in helping forward so grand and good a work.

In the year 1840, three years after his return from Egypt, he published his three superb volumes entitled, "Operations Carried on at the Pyramids of Gizeh in 1837, with an Account of a Voyage into Upper Egypt and an Appendix."

This work contains a vast amount of correct and trustworthy information of various kinds, and has been of invaluable assist-

ance to many a traveler in Egypt as well as to many a stay-at-home student of Egyptian lore. But it is therein both instructive and curious to remark how constantly Howard Vyse reverts to the Great Pyramid as the one impressive and all impressing point to be attended to in Egypt. Had he then *known* what the Great Pyramid had to unfold there need have been no surprise; but seeing he had only been taught to think of it, as one among many other similar monuments of interest, and knew it was not run after by fashionable tourists, because it had no artistic sculptures about it, it appears now as if he had been providentially led in his secret soul to bestow so much care and expense as he presently did on that *one* great monument, preparatory to its becoming his pearl of great price.

During all the time he was in Egypt he was known as Colonel Howard Vyse, and as such we may now most familiarly and directly allude to him, though our excellent dragoman (Ibrahim), when we ourselves were subsequently in Egypt, preferred to speak of him, after the lapse of more than a quarter of a century, as "the *good colonel.*" For this said Ibrahim had been a youthful attendant on him in 1837, and, largely from his training then, was to us a most faithful and good servant in 1864-5, but has since paid the debt of nature.

Colonel Howard Vyse arrived in Alexandria on the 29th of December, 1835, and in the end of February, 1836, visited Syria; but between the time of his arrival and departure for that country of hills and valleys, he occupied himself busily prospecting in or near Cairo; and during a remarkable night-ride along the banks of the Nile he seemed to obtain the first glimpse of his future work, his peculiar destiny to be the chief explorer of the pyramids, the most important and mysterious objects contained in that ever important and mysterious land of Egypt. "Those pyramids," he wrote next morning, "particularly the Gizeh group, how they attract my attention and hold my thoughts—both from their grandeur and the simple majesty of their forms, from the remote antiquity and uncertainty of their origin, and also from the peculiarity of mysterious construction; since, after the investigation of many ages, doubts are still entertained not only as to the purpose for which the pass-

ages and chambers already discovered were originally intended, but in a much greater degree respecting any other passage or apartments which might reasonably be supposed to exist in these enormous structures,"

"An additional interest arose from the great probability that they were the works," not of the idolatrous Egyptian Pharaohs, but "of the Shepherd Kings, whose descendants, according to Manetho, after their expulsion from Egypt, under the denomination of Philistians, built in Syria *Jerusalem!*"

These remarks, and a further note by the good colonel in his valuable book on Bryant's "Ancient History," go a long way to prove how readily his religiously disposed mind would have accepted the present developed theory of the inspired and scientific teaching of the Great Pyramid. For he says of Bryant, whom he had been quoting for the early history of Arabians and Chaldeans: "No person can examine his works without being convinced of the great extent of his learning, of the soundness of his conclusions, and, above all, of his profound conviction of the truth of Revelation, as well as of the unerring justice of the Almighty. The candor and simplicity of his character, and the benevolence of his disposition, are apparent in his writings; and it may with justice be observed, that the chief object of his learned primeval chronological enquiries, through a long and laborious life, was a zealous and humble endeavour to 'assert Providence, and justify the ways of God to men.'"

Though the colonel did leave Egypt for his long intended tour in Syria and Asia Minor early .in 1836, yet we find him returning to it at Alexandria on October 25th, and setting out the very next day for Cairo by the Mahmondie canal. He had not like Jonah endeavoured to fly from his appointed work at the Pyramid, though like Jonah he found the responsibility cling to him. So no sooner was he re-arrived in Cairo, than he made most extensive and generous arrangements with a professed Italian excavator, M. Caviglia, and an English clerk of the works, a Mr. Hill, to engage any number of Arabs, and explore at his expense before and above everything else, the Great Pyramid. Feeling then very sanguine of the success of

such extensive operations under such practiced superintendents, and leaving strict orders to have instant message sent to him when the excavators should come to anything unexpected, he set out on a quiet journey of exploration by himself to view the whole Egyptian land up to the cataracts.

Returning thence on the 24th of January, 1837, and repairing immediatelyto the Great Pyramid, what was not his vexation to find that M. Caviglia had almost entirely neglected the Great Pyramid, and was using the means so largely given to him by the colonel for another object, in seeking for mummies and little green idols in the neighboring burial pits. Worse too than that, for the loquacious, gesticulating Italian waxed furious and abusive; declared that *he* only had the head to conduct excavations and to understand the value of "*curios*" and "*anticos*," the colonel having nothing beyond the money. But never did mutineer more mistake the man he was dealing with, for, discharging M. Caviglia at once, the colonel took his practical place, sat down before the Great Pyramid as a fortress to be besieged, and through winter and spring and the burning summer of Egypt, long after all travelers had left the country, became the sole director of operations, clerk of the works and paymaster of his hundreds of workmen, day after day and month after month, until they had wrought out his own ideas of pyramidal exploration to the full. For not only was he one of those men who was never known to turn back after having put his hand to the plow, but he was a religiously minded man, a devout Christian, who felt that he was in this case called to a certain work for the Master, and though in the first instance he had distrusted himself in a new field of labor so that he had thought it better to use the purchased help of the Italian professional, yet when that failed he became a most admirable example to all kinds of men, rich and poor alike, of giving himself to the work, putting his own shoulder to the wheel, and never quitting it until the end was gained, during all the time, too, preserving the utmost urbanity, but dealing out the strictest justice in a manner that made a most honorable and lasting impression on the tawny Arabs around him.

Misfortune followed one of the ships in which he embarked

some of his more portable finds, such as the highly ornamented sarcophagus of King Mencheres of the third pyramid; for that vessel was lost in a storm off the coast of Spain in deep water, and no man will see again—until the day of judgment if indeed then,—the selfishly superb lying in state which that king, the restorer of the animal idolatry of old Egypt, after the blessed episode of its being strictly interdicted by the agency of the Shepherd Prince, Philitis, during all the period of the building of the Great Pyramid, had prepared for himself.

But the colonel, with all his valuable papers touching the Great Pyramid, returned safely to his own land and forthwith devoted his time to their preparation for the press with a zeal which astonished his friends, and particularly the county gentlemen around him,—but gained him the respect of some of the first literary and scientific men of the country, including among the latter Sir John Herschel, whose essay on the date of the Great Pyramid and its connection with the altitude of the polar star, *a* Draconis, at the time of its erection, contained in the colonel's second volume, has made use of the firmest point that the world possesses for fixing the true chronology of early times.

MRS. PIAZZI SMYTH.

THE TOOLS OF THE PYRAMID BUILDERS.

The arts and civilization of the early Egyptians have furnished a theme to writers and travelers from the time of Moses downward, and scores of books have been written giving minute descriptions of the pyramids, the temples, the tombs and the ruined cities that attest the wonderful progress of a people who, situated in a land of overflowing fertility, where the burden of procuring a livelihood was exceedingly light, were able to turn their energy into other channels, and more than 4,000 years ago produced achievements that have never been rivaled. All this has been told and retold, but when we inquire how these architectural feats were performed, and how the stone was quarried, transported, carved and raised into its place, authors are

silent or else talk mysteriously about mechanical powers that have been lost, and the superiority of the ancients over us even in the matter in which we pride ourselves the most. The fact is that few men who have studied Egyptology have been fitted by their previous training to investigate mechanical processes, or from a number of scattered fragments to arrive at the nature and construction of the tools employed; and Egyptologists in general have been too fully occupied by the more seductive study of the language and social customs of the people to give any attention to these matters. Hence it is that until quite recently we have had but very vague ideas upon the means employed by the builders and masons of the pyramids. A recent investigator, however, Mr. W. M. Flinders Petrie, has brought a sudden accession to our stock of knowledge, and by careful observation and the collection of a number of samples, mostly half-finished articles, damaged and rejected in manufacture, he has arrived at the most unexpected and startling conclusion that the hard stones employed by the Egyptians, the diorite, basalt, and granite, were cut by jewel-pointed tools, used in the form of straight and circular saws, solid and tubular drills and graving tools, while the softer stones were picked, and brought to true planes by the aid of trial or face plates. Mr. Petrie has embodied the results of his novel and most interesting researches in a paper read before the Anthropological Institute; and on this we have drawn for the following account of the specimens and results, which will also be described in Mr. Petrie's forthcoming volume on "The Pyramids and Temples of Gizeh." The first and most important point is that the principle of action of the tool was by plowing out the stone by fixed cutters, as in a planing machine; and not by grinding, as with a lapidary's wheel. The proofs of this are that the cut surfaces do not show a smooth ground surface, as a stone sliced with a diamond dust does, but a grooved surface, like freestone cut by a toothed saw, or like rough sawn timber. And that this grooving is not due to the action of any loose powder is proved by the grooves being just as deep in hard stone (like quartz), as they are in softer stone (like feldspar), where both

occur side by side in the same specimen. The examples of this grooving we illustrate here.

The first (Fig. 1, one-half actual size, as are all the illustrations of this article) is a core from a tube drill hole in granite;

FIG. 1

on this in one part, a continuous spiral of the lines of cutting may be traced for a length of three feet, passing five times around the core; and though, owing to rocking of the drill, it cannot be traced from end to end, yet no shallowing or widening of the grooves, indicating wear of the cutting point, can be seen, in the course of the continuous spiral. The second (Fig. 2) shows the lines on basalt produced by the successive strokes of the saw; their regularity, both in depth and in distance apart, shows unmistakably that they are due to successive strokes of the cutting point and not to any accidental or irregular causes. On other pieces of granite, diorite, basalt, and limestone, similar marks may be found. One piece of diorite shows grooves 1-100 in. deep cut without any irregularity in starting of the tube, and a piece of drill hole in diorite shows seventeen equi-distant grooves, probably equal to a cut 20 feet in length, without any appreciable difference in the groove from one end to the other. The fragments of diorite bowls, with incised subscriptions, which were picked up by Mr. Petrie

at Gizeh, show also the use of a graving point far harder than

FIG. 2.

quartz, since the hieroglyphs are made by a cut with jagged edge, and not either scraped or ground. These are of the earliliest period, as they bear the names of Semaferu and Khufu, the two oldest kings of whom any contemporary remains are known. Considering these examples of work, the definite grooves produced, their depth, continuity and equality throughout, the capacity of the cutting point for dealing with the hardest materials, and the rapidity with which the cutting was done, the tube drills sinking 1-10 in. in granite at every revolution, it seems certain that no instrument but a metallic tool set with fixed jewel points could produce such results. The passage of the grooves without any interruption through the quartz, feldspar, hornblende and mica of the red granite (as seen on the specimen of Fig. 1) is also a feature which shows brilliantly the capabilities of the tools, and the skill with which they were constructed. The strain on the cutting points in thus passing from a softer material into a patch of quartz would be enormous, far greater than if working continually in quartz; and yet there is no starting, no burring, and no failure of the cutter. If examples of work done by any grinding process be examined. it will be seen that there is not a trace of the definite grooves, such as are in the specimens alluded to. On modern lapidaries' work, done by a wheel fed with loose diamond powder, numerous shifts in the plane of the cut may be seen, showing the outline of the wheel, but no grooves or definite ploughings in the material produced by individual points of diamond. Similarly in the tubular drillings done with soft iron and sand by the

Chinese, or in similar work by other nations, there is never seen any trace of ploughing out of the material; and, indeed, it seems physically impossible that any particle of a loose powder could become so imbedded in a soft metal by the mere accident of rubbing, that it could bear the immense strain needed to plough out a groove of considerable depth in such a hard material as quartz, or make a groove passing continuously through hard and soft material without any interruption or difference. This systematic use of jewel points set in some basis may, therefore, be considered as proved by the existing work, and the fact that the loose sand left in a cut and also the side of the cut are found to be stained green, leads to the conclusion that the metal of the setting was bronze.

What the jewels were is not known. The range of possible material is limited to five minerals—beryl or emerald, topaz, chryso-beryl, sapphire, and diamond. Experiments made with beryl and sapphire show that their edges will fail under far less pressure than is necessary to produce cuts such as above described. Some amorphous stone is needed, and it is only the scarcity of diamonds which makes us obliged to refer to corundum as a like agent. The forms of the tools were just such as our modern experience has led us to use in the present generation. Long straight saws, circular disk saws, solid drills, tubular drills, hand gravers, and lathe tools were all made on the same principle of jewel points set in a metallic base, while hammer and chisel, pick and hammer dressing were also freely used where suitable. The straight saws were certainly as much as 8 ft. in length, as they cut a granite coffer 7 ft. 6 in. long from end to end. Their thickness varied from 0.2 in., as on large blocks of basalt, down to 1-30th in. on a small syenite trinket. The principal examples of sawing are the granite coffer of the Great Pyramid, on which the saw has been twice run too deep, and on each side of which the grooves of the saw may be seen; the granite coffer of the Second Pyramid, where the saw has been run too deep on the bottom, though the marks are polished out elsewhere; and a great pavement of basalt ⅓ acre in area, containing some thousands of blocks, all sawn into form, and finally fitted together. This last adjoins the Great Pyramid, and

is probably coeval with it. A fragment from it is shown in Fig. 2. A hand specimen of sawing in gray syenite, picked up at Memphis, is here illustrated (Fig. 3). It is probably a piece of

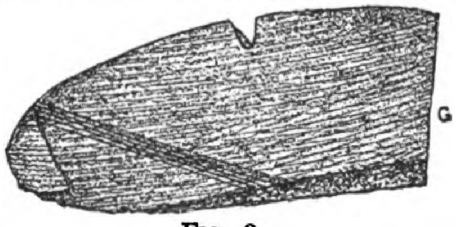


FIG. 3

a statuary's waste, and is sawn on four sides, and has a cross-cut also on the top. Of circular saws we have but one evidence as yet; this is a slice of diorite (Fig. 4), with the repeated cir-

FIG. 4.

cular sweeps so familiar to our eyes on steam sawn timber. These must have been produced by the successive revolutions of the most prominent cutting point at the side of a disk edge set with jewels; and though the surface has been polished, sufficient traces of the lines remain to show their character and to prove by their exact equality, uniformity of cut and regular spacing apart that they are not due to any casual or accidental cause.

It has been suggested that the marks might have been produced by a series of points set on a flat rotating face for planing down the flat bottom of a dish; but beside the fact that no flat-bottomed dishes are known, and that the polishing lines cross the surface in all directions, it would need greater skill to set a row of stones on a face to exactly the same level as to make such marks, than to set them on an edge for slicing. So the simplest explanation of the specimen is that a circular saw was used. Though sawing was thus freely used for cutting the outsides of the great granite and basalt coffers, some other means was requisite for the hollowing out of the insides of such vessels. Here the inventive genius of the fourth dynasty exactly anticipated modern devices by adopting tubular drills as the

readiest and cleanest way of removing material with the least waste of force. These tubular drills varied much in diameter, thickness and length. Those in softer materials, as alabaster, were smaller and thinner, not needing to carry set stones on the edge, but being merely worked with powder. But the

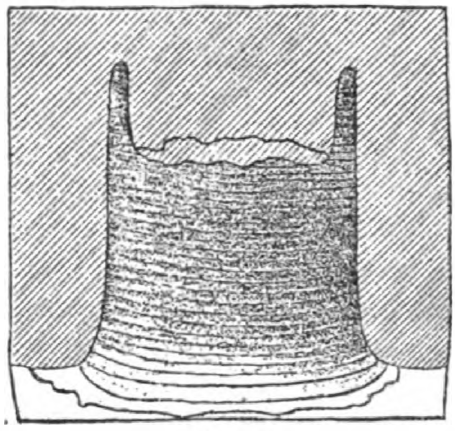


FIG. 5.

larger ones, used for hollowing out granite on a large scale, were usually about four inches in diameter. One of the finest examples (about two inches in diameter) is in the pivot-hole of a door in a lintel of the granite temple at Gizeh, built by the king of the Second Pyramid, Khafra. This is shown here (Fig. 5), drawn from a cast which Mr. Petrie obtained by means of a gutta-percha mold. Here it will be seen that the core could not be broken out entirely, owing to its running into a tough patch of hornblende. The granite core already described (Fig 1) is also a fine illustration of tubular drill work, and would be considered a creditable result by modern men using modern tools. The various examples of such drilling that have been found, mainly at Gizeh, may be tabulated thus:

Diameter.	Material.	
.24	Alabaster.....	Tube .02 thick (Fig. 6); others up to
.7	"	Tube .04 thick.
1.8	Basalt	A hole in a vase.
1.9	Limestone.....	A core.
2.2	Granite.....	Tube .1 thick (Fig. 5).
2.5	Alabaster.....	A core.
2.8	"	A core.
4.2	Granite.....	Inside of Great Pyramid coffer.
4.5	Greenstone.....	Fragment of waste.
4.8	Limestone.....	Two holes joined (Fig. 7).
4.8	Diorite.....	
18.0 (about)	Limestone.....	Rock dressing.

Of these the holes inside the Great Pyramid coffer show the length of drill used, as they end about 8 inches below the top. The holes in limestone show how closely they were placed together for hollowing out material; and the holes were all skilfully placed so that each annular groove of the tool over-

FIG. 6.

lapped and used as much as possible of the cut next to it, so as to economise labor to the utmost. The rock dressing at El Bersheh shows apparently the use of large tubular drills for clearing away masses of rock; the surface of a large excavated platform being covered with circular grooves, smooth around their bottoms as if produced by a continuous cut, and not by chisel work, and just joining one another. This could not be the result of cutting out columns, as the rock surface is rough broken both within and outside of the smooth grooves, and the grooves sometimes interset. This work is probably of the twelfth dynasty, or about 2000 B. C.; and hence later than the pyramid work, which is the principal subject of examination in the present inquiry.

Hence it seems almost certain that the tubular drill principle, of which examples are here described from ¼ inch to nearly 5 inches in diameter, was carried still further into sizes suitable

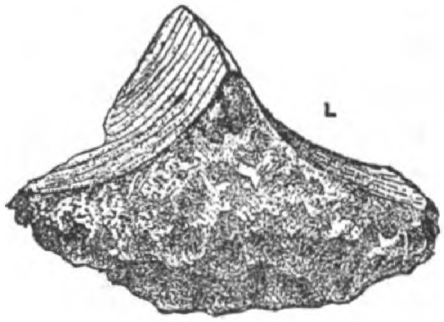


FIG. 7.

for removing rock on a large scale; sizes which must have needed several men to turn the capstan head of the drill. Many other traces of the use of tubular drills were mentioned, as, for

instance, in roughing out statues, but more particularly for beginning the hollowing of the insides of vases and bowls, which were afterward finished in the lathe.

A peculiar feature of the cores and holes made by the tubular drills is a certain amount of tapering, which is always to be found. This tapering cannot have been produced by the mere rubbing of the side of the drill in turning round in the hole, since not only would such a cause be quite inadequate, but the grooves plowed out by the cutting points are just as distinct on the sides of the tube or core where it is tapered, as on the lower part. Hence it seems that not only did the Egyptians set cutting jewels round the edge of the drill tube, as in modern diamond crown drills, but they also set them in the sides of the tubes, both inside and out. Thus the holes were continually rimered larger by the tool, and the core turned down smaller as the cutting proceeded, and so the tool could be withdrawn

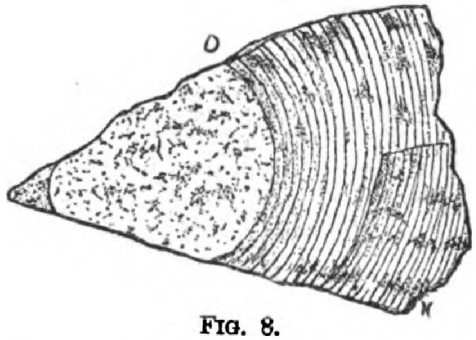


FIG. 8.

more readily from the groove, as the annular space was thus wider at the top than at the bottom. Other drills, not tubular, were used for very small holes, such as those in the symbolic eyes, which are drilled in syenite, 1.2 in. long, and only 0.08 in. in diameter.

Experiments made by the author seem to show that the minimum pressure upon a 4-in. drill could not be less than half a ton, and was probably two tons, and this is amply confirmed by the speed at which the tool is seen to have been advanced, and is in accordance with the experience of modern engineers. Upon the granite core (Fig. 1) the grooves are a double spiral, showing that they were made by two stones at opposite sides

of the tube; the pitch of the thread is 1-10th in., the circumference of the core about 7 in., and therefore the rate of sinking was 1-70th of the distance traveled by the tool. The wonder is how any bronze tube or saw-blade could bear the requisite pressure without doubling up, and how the jewels could be set in sockets to support them against such a violent drag.

Not only was a rotating tool employed, but the further idea of rotating the work and fixing the tool was also familiar to the earliest Egyptians. This is evidenced by the fragments of bowls turned in diorite. One piece of the bottom of a bowl (Fig. 8) shows the characterized marks of the turning. Not only are there the circular grooves of the jewel-pointed tool, but also the marks of two different centerings, showing that the work had been displaced by the force applied in turning, and afterwards reset, but not accurately, the old and the new surfaces meeting in a cusp. Other specimens of turning in black granite, basalt and alabaster, all of the pyramid period, were exhibited by the author. The finest examples of turning in hard stone, however, are in the British Museum. Among these are a small, highly-polished, narrow-necked vase in diorite, or rather in transparent quartz with veins of hornblende, which has its neck only 0.05 in. thick, and a large vase of syenite turned inside and out remarkably thin considering the size of the component crystals. But the greatest triumph is a bowl of diorite (No. 4,716), translucent and full of minute flaws, which must render it very brittle; yet this bowl, 6 in. in diameter, is only 1-40th in. thick (.024) over its greater part; just around the edge it is thicker, but a small piece broken out of the body of it shows its extraordinary thinness, not stouter than a thin card. An alabaster vase, of Unas of the fifth dynasty, almost rivals this in thinness, being only 1-25th in. to 1-30th in. thick, but the softness of the material makes it of far less interest. A very favorite plan for narrow-necked vessels was to turn them in two parts and join these together, sometimes finishing off the inside on a fresh centering on the lathe. One example shows that the early Egyptians were familiar not only with jewelled turning tools, but with mechanical tool rests, and with sweeping regular arcs in cutting. A

fragment of a diorite bowl (Fig. 9) shows that the original

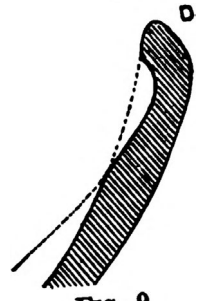


FIG. 9.

article was turned as a segment of a sphere inside by a tool working from a fixed center in the axis of the lathe, with a radius of 3.94 in. Having cut this spherical curve, the center of play of the tool was shifted about .5 in. higher, and .7 in. out of the lathe axis, and a fresh arc on the bowl was struck from this fixed center, thereby cutting out a fresh curve which left a raised lip round the edges. The proofs of this explanation of the process are found in the exact equality of the two curves—that of the bowl in general and that under the lip—in the fact of the principal surface exactly coinciding with the inner edge of the lip, in the fact of the circularity of the section of the curves, and in the cusp formed where they meet, an awkwardness which no hand turner would ever take the trouble to make, but which necessarily results from a sudden change in the center of the arc of the tool. All these details have been worked out by the author from very careful measurements of the fragment, using successive templates of slightly varying radius to measure the exact curvature, etc.

In addition to the tools we have already described, graving instruments were employed in the production of intricate forms. Blocks of stone were likewise hammer dressed; sometimes saw nicks were cut ½ inch deep round a block, and then the hammer dresser was left to work the surface down to the plane of the grooves. Also on sawn blocks the surface to be placed in contact was usually hammer-dressed to have sufficient space to hold the cement, while the edges were left quite smooth. For dressing surfaces to a true level the regular custom of the workmen was to use a trial or face plate,

prepared as a true plane and smeared with red ochre; wherever the ochre came off on the stone they knew there was an excess, and accordingly dressed it off. The tool used appears to have been a sort of small adze, with which the stone was sliced down very delicately and regularly by hand. All the blocks of the Great Pyramid casing were prepared with these facing plates, as may be seen by the remaining touches of ochre on the prominent points. Not only on building stones, but also on rock dressing, the same ochreing is visible. Where the stone was much larger than the facing plate, as was the block of granite over the King's chamber doorway, about 8 ft. by 12 ft., then a diagonal draft was cut along the stone from corner to corner, and thus any wind in the plane of the face was avoided. In a painting at Thebes the workmen are apparently shown chiseling down a stone to a plane face; they have a string stretched quite clear of the stone over an offset block at each side, and are then applying an offset piece to the face of the stone to see whether the face is in excess. This is a skillful method of working, as an excess does not bulge out the string, and can be exactly measured as they proceed, while the string does not need to be removed, as the chisel can be used under it. Working on a vertical face the bellying of the string does not affect it.

This completes the list of Egyptian tools dealt with by Mr. Petrie, but he adds many interesting details of the methods of building and quarrying, which, however, we can hardly notice as fully as the tools, since they do not present so great a novelty. The center lines of passages were carefully marked in red to guide the workmen, and reference marks were added in case the first grew illegible or were covered up. In the rough courses of the mass of masonry of the pyramids the irregularities of the stones of one course were let into the course below them, thus each course bears on it a sort of plan, sunk to different levels, showing the stones that came above it. The method of fine dressing all the limestone was by carefully picking, as if with a small adze, and the standard of flatness appears to have been that no more than a couple of inches across should miss touching the true plane within the thickness of the smear of ochre. The method of quarrying limestone was by driving galleries into

the hillside and taking out a stratum of stone, leaving the hill standing above on the support of pillars. The manner of raising the blocks is not known except by inference, and that points to rocking them and packing them up on two piles of timber near the center; but this does not afford a satisfactory explanation of the way in which some of the stones were got into place. For instance, the lower granite portcullis of the Second Pyramid, a block that would require forty to sixty men to lift it, was slid on its edge along a passage only 3½ ft. wide, and then slewed round in a complex way to turn it up into the grooves prepared in the rock for it to slide in. Not more than four men could well work at it, and these in a cramped space; some great advantage of leverage skillfully applied must have been available.

These investigations of the mechanical methods employed by the pyramid builders are but a small portion of the researches carried on by Mr. Petrie during the two winters' residence in a tomb at Gizeh. The main object of this work was the accurate surveying of the pyramids with instruments of first-class precision, the results being obtained to within one or two-tenths of an inch over ground half a mile across, by means of an extensive and closely-checked triangulation. We hear that the Royal Society have recognized the value of the work, by giving a grant for its publication from the Government Grant for Research; and we may soon expect to have a full account of the instruments employed, the measurements obtained, and the bearing of these on the various theories of the pyramids, besides various historical and architectural notes, and a discussion of new methods in the mathematical treatment of observations.—*Engineering News.*

PYRAMIDAL FREEMASONRY.

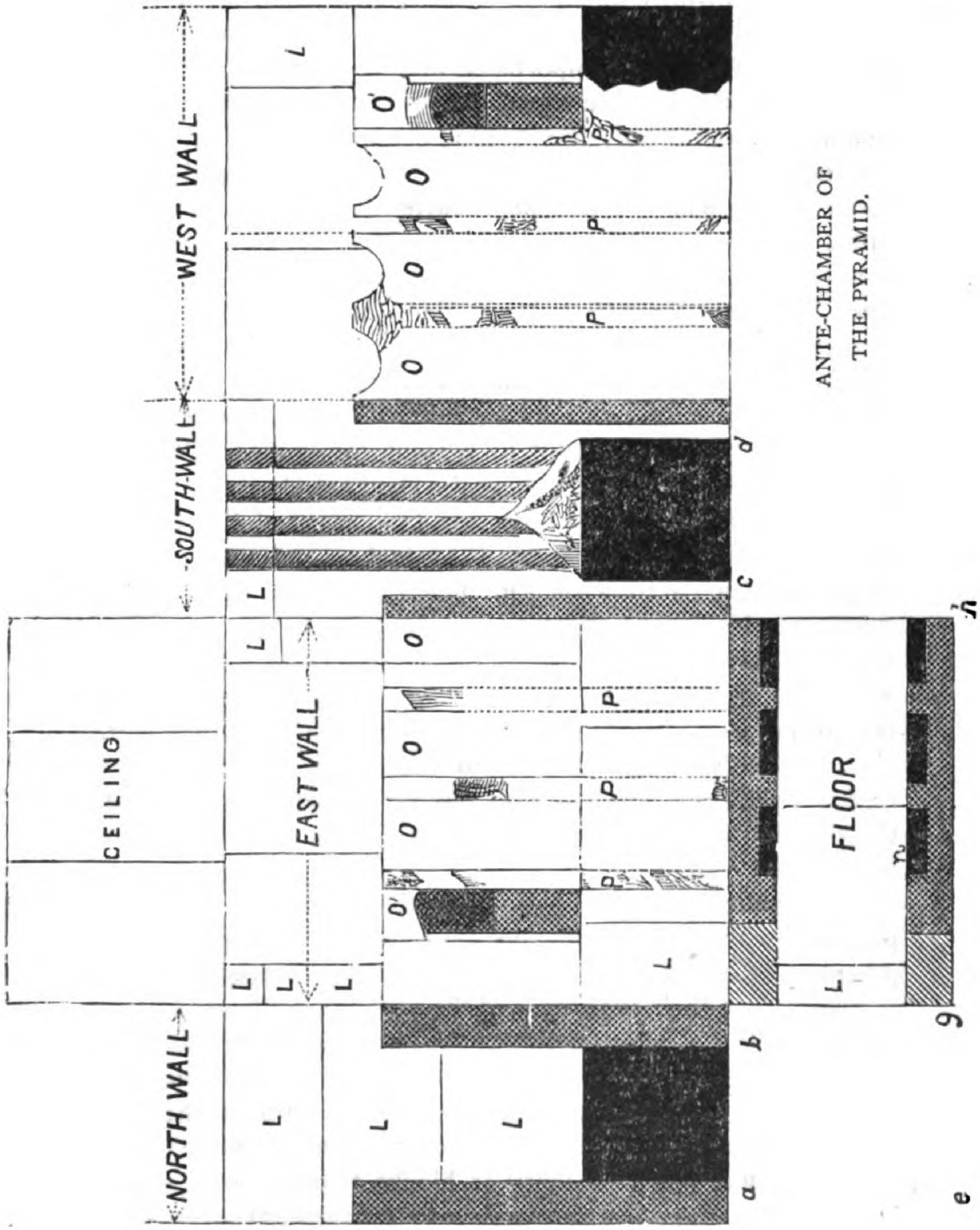
Mr. Thomas Holland, of London, has kindly sent us for publication the following paper on Pyramidal Freemasonry, read by the secretary before the officers and brethren of the St. Ambrose Lodge, No.{1,891, held at Baron's Court Hotel, West Kensington. The paper was also read before the Auxiliary Society for Preserving Anglo-Saxon Weights and Measures, Cleveland, Ohio, by W. H. Searles, a distinguished member of the last named society, and also of the American Society of Civil Engineers. It is given here in the form of a lecture before the first named society. We hope to have more from the pen of Mr. Holland.—[EDITOR.

WORSHIPFUL MASTER, OFFICERS AND BRETHREN:—In both my former lectures you have followed me through the intricate winding of this grand and noble pile of masonry, embodying over five million tons of hewn stone, and standing on a levelled platform of thirteen acres or more of solid rock—that particular spot being assigned to it for latitude and longitude, in the midst of the land of Egypt. And here I would note that carefully summing up all the dry land habitable by man the wide world over, the centre of the whole falls whithin the Great Pyramid territory of Lower Egypt. Another great fact, brethren, for critics to correct.

I told you, at the close of my last lecture, that I would show you something that would surprise you, and which would be awkward to controvert or disapprove. I have made further researches in this practical and constructive direction since we last met, and not only have I established what I then thought a great discovery and worth our critical consideration, but by this scrutinizing, piece-by-piece examination, have made another discovery in the Ante-Chamber of the Pyramid, of great constructive skill and giant magnitude, but not to surpass what it was my intention at that time to bring before you.

Several writers have said the Ark of the Covenant and the Tabernacle are hidden in the Pyramid; that statement I intended dealing with. Yet that question will stand over, as probably they will not be wanted before our next lecture comes on.

I shall now record, with a good show of originality, another probable hiding-place, or, perhaps, passages and chambers in



ANTE-CHAMBER OF THE PYRAMID.

this Pyramid, so far unknown, but quite likely leading to the 75th or 100th course of masonry before alluded to. This part, however, exhibits such direct design and conspicuous motives that I think far greater importance may be attached to the discovery, if it should so turn out, than may be attending the last named. I have already, my brethren, told you the ante-room leading to the King's Chamber is full of detail and wonderment for so small a place; and it has occurred to me that the portcullis, or granite leaf, as it is called, has a most important duty silently to perform, yet so obvious in a practical sense that when its reality of existence is examined in a constructive point of view, its utility is seen. Certainly it seems surprising the fact has been overlooked by our skilled engineers on the spot. The fact of the granite leaf being in two heights confirms and supports the idea I am about to present for the consideration of the most skilled among you in the mechanical arts.

Professor Piazzi Smyth gives the full height of this granite leaf as about 49 inches, over it, 57 inches, and under it, 43 inches, making a total of 149 inches for the height of the chamber. Now, the upright slabs, or wainscoting, at each side, are 103·1 inches high on the east side, and 111·8 high on the west side. I should like you, brethren, to keep your eye on the lower diagram, and follow me in this constructive part. The granite leaf is 49 inches; add this to the height of the east side slab, 103.1 = 152·1, or full three inches higher than the chamber itself. The reason for adding these together will be seen as we go on.

The builders, when constructing this chamber, no doubt planned for the long future, that their intentions might be apparent to the beholders. They therefore constructed these side slabs with their grooves, and the west side hollowed out on top (the utility of which will again be apparent as we proceed), and finished the one 8·5 inches, the other 11·7 inches thick, all squared with mathematical precision, and set up in their respective places. To keep them thus in position, while being backed up with heavy masonry or blocks of huge solid stone, it would be necessary to accurately fit in these grooves solid blocks of timber, cross-wise of chamber, to ensure perfect solid-

ity, and prevent the possibility of displacement from any sudden jar from these massive blocks of stone, while adjusting them on their proper basis, and forming and constructing the secret arts and hidden mysteries behind, till all was properly built up and set, when, in due course these timbers could be slid or lifted up in these grooves and released, when the top of the east slab was reached; the west slab being higher would keep each in position, and the hollowed-out part would enable and greatly facilitate their being moved forward and lowered. Thus these struts would be removed, one after the other, leaving in its place, or putting in after, as the case may be, the stone, granite leaf, strut or portcullis, in two pieces, but so very accurately fitted and adjusted to keep all rigid and firm, and silently remain till the time should come for them to be raised.

We see here the forethought displayed by the builder or grand master and designer to so adjust and construct that no damage would accrue or be apparent by removal, like the foot of the Grand Gallery. Much has been removed but no unsightly damage done. It is also obvious that leaving 43 inches clear under granite leaf from floor level, enables raising screws to be easily worked, and the stones to be raised; and when the top stone is sufficiently high to clear top of slab, or set-off, on the top, it, like the timber strut, could be removed at will, making room for the lower stone to undergo a similar operation.

And now, brethren, I would ask, Is it not easy to discern that if the granite leaf had been in one stone it could not be got out for want of space enough between the set-off at the top of the side slab and the ceiling, by three inches, as before described? There is little doubt it would be necessary to put in temporary struts before removing the granite leaf, which, when all was removed between these wainscotings, if they did not press themselves forward, could easily be brought forward. And what then? A magnificent disclosure of passages and chambers, hitherto undiscoveréd. If not, all this precision of planning in the ante-chamber would be purposeless—without

any specific aim or end. But this cannot be with such positive, constructive, indubitable evidence.

Why is this granite leaf made in two pieces? Why does it form a strut between the two slabs? Why of such indestructible and imperishable material? Why fitted in grooves and constructed to slide up? Why the side slabs standing out the thickness of themselves from the face of the solid masonry? Why all so admirably adjusted to take away without damage to other parts? My brethren, it is like the whole of the noble structure. Its information is practically given by its wise and detailed construction, and further demonstrates that the researches of the skilled craftsman will not be in vain, while those of our tribes and families, and even of noble descent, may explore and make further discoveries.

Dealing with such facts and figures (and, like all else in the world, no matter how positively correct) will meet with criticism. But I can come boldly forward and say the truths I have brought before you are of such giant proportions and known realities, presenting externally and internally such a witness no other building in the world possesses, and more scientific skill and profound wisdom than the mind of man in the present day is capable of grasping, "with all our boasted knowledge." And now, brethren, I would ask you from where did this great wisdom emanate? You will at once join me in saying: the Great Architect of the Universe. And next, I would inquire who have been the custodians of these secret arts and hidden mysteries? Here you pause; but I hope to show conclusively that we Freemasons, so-called at the present day, have diligently, zealously and religiously retained and instructed those who were found worthy to receive the same at our hands, and so spread wisdom and learning onward with due caution.

Most of you have heard explained the tracing-boards of the lodge. The first tracing-board says our lodge should be in length from east to west, and breadth from north to south; just so is the King's Chamber with its ante-chamber, from which, in stooping humility, we approach the King's Chamber or Grand Lodge, with every inch of its surface adorned with

wisdom, strength and beauty; and furthermore, seven hold the lodge, depicted by seven stars (Pleiades), which seven stars are the very centralization of construction, begun, carried out and finished at the Pyramid in this Pleiades year, astronomically so called, when Alpha Draconis was the visible polar star, looking up from the depths of the first ascending passage, which will not occur again, according to the slow orbit of the procession of the equinoxes, for 25,827 years, which number is built into fact by the diagonals of the base, and repeated by the perimeter of the 50th course of masonry, and it is by the science of astronomy that the figures and dates are proved to be true or false. The Pyramid being thus before you, in this enlightened age, to criticise upon, so, brethren, a starting-point in Freemasonry is gained. As far as comparison is concerned, the one might be symbolical of the other. As I said in my first lecture, a school, college or lodge would be formed, and many symbolisms put in order, perhaps worked as we do at the present time, as the most impressive way to inculcate and work a lasting impression on the mind; and thus in whole or in part, we traditionally keep pure and unsullied what has been entrusted to us to this our day.

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*WHY ANGLO-SAXON METROLOGY SHOULD NOT BE ABANDONED.

The future of the Anglo-Saxon race, its present predominating influence among the peoples of the earth and its wonderfully rapid progress in all that pertains to art, science and commerce—in short, toward the apex of civilization—have been made the subject of a volume recently published in London.

In reviewing some of the facts presented in the work alluded to, it is proposed to show that Anglo-Saxon metrology is by no means the incongruous failure its adversaries have endeavored to demonstrate, and to make it clear that, if without any particular attention it has already accomplished so much, it will certainly accomplish all metrologists can wish for when once it shall have been unified and rectified.

In a paper upon Weights and Measures, written in favor of the metric system and delivered before the American Society of Civil Engineers, Mr. Frederick Brooks, C. E., laid great stress upon the fact that of the imports into the United States (which in the year ending June 30, 1879, amounted to $445,777,777), only 28 per cent was produced in Great Britain and countries using the Anglo-Saxon weights and measures, while more than

* From The N. Y. Herald.

half—50 per cent—was produced in countries that within the last hundred years have adopted a common international system of metrology. The remaining 13 per cent was produced in countries which use various other systems of weights and measures. These facts were all exhibted in detail by Mr. Brooks in an accompanying diagram, and from them, as of primary importance, he drew the conclusion that the Anglo-Saxons—at any rate, those or the United States—should also unhesitatingly come into the International Congress and speedily adopt the metric system.

DEFECTS OF THE ARGUMENT.

At first glance this argument seems to be of some weight, but it is only so upon its surface. Indeed, the reverse consideration of the subject entirely overturns it. The argument is drawn entirely from our imports, which are sold to us, and therefore to things in which naturally the purchaser is enough concerned to look after his own interests, and, if needs be, to better guard them, learn the metric system. But importing is by no means the business of this country. It certainly did not monopolize our wealth in 1879, and still less does it do so to-day.

The combined industry of the country in 1879 was represented by a money (gold) value of some two thousand million pounds sterling, or at least ten thousand million dollars, of which the import business barely represented 22 per cent. Shall the 78 per cent. involved in other industry adopt new "times and seasons," and change its manners and its customs simply to accommodate the business of so small a minority? Surely Mr. Brooks must have a strange idea of American institutions to found an argument upon such a basis. Now, the imports into the United States are generally luxuries and high-priced articles, or are raw material. They are mostly the surplus from arts and trades of long standing in foreign countries, and from them in particular is derived the wealth of the countries whence we procure them. In times of patriotic war our people have given ample proof of their willingness to sacrifice them all.

ANOTHER SIDE OF THE SUBJECT.

But there is another and far more important side of the subject—that of our exports, with which foreign countries are now so amply concerned. In the very year selected by Mr. Brooks for this discussion our exports were in value $736,634,834, or in excess of our imports by $290,000,000. This excess alone is more than half of the total imports for that year. Moreover, if there be any value in the argument of Mr. Brooks, it is, of course, turned back upon his conclusions from this opposite standpoint. Of our exports $426,000,000, or about 66 per cent., went to the Empire of Great Britain alone—an empire using Anglo-Saxon metrology—and this amount, let it be noticed, was practically equal to the bulk of our whole import business. With our exports it is not as with our imports. While we can easily get along without the latter, the world itself cannot live without the former. We hold the food surplus of the earth, and the bulk of our exports is in breadstuffs, provisions, meat, etc.

While carefully examining this matter it is intended that the data used shall be drawn largely from the London book already referred to. Speaking of the country, the author remarks: "Ten years ago the balance of trade was against the country, but now the exports are 31 per cent. over the imports." This is still more true in 1883. "The Americans now make one-fifth of the iron and one-quarter of the steel of the world." * * * "The United States raise one-half of the gold and one-half of the silver of the world's supply." * * * "Taking all the mining industries of the world, the United States represent 36, Great Britain 33 and all other nations 31 per cent. of the total." Thus Anglo-Saxondom represents 69 per cent. of the mining industry of the earth. "The sailing vessels of the world now trade mostly to the United States." This being a fact, it follows that, no matter what weights and measures they use at home, they use the Anglo-Saxon ones in our own markets. "But in comparison with commerce

the Americans use three times as much money as the English, and nearly twice as much as all Europe." Moreover, in the past ten years the United States has coined one-fourth of the gold and one-sixth of the silver coined by all the earth. "The net income of the United States per inhabitant is double the European average."

GROWTH OF POPULATION.

Our military expenditure is the least of all nations, and is less than one-fourth of what it is for Europe in general. Our national debt has been reduced 22 per cent. in ten years—in fact, the ratio of debt per inhabitant has fallen 42 per cent., that of interest 54 per cent. in ten years. "Population has increased 31 per cent. since 1870 (*i. e.*, to 1880), being the largest number gained in any decade of the Union." The increase of births over deaths "is three times the European increase and double that of England or Germany." "Everything seems to promise that twenty years hence, at the close of the nineteenth century, the United States will have between 90,000,000 and 100,000,000 inhabitants."

"It appears that, in spite of the population increasing 1,250,000 yearly, the supply of grain is growing faster and of meat as fast. So that the exportation to Europe is likely to go on rising for many years to come." In spite of the home consumption of meat being 120 pounds per inhabitant, equal to 2,740,000 tons, a surplus of 1,076,000 tons is annually left, one-half of which is exported to the over-populated and hungry foreign nations. Now, in view of all this wealth and the constantly increasing importance of this country as the market of the whole world, how ridiculous is any appeal to our imports as an argument in favor of changing our hereditary weights and measures and abandoning, to our own inconceivable discomfort, our traditions for those of other nations!

THE ANGLO-SAXON RACE.

Thus far this argument has only been answered from a single standpoint—that of our own nation—and it should be borne in mind that the statements have been drawn from the candid pages of a foreign book. There is a grander view to take of this topic. It is from the standpoint of all Anglo-Saxondom compared with the rest of the world at large. The world has increased in population in the decade from 1870 to 1880 about 9¾ per cent. In the meantime Great Britain increases 10½, the United States 31, Australia 56½, Canada 14¼ and South Africa (Anglo-Saxon) 73¼ per cent. No other nation save Belgium, has increased over 11 per cent., and France but 1.67 per cent. Even Turkey (2.01 per cent.) has increased at a higher rate than the mother of the metric system. At such a rate of increase all other nations must in time be smothered out, and France among the very first, before the Angle-Saxon race. But further, the tabulated statement of the port entries of all other nations for the ten years under consideration shows that of tons burden that of the world was 50,000,000, while of this total that of the United Kingdom, British Colonies and the United States was 28,000,000, or more than half.

One-half of the whole industry of the world is already in Anglo-Saxon hands. In millions sterling the increase for the ten years was, for all the earth, 1,866, while it was for Great Britain, 337; United States, 525; Australia, 57; Canada, 28, and South Africa, 14, making a total of 991,000,000 pounds sterling increase. To this increase can also be fairly added that of South American industry, 24,000,000, almost all of which is represented by British capital. In 1880 the industry of the earth, expressed in millions of pounds sterling, was 2,024 for Great Britain and 2,004 for the United States. These two nations headed the list, being followed by France at 1,325 and Germany at 1,269, and by other nations at a greater distance.

MANUFACTURING INTERESTS OF THE WORLD.

The increased consumption of cotton, wool, flax, jute, etc., in the decade has been 1,666,000,000 pounds, of which 922,000,000 pounds—much more than half—has been in Anglo-Saxondom. The increase for the world in manufacturing has been £558,000,000, of

which £324,000,000 has been among those using pints, and pounds and inches. That for all Europe (non-Anglo-Saxon) was but £212,000,000.

Out of 118,000,000 increase of production of coal, Anglo-Saxon weights have measured 78,000,000. Out of 7,233 increase in thousand tons of iron they have measured 5,250, and of steel of 4,068 they have measured 2,255—*i. e.*, in every case far more than half of all the earth. Anglo-Saxondom produces and measures out by the pound and yard more than fifty per cent of all the wool, and the United States alone seventy-five per cent of all the cotton raised upon the earth, and other nations are glad to purchase it in pounds and yards. In general terms, the study of the commerce of the world for the past twenty years (1861 to 1880) shows that out of £40,000,000,000 (giving the value of the exports and imports in round numbers) Anglo-Saxon metrology has measured and re-measured far more than half of it.

The shipping of the earth has increased £40,000,000 in the decade, £26,000,000 of which was in Anglo-Saxon bottoms; that of all the metric nations put together was only £13,000,000, the remaining £1,000,000 being scattering. Thus two-thirds of the carrying trade is already Anglo-Saxon and but one-third "metric." Which, therefore, it may well be asked, is the de facto international system? Does it not rather appear that France, leading the opposition in "the Napoleonic day," when all her interests are known to have clashed with those of England, strove for the mastery in commerce by this politic though vain attempt at banding subjected Europe in a new metrology? And does not the irresistible march of industry prove that her dying system is international only in its self-assumed, high sounding name.

Since 1870 (and to 1880) the mines of the earth have produced £360,000,000, of which £215,800,000 were from Anglo-Saxon mines. And Anglo-Saxon mints have coined in the same decade £224,420,000 out of £526,781,000 coined over all the earth. Furthermore, out of £905,000,000 in coined specie current in the decade ending 1880, £524,000,000 were used in Anglo-Saxon import business, against £367,000,000 on the European Continent, and £514,000,000 in export business, against £339,000,000 upon the Continent.

ACCUMULATED WEALTH OF NATIONS.

In accumulated wealth, in 1880, Great Britain and the United States led all the earth, followed next by France and Germany. The accumulated wealth of the whole European Continent was £28,000,000,000, that of the Anglo-Saxon nations £18,000,000,000, while that of the world was only £47,000,000,000. Considered from another standpoint, the world had £113 per inhabitant; Europe, including Great Britain, £111; Great Britain alone, £260 (more than any other nation except Holland, £283, and more than double that of the world); the United States, £158; Australia, £112; and Canada, £148. Thus the Anglo-Saxons, as individuals, are worth per inhabitant some £184, the world average being £113, and that of the whole Continent of Europe being but £91.

But a consideration of the public debt of nations is even more significant. In the decade 1870 to 1880 that of all Europe increased £52,000,000 and that of the world £44,000,000. But three nations of the earth effected any reduction of their national debts—these were the United States, by £86,000,000; Great Britain, by £24,000,000; and Denmark (a former "resting place" of the Anglo-Saxon), by £3,000,000. The public debt of the world in 1880 was £5,207,000,000, that of the Continent of Europe alone being £4,513,000,000, while that of all Anglo-Saxondom together was but £1,276,000,000. Now, it is also noticeable in this connection that while the debt of Anglo-Saxondom is almost entirely held in native hands that of the world is in foreign hands, and that more than one-half of it is actually held by Anglo-Saxons. The race, in fact, has bonds and mortgages on all the world.

In earnings the United States leads all other nations—their earnings for 1880 being £1,406,000,000. They were followed by Great Britain and her colonies at £1,381,000,000,

and far behind by France at £927,000,000; by Germany, £851,000,000, and by other nations at continually lower figures. The earnings of the Continent were £3,797,000,000; of the world, £6,773,000,000—those of Anglo-Saxondom being £2,787,000,000, or more than two-thirds that of the Continental nations, and far more than one-third of all the earth.

As to the food supply of all nations, Europe in 1880 had a deficit of 330,000,000 bushels of grain, while the United States alone had a surplus of 370,000,000 bushels. In tons of meat Europe had a deficit of 853,000, while Australia alone had a surplus of 838,000, the United States of 1,076,000 and Canada of 170,000. Of the grain surplus of the world (22,000,000 bushels) in 1880, 17,000,000 were held by Anglo-Saxons, and of the 2,144,000 tons of meat—then surplus—1,931,000 were also owned by Americans, Australians and Canadians. The balance was held in South America and Algeria, and almost entirely controlled, as in fact is almost all South American industry, by English capital.

The truly international system of metrology, then, is in fact our own Anglo-Saxon one. In changing Anglo-Saxon weights and measures, for the metric system we would not only disastrously, and to no purpose, disturb our own affairs, but inconvenience those of all mankind.

C. A. L. TOTTEN.

THE YARD, THE PENDULUM AND THE METRE CONSIDERED IN REFERENCE TO THE CHOICE OF A STANDARD OF LENGTH.*

[The biography of Sir John Herschel has been written, but it has not yet come to hand from our correspondent in Scotland. It will appear in the next number of the Magazine; in the meantime we present to our readers one of the most remarkable of the lectures of Sir John Herschel, which cannot fail to elicit the greatest interest.]—ED.

The attention of the public has of late been strongly drawn to the subject of a proposed alteration of our national system of weights and measures, by the attempt made during the last session of Parliament to carry through a bill, having for its object the abolition of our existing system in its entirety, and the introduction in its place of what is known as the "French Metric System."

The bill, it is true, was withdrawn after passing the second reading, (by which the House, as is usually supposed, "*affirmed the principle of the measure*") and it may therefore be reasonably presumed that it will be brought forward again in the next session, in the same or modified form. As the discussion it received in the House seemed to be in no respect commensurate with the immense importance and sweeping nature of the change proposed, and with the exception of one or two rather cursory notices in *The Times*, excited a marvellously small amount of public interest pending its progress; it will not be amiss if, being called upon by the committee of the Leeds Astronomical Society for an exposition of some point of general interest in the form of a lecture or essay, to be read at one of their evening meetings, I select this for a subject, and endeavor to place before you the several conditions which any standard or typical unit of length which shall be assumed as the basis of a system of measures and weights intended to be national, and which may justly claim to be universal, ought to fulfil; and to compare with these conditions in order to see how far they are fulfilled in fact, both our actual standard, the French

* This lecture or essay was communicated to the Leeds Astronomical Society, and read at a meeting of that society on Oct. 27, 1868.

metre now in use and the length of the pendulum, which has more than once been proposed as a natural unit of length. And this I will endeavor to do in as elementary and familiar a way as shall be consistent with perfect correctness. Those of the present audience who are not already familiar with the subject will thus be better enabled to form an opinion as to the desirableness of the change actually proposed, or of any legislative change in our existing standard and in our system of measures, weights and coinage generally. And to such it will not be amiss to observe in the outset that the subject being an exceedingly delicate and refined one, they must not be surprised at seeing very minute quantities and very small fractions treated as matters of much greater importance than they may have been accustomed to regard them.

(2.) The general subject of a national system of weights and measures, be it observed, divides itself into two very distinct and separate points of inquiry, viz.: First, what is intrinsically the best and most available unit of linear measure to adopt as a basis; and, secondly, what system of numerical multiplication and aliquot subdivision of such unit for measures of length, and of it derivative units of area, of capacity and of weight (for these all refer themselves naturally and easily to the unit of linear measure, or at least ought to do so) is most advantageous, either in a great mercantile community like our own, or for the great mass of mankind in the ordinary transactions of life. And it cannot be too strongly impressed, and perseveringly borne in mind, that these two questions stand in no natural and necessary relation to each other, but are perfectly independent. We may resolve, with perfect logical consistency, either to toss aside our present system *in toto*, and adopt the metrical one in preference, or to retain our fundamental unit (the imperial foot or yard) and decimalize our system of denominations; or, lastly, by a slight, and, practically speaking, imperceptible change in our present standard, to bring it into conformity with our view, of theoretical perfection (which I shall show may be done.) We may, too, retaining all the convenience of our present denominations *(so far as they are convenient)* superadd to them, by permissive legislation, the additional convenience of a decimal system for facility of caculation; relying on its holding its ground if really affording such facility, or working its way into general use, and ultimately driving out the old system, if found by the mass of the population to be practicably preferable. This last is the course I myself would prefer, and I think it best to say so in the outset, lest those who may take a contrary view should imagine a foregone conclusion to be urged upon them under the semblance of free inquiry.

(3.) It is unnecessary, of course, to observe that the measurement of length being required for almost every purpose of construction, as well as every intelligible statement of the sizes of material objects, the lengths of journeys, the distances of places, etc., renders indispensable the recognition, in every community, of some common standard, some well known and identifiable *units*, by whose repetition great, and by whose aliquot subdivision small lengths, distances, sizes, etc., may be expressed in words and numbers. The common sense of mankind, moreover, would naturally point, in the selection of such unit, to some object of common occurrence, of moderate linear dimension, and of which individual exemplars differed but little, or, if possible not at all in this respect; so that appeal might at once be made to such exemplar in case of a question arising as to the length of any object stated to contain a certain number of such units or aliquots. A very moderate experience would, however, suffice to convince anybody that among natural objects of the same kind, even those most common, perfect identity of length, of breadth, of thickness, any more than of weight, is never observed—even a close approach to it rarely —and a very close one extremely so. Still, with all drawbacks so arising on the adoption of a natural standard, the first rude demand for such a standard would be easily enough satisfied, and that in two ways, viz.: First, by actually fixing upon some individual among all the existing objects of the sort selected, to the exclusion of others; or, secondly, by the very natural though somewhat more refined conception of an ideal medium, or *mean* among a

very geat multitude of such objects, such as might be regarded as neither unusually great nor unusually little ones of their kind.

(4.) Among objects of common occurrence, the human person, or some distinct member of it would be most likely to claim the attention of mankind as affording a standard of measure; if only for the very obvious reason that the relation of the sizes of material objects to that of man mainly determines his faculty of handling, or otherwise applying them to human uses. Accordingly, the height of a full-grown person, the length of his arm, his forearm, (ulna or ell); his foot, his hand, his ordinary step, etc., would present, and is well known to have presented itself among almost all communities of mankind to their choice for this purpose. And so, among all nations whose measures have been handed down to us, we find in speaking of the unit of lengths, some members of the human person designated. Thus, the body of the gigantic king of Basan is related to have measured eight cubits in length, "after the cubit (*i. e.* the forearm) of a man." The height of Goliath, the Philistine, was "six cubits *and a span.*" The bow of Pandarus, described by Homer, was formed of the horns of an ibex, which grew out sixteen *palms* (or hand-breadths) from his head. The Romans reckoned their distance by intervals of 1,000 *paces* (*millia passuum*) whence our *name* for a mile, though differing widely in reality. If, however, we may judge from the great diversity in the actual lengths adopted under the common name of "a foot" as the standards of different nations, we shall see reason to believe that the typical foot selected was usually that of an individual—some chief, king, or high priest who could claim pre-eminence among them as a man *par excellence*, and who would seem to have been generally somewhat above the average stature. Thus we find the Roman foot equivalent to 11.6 of our inches, the English to 12, the Greek to 12.1, the French to 12.8, and the Egyptian or Drusian to 13.1—all of them (especially the two last) in excess of the length of a foot of a well developed man of medium stature (say 5 feet 10 inches) which does not exceed 10¾, or at the most eleven inches.

(5.) Another class of objects, which from the universality of their occurrence in vast numbers, and their general uniformity of dimensions, would naturally occur as unit types, available for the measurment of small lengths, or for the small aliquots of a larger unit, has been found in the cereal grains of most common use, and of these, the barley corn, and the rice grain, have found the preference. Our inch, for instance, has been defined in an old statute (now repealed) as the length of three grains of barley, taken from the middle of the ear, and placed end to end. And in a somewhat similar manner have been derived from those cereals the smaller subdivisions of the Hebrews and Hindoos; while the larger have, in these, as in other nations, originated in parts of the human person.

(6.) It is very evident, however, that types of this kind admit of no precise and vigorous identification or intercomparison. The medium stature of a man is very different in different countries. That of an adult French conscript for instance, is (or at least was in 1817) 5 feet 4 inches as concluded from the measurement of 100,000 individuals, while the Belgium type, or mean adult stature, has been placed at 5 feet 8 inches, and that of a Lancashire non-manufacturing laborer, as high as 5 feet 10¾ inches. So great a discordance as a result of local and secondary circumstances, is, of course, fatal to the pretensions of the human person as a natural type. So again of the cereals. The difference of soil, climate, and cultivation must produce, and does in fact produce very great variety in the medium size of grain grown in different countries, and in different years; so that, even supposing them to be measured by millions, the mean results would be found to differ too much for the object in view. And the same kind of objection holds good against having recourse to any kind of medium magnitude, among multitudes of objects of like specie which occur in nature. Such must of necessity, be chosen among organic structures of the animal or vegetable kingdom (for among inorganic masses of whatever kind, nature presents no instance of a *mean* or typical magnitude, as distinct from the *average*

of a number accidentally assembled, which may differ to any extent from an average similarly taken from an equal number elsewhere collected). And among the former classes of objects, even were it possible to assemble and measure them in sufficient numbers to afford a true *typical mean*, we should have no security for its identity in different ages and climates.

(7.) We are driven then, in our choice for a universal standard, to the selection, either of some individual object, (if such there be), natural or artificial, imperishable in its nature, unsusceptible of variation by lapse of time or decay, and indestructible by accident, or else to some ideal or resultant length or magnitude, (if such there be), susceptible by its definition of being, as it were, translated into a material expression and marked out as the result of some process which we are sure will, in all ages and places, reproduce the same result. And besides these qualities of invariability, indestructibility and identical reproducibility it ought to possess some obvious claim to *general* acceptation as of common interest to all mankind, or at least to all the civilized portion of it. An interest from which national partialities and rivalries should be altogether excluded.

(8.) The individual human type is at once excluded by these conditions. Supposing the foot of the most remarkable person who ever lived to be marked out on steel or adamant, it would be at the mercy of fire, earthquake, loss in political convulsions and a hundred other forms of destruction or disappearance without the possibility of reappeal to the original form. Of human works, the most permanent, no doubt, and the most imposing as well as generally interesting and respected, are those mighty monumental structures which have been erected as if for the purpose of defying the powers of elementary change. Take the vastest of them—that to which appeal has often been made for this very purpose—the Great Pyramid of Cheops. When built it was 481 feet in height, and the square area of its base was 764 feet in the side. The height is now only 451 feet and the side of the base only 746 feet; and the sole means by which we are enabled now to determine the original height consists in a block of the exterior marble casing which will, in all probability, disappear in the hands of "the curious" within the next century. Nature presents to us but one material *object* which combines all the requisites enumerated and combines them all in perfection, viz: the globe itself, which we inhabit, and in that globe we find only two natural defined lengths which unite the requisites of individuality to identify them under every change of human relations, and even of geological revolutions and catastrophes, and of universality, so as to stand in relation to both hemispheres and to all meridians, viz: the earth's polar axis and its equatorial circumference. For the latter the equatorial *diameter* might be more advantageously substituted, but that we have good reason to believe the equator to be not strictly circular but in some degree elliptic, the proportion of its greatest and least diameters not being yet precisely known though very much nearer to equality than that of the equatorial and polar diameters. This, however, will not prevent its *mean* equatorial diameter from being assumed in preference to its circumference, were not the polar axis, for very obvious reasons, preferable to both. Of the latter, and, indeed, of all three, (thanks to the elaborate geodesical surveys which have been made within the century last elapsed), we possess a knowledge so precise as to render them perfectly available for our purpose.

(9) Of lengths which exist not marked by the dimensions of any material object, but which are defined by the nature of things and by physical relations, and which are susceptible of exact determination and of being marked off on a scale. and of so becoming materialized for practical reference, there have been proposed only three which can be considered theoretically, and of these only one practically available. These are, 1st, the velocity of light or the space passed over by light in some definite time, (say the ten millionth part of a second, which would give a modulus of about 100 feet); 2ndly, the length of an undulation of a ray of light of some definite refrangibility—a length so minute as to require multiplication a million fold so as to produce a modular unit; and 3dly, the length

of a pendulum vibrating seconds under certain definite and normal circumstances, or rather that of an ideal seconds pendulum to be placed at the extremity of the earth's polar axis. To this is in effect equivalent, and derivable from it as a mere arithmetical conclusion; the space fallen through by a heavy body on the same place by the earth's attraction in a second of time.

The modulus so obtained is therefore a measure of the earth's total attractive power (independent of centrifugal force arising from its rotation), as that derived from the length of its diameter is of its total bulk, and equally unalterable and universal. As for the other two which depend on the nature of light, the difficulty and delicacy of the processes they would involve render all idea of resorting to either of them purely visionary.

(10) The linear dimensions of the earth then on the one hand, and the linear measure of its attractive force embodied in the pendulum on the other, are the two, and, so far as we can see, the only two available sources of the invariable and universal standard length which we seek. And it is curious to observe that while the French after considering both of them threw aside the pendulum in favor of the metre, (or ten millionth of the meridian quadrant); the English, on the other hand, by the act of Parliament, in 1824, which repealed the old statute already alluded to (and so threw aside the principle of resorting to an organic type), did in effect, at that time, adopt the pendulum as their ultimate resort. For while that act declares that a certain metallic bar, made by Bird in 1760, when at the temperature of 62 Fahr. should, without any further reference to its origin, be considered the standard yard of the British Empire, it provided for its recovery and reproduction in case of the total destruction or loss of it and all of its authentic copies and fac-similes, by a declaration that its length is 36 inches, such that 39.13929 of them are equal to the length of a pendulum vibrating seconds *in vacuo*, and at the sea level in the latitude of London. The report of the French commissioners also, in 1798, which led to the enactment of the metrical system, is careful to state that in the event of total loss or destruction of all material representatives of the metre, its value would be easily recoverable from a numerically specified relation between its length and that of the pendulum vibrating seconds at Paris, which had been determined with great accuracy by Borda, one of the commissioners. So that practically speaking, in the event of the total destruction, by political convulsions, of every authentie yard and metre, (supposing any written record of our existing knowledge to survive them) the metre would have been recovered, not by the costly and laborious process of remeasuring the French meridian arc, but by the infinitely more summary one of a precise repetition of Borda's experiments and the exact reapplication of all his corrections and reductions.

(11.) For the reproduction of the English yard, a similar repetition of those experiments in London, which led to the adoption of the number 39,13929 in., as the measure of the pendulum would, in such an event, no doubt have been, at that epoch, resorted to; though in departure from the wording of the act, which speaks of a pendulum vibrating seconds, not *at*, but *in the latitude* of London; a very different thing, as General Sabine has pointed out in his "*account of experiments to determine the figure of the earth by means of a pendulum vibrating seconds in different latitudes.*" For the object would have been then, as it really was on the occasion of the actual destruction of the parliamentary standard in 1834, not to *produce* a theoretically *better*, but as far as possible to *reproduce* the same *identical* length by the most summary process without undertaking circumnavigatory voyages or entering on any theoretical discussion. The new act necessary for legalizing the standard so arising would probably have sanctioned this procedure, and we should have thenceforward had a standard of a purely local character, assuming for the fundamental basis the individual seconds' pendulum in London.

(12.) This, however, is not now the case. On the destruction of the standard of 1760 by the burning of the Houses of Parliament, the new standard was constructed, not by any measurement of the length of the pendulum, (for, in the ten years elapsed since 1826,

very grave doubts had been raised, or rather very serious sources of error pointed out in the processes used for the purpose on the former occasion), but, by an assemblage and most careful comparison of all the scales and standards of any authority which could be got together, resulting in the production of one primary and a great many secondary standards, in all probability identical with that destroyed. The act, moreover, (of 1855), which constituted that one, our legal yard, and named the others in a certain order as its successors in the event of its destruction or loss, omitted the clause identifying its length with any numerical multiple of the pendulum. In fact, then, our yard is a purely individual material object, multiplied and perpetuated by careful reproduction, and from which all reference to a natural origin is studiously excluded as much as if it had dropped from the clouds. Apart, then, from the extraordinary pains taken in its construction, and from the singularly fortunate, but, at the same time, purely accidental coincidence which I shall presently mention, it has no pretentions whatever to be regarded as a scientific unit.

(13) Let us now consider the claim which the pendulum, in the abstract, as a measure of the earth's gravitation, can advance for its reception as a fundamental and universal standard of length (and here incidentally it may be remarked that, *as a length* it is not more inconvenient than the metre, being within about ¼ of an inch the same).* One of the reasons assigned by the French Savans for their rejection of it in favor of the metre and as would appear, the only one which weighed with them (for their other reason ostensibly advanced is a mere appeal to the political passions of the time) was the dependence of the length of the pendulum, on the time of its vibration; as if the 86,400th part of a day, which we call a second of time, were not as definite and as invariable a quantity as the 100,000th part, which, in their rage for decimalization, they proposed to call one; and as if they might not have fixed on a pendulum vibrating 100,000 times in a day (which would have given a very near approach to our yard). But their stumbling block was the introduction of an extraneous element, *time*, at all, into the subject: as if the length of the day were not as much an invariable, universal and physical element as the dimensions of the earth or its gravitation. But in this they seem to have overlooked the fact that their adoption of the quadrant of a meridian for the base of their system does really admit this extraneous element, time, into that system, though in a much more insidious way. For the total bulk or mean radius and the total mass or gravitating energy of the earth remaining the same, the ellipticity of its meridians, and therefore their absolute length depends on the period of its rotation or the length of the day. The same objection, to be sure, if it be one, would equally apply to the adoption of the polar axis, or the equatorial diameter of the earth; and the only way to exclude all ideas of time and force from a metrical system and render it *purely* metrical, *i. e.*, dependent on geometrical magnitude alone, would be to take for a fundamental unit the radius, diameter, or circumference of a sphere, or the side of a cube equal in volume to that of the earth. And perhaps were a *tabulu rasa* made; were the ground totally unoccupied and the whole matter to do over again, this would be as good a unit as could be proposed.

(14.) But the true objection to the choice of the pendulum for a universal unit of measure lies, not in any metaphysical and abstract considerations of this kind, but in the uncertainty which prevails and must necessarily always prevail as to the true length of that normal or ideal pendulum which shall stand equally related to the whole globe, and from which the mean length corresponding to any assigned latitude can be calculated, that is to say, the length of a pendulum which would swing seconds at the pole of the terrestrial spheroid—an uncertainty which, as I shall proceed to show, must affect the result of every

* The metre has this inconvenience, as compared with the yard—that while the latter can be readily extemporized by a man of ordinary statute (and often is so in practice), by holding the ends of a string or ribbon between the finger and thumb of one hand at the full length of the arm extended horizontally sideways and marking the point which can be brought to touch the center of the lips (facing full in front), the former is considerably too long to afford the same facility.

attempt to deduce it with the precision the subject requires from experiments made on the surface of our planet; however refined the methods employed, and however numerous and diversified the grographical stations at which they may be instituted.

(15.) In practice the mean length of the polar or equatorial pendulum is concluded from an assemblage of the observations of the times of oscillation of one and the same invariable pendulum at a multitude of geographical stations in all accessible latitudes in both hemispheres; no two combinations agreeing in giving the desired length, by reason of the local deviations of the intensity of gravity due to the nature of the soil, and the configuration of the ground immediately beneath and around the places of observation. Now, since the pendulum cannot be observed at sea, the whole sea covered surface of the globe is of necessity excluded from furnishing its quota of observations to the final or mean conclusion. And the influence of this, it should be observed, is not self-compensating as that of local inequalities of mere density on land would be, but tells all in one direction. For water being on the average, not more than one third the weight of an equal bulk of land (such land as the earth's surface consists of) and only 2-11 of the mean density of the globe, the force of gravity at the surface of the sea is less than at the sea level on land by the attractive force of as much material taken at twice the specific gravity of water, or at 4-11 of that of the globe, as would be required to raise the bottom to the surface. Supposing then the difficulty of observing the pendulum at sea overcome, and that the whole surface of the globe were dotted over with stations of observation equally distributed over sea and land, from whose intercomparison it were required to derive the mean co-efficient of terrestial gravitation, or the mean length of the polar pendulum; it is evident that the sea stations would everywhere conspire to give a less result than the land. According to Dr. Young (Phil. Trans. vol. 109, page 93) the attraction of an extensive flat mass of any thickness on a point in the middle of its surface is three times that of a sphere of the same materials having that thickness for its diameter. And from this, it is very easy to conclude that, supposing the sea to have a mean depth of four miles (which seems not improbable) the mean defalcation of gravity at its surface, due to the deficiency of attracting matter, would be three times the attraction of a sphere four miles in diameter, and 4-11 of the earth's mean density—that is by a simple calculation 1-1833 or rather less than one 1800th part of the whole attraction of the earth—a fraction far too large, as well as far too uncertain in its amount either at any given spot or in general, not to vitiate irremediably any conclusion as to the ultimate result of the operation.

(16.) Similarly, if we look to the reductions to the sea-level necessary for stations in the interior of continents, we shall find that they depend partly on the diminution of gravty due to the *height above* sea-level, or to the increase of distance from the earth's center, which always tells in *diminution* of gravity; and partly on the protuberant matter, be it mountain or elevated table-land immediately beneath and around the pendulum, which always tells in favor of *increased* gravitation. The former portion is rigorously calcuable, and therefore need not trouble us, but the latter is in an extreme degree uncertain in particular localities, and in a general estimate falls very short of compensating for the sea deficiency. For the mean height of the European continent is only 1,342 feet; of Asia, 2,274; of North America, 1,496; and of South America, 2,302. The mean is 1,840 feet, or rather more than a third of a mile, which, on the same principle of reckoning, would be equivalent to about 1-15,000 part only of the total gravity, which has to be reduced to one-third of its amount, or to 1-45,000, inasmuch as the proportion of land to water over the whole globe is only that of 51 to 146, or about 1 to 3. This is the mean effect of the elevated matter to increase gravitation. That of mere *elevation* above the sea-level to the height of one-third of a mile (similarly reduced) is, however, 1-36,000 in the opposite direction, or to diminish it—and the difference, or 1-10,000 of the whole, is effective, *not to compensate but to add to* the sea deficiency.

(17.) To obtain the real length of the normal pendulum then we must go out of our

own globe, and ascertain the true co-efficient of gravity from astronomical facts; and, as the only one available for the purpose, compute the distance fallen through by the moon in a second of time toward the earth from a tangent to her orbit. This, it is evident, is independent of the influence of those local inequalities which effect the pendulum measurements. But, on the other hand, it must be remembered: First, that our knowledge of the distance in question depends on our previous knowledge of the moon's distance, which, in its turn, depends on that of the earth's diameter, and therefore presupposes the metre to be *accurately* known. For any *aliquot* error in the metre will produce an equal *aliquot* error in the moon's distance estimated in metres, and therefore also in the linear deflection per second from the tangent to the orbit. Second, that this linear deflection or approach of the moon to the earth in one second of time, is the result of the joint attraction of the earth on the moon and of the moon on the earth, and is in effect the sum of the spaces fallen through by the moon towards their common centre of gravity, in virtue of the earth's attraction, and by the earth towards that point in virtue of the moon's. Now the mass of the moon is about 1-88 part that of the earth, so that 1-88 part of the force that draws them together is due to the moon. By so much then must the space fallen through be diminished, to get that due to the earth's alone. Suppose, now, that the moon's mass assumed should be in error 1-50 part of its whole amount (and Laplace's estimate of it differs by as much from that at present received), and we shall find ourselves landed, from this cause of uncertainty, alone in an error to an extent of nearly 1-4,000 of the quantity sought.

(18.) Lastly, our knowledge of the moon's mass is mainly derived from its effect in producing the phenomenon of nutation, which it does through the medium of the earth's ellipticity, so that not only the dimensions, but the figure of the earth, are thus mixed up in our attempt to derive the length of the normal pendulum from the moon's motion.

(19.) I cannot but consider then that the uncertainty of the one mode of obtaining the length of the normal pendulum, and the non-independence of the other, unfit it for being received as the ultimate scientific basis for a universal standard, whatever merit it may possess in an abstract and metaphysical point of view, and that the true and only practicable use of the pendulum in relation to such a standard is the ready, cheap and unobjectionable means its measurement, at a determinate spot and under defined circumstances, affords of recovering it, when lost, by the recorded statement of its length in terms of such standard.

(20.) The causes of uncertainty which tell with such very appreciable effect on the local determination of the force of gravity by the pendulum, have little or no influence on the local curvature of the surface of equilibrium, and absolutely none on the measures of large arcs of the meridian. Suppose, for example, a sea of four miles in depth, and of great extent, to cover one part of the earth's surface. Its surface water will gravitate less by 1-1800 part of its proper weight, owing to the deficiency of attracting matter below it, and, the diminution of gravity growing less and less in descending (being proportional to the height of a particle above the bottom) the whole weight of the column of water vertically above the given spot, will be diminished by 1-3600 part, so that to maintain the equilibrium, 1-3600 part of four miles, or 1-900 of a mile, *i. e.*, about six feet of additional water must be heaped on: a mere infinitesmal of the radius of curvature of its surface, which is that of the earth itself.

(21.) Let us now see how far the French metre, as it stands, fulfills the requirements of scientific and ideal perfection. It professes to be the 10,000,000 part of the quadrant of the meridian passing through France from Dunkirk to Fomentera, and is therefore, scientifically speaking, a local and national, and not a universal measure. The earth's equator is not a perfect circle, but slightly elliptic, and the meridians of places differing in longitude are therefore not all of the same length. The difference, however, is so trifling (the ellipticity of its equator being not more than a thirtieth part of that of its meridian) that, to

raise an objection against the practical reception of the metre, either *per se*, or, as a substitute for the yard, on this score, would savor of hypercriticism. A more serious objection is the choice made of the circumference of the meridional or generating ellipse of the terrestrial spheroid in preference to its axis of revolution. This is a blemish on the very face of the system—a sin against geometrical simplicity. Still, were the length of the metre as determined by the French geometers rigorously exact, or correct within limits which the much more extensive measurements of meridian arcs since made elsewhere than in France, have proved to be attainable, this would be only a matter of regret, and could hardly, of itself, be drawn into an argument for its rejection. But this is far from being really the case. The metre, as represented by the material standard adopted as its representative, is too short by a sensible and measurable quantity, though one which might certainly be easily corrected. To show this it will be necessary to enter into some detail.

(22) In effect, that standard is declared, in the Annuary of the Bureau des Longitudes, to be equal to 39.37079 British imperial standard inches. The quadrant of the French meridian then ought, if this be correct, to be 393,707,900 such inches, or 32,808,992 feet. And by whatever aliquot part of its whole length the true quadrant exceeds this, by that same aliquot of *its* length is the metre, so stated, erroneous.

(23) Mr. Airy, by a combination of the whole series of meridian arcs, whose measures had been obtained in every part of the globe, in 1830, was led to conclude for the value of the minor or polar axis of the terrestrial spheroid, 41,707,620 feet; while the late Professor Bessel, pursuing a course similar in its general principle—that is to say, using all the measured arcs, great and small, in combination one with another, and taking the most probable mean among the (necessarily) discordant results, obtained by combining them two and two—arrived at a value very slightly different, viz: 41,707,314 feet. The mean of these gives, as the result of this mode of procedure, 41,707,467.

(24) Quite recently, M. Schubert, in a very elaborate Memoir, which appears as part of the 1st vol., 7th series of the Memoirs of the Petersburg Academy, has pointed out the inconvenience and necessarily discordant results which the combination by pairs of a multitude of small arcs, each of itself insufficient to afford any precise measure of the ellipticity affords; and assigned his reason for restricting the inquiry in the first instance into the length of the polar axis, as an element unique in itself, and common to all the meridians, deducing it separately from each of the most extensive arcs, the Russian, the Indian and the French, each taken independently; comparing the three values so obtained, and thence concluding the final result. In this manner he obtains the following three values of the axis, viz: From the Russian arc (25° 20′ in extent) 41,711,019.2 feet; from the Indian arc (of 21° 21′ in extent) 41,712,534.2 feet; from the French arc (of 12° 22′ in extent) 41,697,496.4 feet. In concluding for these a mean, or final value, M. Schubert, however, arbitrarily, and as I think quite indefensibly, rejects altogether the result of the French arc, and assigns to the Russian double the weight of the Indian; a mode of procedure in which he will find, I presume, few to agree with him. A much fairer, indeed the only fair way to treat them, is obviously to ascribe to each of the separate results in taking the mean, a weight proportional to the total extent of the arc, and this gives for the length of the axis 41,708,710·0 feet. Comparing then the final results of the two modes of procedure we find: From the former, 41,707,467 feet; and from the latter, 41,708,710 feet, which differ only by 1,243 feet or less than ¼ of a mile—so that their mean or 41,708,088.5 feet is in all probability within a furlong, or one part in 64,000 of the truth.

(25.) From each of the great arcs of Russia and India, M. Schubert then obtains a separate value of the equatorial or the larger axis of the elliptic meridian to which it belongs; and by a similar treatment of the arc of Peru, which, lying under the equator, is especially favorable for the purpose, he obtains a third value of the equatorial diameter. The three diameters of the equatorial ellipse thus obtained, with the angles they include at the center (which are the differences of longitude of the respective meridians, and which

are as favorably arranged for the purpose as the nature of the case seems to admit), suffice for the determination of the major and minor axis of the equator, regarded as an ellipse, and the longitudes in which they lie, viz :

Axis major=41,854,800 feet in longitude 38° 44' east from Paris (one end falling about half-way between Mount Kenia and the east coast of Africa, the other in the middle of the Pacific Ocean).

Axis minor=41,850,007 feet in longitude 128° 44' east from Paris, (one end falling on Waygiou, one of the Molucca Islands, and the other at the mouth of the Amazon River) giving an ellipticity of one 8880th, or about one thirtieth part of that of the meridians as already stated.

(26.) The figure of the equator, and its dimensions thus obtained, the exact equatorial diameter corresponding to any given longitude is easily calculated. And by comparing this with the polar axis, the precise ellipticity of the meridian for that longitude may be computed. And executing this computation for Paris, Mr. Schubert finds 1-296 for the ellipticity of the French meridian.

(27) With these data, viz., a polar axis of 41,708,088 feet, and an ellipticity of 1-296, which certainly may lay claim to greater precision than anything previously obtained, I shall now proceed to calculate the true length of the quadrant of the French meridian, for which purpose the following very simple and convenient formula may be used, * viz., $Q=\frac{\pi}{4} A (1+2m+9m^2+38m^3)$ in which Q represents the length of the quadrant required. A that of the polar axis, π the circumference of a circle whose diameter is I, and m, *one-fourth part* of the fraction expressing the ellipticity, or in this case 1-1184. Executing the calculation the result is, 32,813,000 feet.

Subtract 100,00,000 metres .	32,808,962
Remain, excess . . .	4,008

for the excess of the true quadrant over that assumed as the basis of the metrical system, that is to say, 1-8194 aliquot part of the whole, or one 208th of an inch on the whole metre, which is therefore the quantity by which the French standard is actually too short.

(28.) It must not be denied that this is a very wonderful approximation, and in the highest degree creditable to the science, skill and devotion of the French astronomers and geometricians who carried on their operations under every difficulty, and at the hazard of their lives in the midst of the greatest political convulsion of modern times; and adopted as it is over a large portion of Europe, were the question an open one what standard a new nation unprovided with one, unfettered by usages of any sort, and in the absence of any knowledge of the British yard, should select, there could be no hesitation as to its adoption (with that very slight correction above pointed out—which in no way would interfere with its practical use—a correction which the French themselves might, under such circumstances, consent to adopt). But the question now arising is quite another thing, viz.: whether we are to throw overboard an existing, established, and so to speak, ingrained system—adopt the metre as it stands for our standard—adopt, moreover, its decimal subdivisions, and carry out the change into all its train of consequences to the rejection af our entire system of weights, measures and coins. If we adopt the metre we cannot stop short of this. It would be a standing reproach and an anomaly—a change for changing's sake. The change, if we make it, must be complete and thorough, and

* For the present purpose it is necessary to carry out the calculation to the cube of ellipticity—but in cases where the square of that fraction may be neglected, the following simple rule for finding the circumference of an ellipse is worth remembering. On the longer axis of the ellipse describe a circle, and between this and the ellipse describe a small circle having its centre in the prolongation of the minor axis, and touching the ellipse externally and the circumscribed circle internally. The circumference of this small circle is the difference between those of the ellipse and of the larger or circumscribing circle.

this in the face of the fact that England is beyond all question the nation whose commercial relations, both internal and external, are the greatest in the world, and that the British system of measures is received and used, not only throughout the entire British empire (for the Indian "hath," or revenue standard, is defined by law to be eighteen British imperial inches), but throughout the whole North American continent, and (so far as the measure of length is concerned) also throughout the Russian empire, the standard unit, of which the Sagene is declared by an imperial ukase to contain *exactly* seven British imperial feet, and the Archine and Vershock precise fractions of the Sagene. Taking commerce, population and area of soil into account, there would seem to be far better reason for our continental neighbors to conform to our linear unit could it advance the same, or a better *a priori* claim, than for the move to come from our side. (I say nothing at present of decimalization.)

(29.) Let us see then how this part of the matter stands. Taking the polar axis of the earth as the best unit of dimension which the terrestrial spheroid affords, (a better, *a priori* * unit than that of the metrical system) we have seen that it consists of 41,708,088 imperial feet, which, reduced to inches, is 500,497,056 imperial inches. Now, this differs by only 2,944 inches, or by 82 yards from 500,500,000 such inches, and this would be the whole error of the length of 8,000 miles, which would arise from the adoption of this precise round number of inches for its length, or from making the inch, so defined, ur fundamental unit of length. Suppose, then, that any length were proposed in English measure, and we desire to know what decimal fraction such length were of the earth's axis. We have only to express it in inches and decimals, and from the number so stated take off its thousandth part (a calculation involving only the writing down the number twice over, removing the figures of the under line three places to the right and substracting) and the thing is done, and *vice versa*.† Suppose now the same length stated in French metres, and we would ascertain what decimal fraction it is of a quadrant of the French meridian. The number of metres assigned must be divided by 8,194, either by a long division sum or by the use of a table, before the proper number to be substracted can be found. Which then is the shorter process? and which, both scientifically and practically, the preferable unit?

(30.) If we are to legislate at all upon the subject, then the enactment ought to be to increase our present standard yard (and of course all its multiples and submultiples) by one precise thousanth part of their present lengths, and we should then be in possession of a system of linear measure, the purest and most ideally perfect imaginable. The change, so far as it relates to any practical transaction, commercial, engineering, or architectural, would be absolutely unfelt, as there is no contract for work even on the largest scale, and no question of ordinary mercantile profit or loss, in which one *per mille* in measure or in coin would create the smallest difficulty. Neither would it be doubted that our example would be very speedily followed, both in America and Russia, so soon as the reason of the thing and the trifling amount of the change came to be understood. And even without legislation the relation between the proposed new, or *geometrical* measure and the imperial ones, so simple and striking—fixing itself so easily in the memory, and the conversion from the one

* A writer in *Quesneville's Moniteur Scientifique*, No. 163, V. 736, argues that *itinerary* measures ought to be based on the *circumference* of the globe and not on its *axis*, by reason that the decimal principle of subdivision, if carried out, would apply to the decimal graduation of the quadrant, *adding* that "the greatest advantage of the French system is in reality its decimal division," but *forgetting* to add that the decimal division of the quadrant *was* introduced in France, *but was abandoned by common consent even in France*, and can never be reintroduced. In the "*Mondes*" (suppl. 38, p. 616) the same argument is advanced, and the same answer applies.

† Strictly speaking for the conversion and reconversion we should *substract* 1-999th and *add* 1-1000th. Butthedifference is only one part ina million whice can never be of the slightest importance. *Per contra* the conversion of the metre, according to the process here stated, leads to a result which, though exact in parts of the *French* meridian, is erroneous in parts of the *mean terrestrial* meridian by a considerably larger proportional part; and this is what we really want to know.

to the other so readily, that, *were there no other reason*, it might almost be questioned whether it would be worth while to make the change.

(31.) But there is another reason, and I think a decisive one. Hitherto I have said nothing about our weights and measures of capacity. Now, as they stand at present nothing can be more clumsy and awkward than the numerical connection between these and our unit of length. A grain is defined as the weight of distilled water, so that 252,-724 of such grains at the freezing temperature, or 252.46 at that of 62 degrees Fahr., which is the standard temperature of our imperial yard, shall fill a cubic inch. Of such grains, so defined, the pound contains 7,000, the ounce 437.5, and the gallon of water at 62 degrees, 70,000. According to this system, the cubic foot of water at our standard temperature weighs 997.145 ounces, falling short of 1,000 ounces by nearly three ounces. However tempting this approximation might appear, still, in the absence of any more cogent reason, the commissioners who recommended our system of weights and measures, legalized in 1824, forbore to recommend such a change in the ounce (about one and a third grains) as would have brought it about; though the rule that a cubic foot of water weighs 1,000 ounces is still handed down as a rough and ready way of converting cubic measure into weight. But were we to adopt the geometrical instead of the present imperial standard—the linear foot being increased by one thousandth, the cubic foot would be increased by three times that aliquot, or would become 1.003 times our present cubic foot and so would make up just the deficient three ounces, or at least so very nearly that a legislative change in the ounce, increasing it only by one part in 8,000, or by one eighteenth part of a grain would bring everything into decimal coincidence, by making the ounce and the cubic foot the links of connection between weights and measures instead of the grain and the cubic inch as at present. As regards our measures of capacity, the connection would be equally consecutive. at a decimal one, between the cubic foot and the half pint, which for the purpose in view, ought to have a distinct name (such as a "*tumbler*," or a "*rummer*," or a "*beaker*,") and which would contain exactly one one-hundredth part of a cubic foot, with whatever liquid or solid matter it might be filled. And thus the change which would place our system of linear measure on a perfectly faultless basis, would at the same time rescue our measures and weights of capacity from their present utter confusion, and secure that other advantage second only in importance to the former of connecting them decimally with that system on a regular, intelligible and easily remembered principle; and *that* by an alteration practically imperceptible in both cases, and interfering with no one of our usages or denominations.

(32.) On the subject of decimalization it will be gathered from what I have said that I would make any decimalized denominations which anybody might agree to buy, sell, or contract by, permissive. There seems to be a doubt whether such is now the case, and if so, the law should, I think, be altered. But I would leave untouched all our present *denominations* and their relations to the standard—and the only new measure I would legalize would be a "module" (or some other name *at present unoccupied*) of fifty geometrical inches, being the ten millionth of the polar axis, or its half the "geometricol cubit" of twenty-five such inches—leaving its use quite voluntary.

Collingwood, September 30, 1863.

ADDENDUM.

(33.) Since the foregoing remarks were written, my attention has been called by the Astronomer Royal to a very elaborate memoir by Captain Clarke, in volume xxix. of the memoirs of the Royal Astronomical Society, whose conclusions, though differing from those of M. Schubert In in some particulars (as in making the equator more elliptic), yet, so far as the present subject is concerned, tend in the same direction, and that, as regards the aliquot error of the metre, even more strongly.

(34.) Captain Clarke assigns for the three axes of the earth the following values:

Polar axis, feet	41,707,536
Or in inches	500,490,432
Longer equatorial axis, feet	41,852,970
Shorter equatorial axis, feet	41,842,354

Longitude of the vertex of the longer axis, 13° 58′ 30″ east, or 11° 35′ 15″ east of Paris, whence it is easy to conclude as follows:

Diameter of the equator in the longitude of Paris, 41,852,695 feet.

Ellipticity of the Paris meridian, 1-288.2—say 1-288.

(35.) Calculating now the quadrant from this ellipticity, and from Captain Clarke's polar axis, we find it 32,814,116 feet, which exceeds 10,000,000 metres by 5,124 feet, being in excess of that above found (4008) by 1,116 feet; and corresponding to an aliquot error of one part in 6,404, or on the metre itself to 1-163 part of an inch. The aliquot error in our "geometrical yard" is also somewhat increased by the adoption of this polar axis, viz., to one part in 52,310, or to about 1.453 part of an inch on the yard.

(36.) As this memoir by Captain Clarke contains by far the most complete and comprehensive discussion which the subject of the earth's figure has yet received, and must be held as the ultimatum of what scientific calculation is as yet enabled to exhibit as to its true dimensions and form, this concludsion will of course be considered to supersede that arrived at in the foregoing pages.

Collingwood, October 11, 1863.

P. S.—Some slight subsequent corrections made by Captain Clarke in his calculations, founded on data quite recently published, make the polar axis approximate *still more nearly* to 500,500,000 inches.

LETTERS.

FROM MRS. E. BEDELL BENJAMIN.

STRATFORD, CONN., September 21, 1883.

MR. CHARLES LATIMER.

Dear Sir:—Yours just received; I hasten to express my sympathy not only with your work, but with the principle or truth which underlies it all, that is, the evidence in all science of the one controlling mind of the Great Architect. We can only use a less fact to illustrate the greater, therefore the suggestion will not be irrelevant that it is something like the work of that huge engine in the machinery hall at the Centennial which set in motion the industries of hosts of inventors. Doubtless if it could be applied, and be large enough, one engine would move the manufactories of the world. The idea must be a familiar one, but your letter brought it before me in renewed force. I see the same principle also in the minute study which is now directed to the Scriptures, and the wonders that are developed in the numerical value of Hebrew words, as well as in the subtleties of meanings in the Hebrew roots.

In regard to astrology, I have said somewhere, in some writing, that astrology is to astronomy as mythology is to religion, and so I think. Yet there is an independent truth in each science or rather the application of a truth on an old foundation. Zadkiel is the best astrologer now. I suppose you are familiar with his almanac. He is a Tavist, but of what nationality I do not know. If a gipsy, I leave you to decide whether he is a branch of lost Israel or not. He is scientific, and believes in his own work; but the point I would make is this: even he makes great blunders and his predictions are not more than half correct. Now, if the science were understood so that the rules could be laid down,

they would work like our mathematical rules. We might have predictions, but *cui bono?* Suppose a life-time of labor proves some rules and forms others, is the brain-work worth it? Your letter made me wish to raise a warning voice lest you undertake too much. The Egyptians were wiser, even the physicians each attempted to study only one organ of the human frame. Surely there is enough work in one branch that you have undertaken. I fear to add to your work in reading this, and will hasten through my topics. Your Isis picture is not clear to me. It seems to aim at too much. My idea of the Veil of Isis is that it represented the purity of the Virgin Mary. As the Romanists have it, "Mary, always a Virgin," and I have always supposed this the idea of the Saitic inscription and that it proved the knowledge of the Egyptian priests of our Lord's divinity. Mariette Bey found an inscription—repudiated utterly by Professor P. Smyth—in which Isis is termed "Rectrico of the Pyramid." I believe the sphynx represents Isis—the Virgin—(combined with Leo) and am trying to write for you a few researches, etc., on the subject. If Mariette Bey was right, the sphynx would be a grand watcher at the Pyramid entrance, and shows the alpha and the omega of the Lord's life, "born of a Virgin, the lion of Judah." There are immense difficulties in this—one is the *beard*, but I will give this in another shape.

Now the 600 year circle. One of its attractions to me is its being the divisor of our 6,000 years of this dispensation, with ten for a quotient. Mahan says less of 10 than of the other numbers, but it contains seven and three. That is two threes and one four—to my mind the world's history. First, *God*, the three persons, existing before all worlds, then the earthly *four;* after which *God* in three persons again superseding all else. "God shall be all in all." But I can no more follow thoughts to the circumference of the wheel than can any of us know all things.

I have a series of articles which I wish you had time to read. They appeared in the *Heir of the World*, and were called "On the Threshold." They came to an abrupt ending on the morning of Garfield's death. The bell of the village church tolled the sad news. I rose from my bed and went to my desk and sacrificed the hero of my story, combining his death and Garfield's. Something made me do this. I felt I could say no more it was like "silence in Heaven," all creation seemed to pause to listen to the voice of God.

But I must stop. These articles contain a great deal of star thought, though not scientific. They suggest the wonderful revelations made to Adam, and how they were the foundation of our knowledge now. E. BEDELL BENJAMIN.

FROM ALFRED B. TAYLOR, MEMBER OF COMMITTEE OF REVISION AND PUBLISHER OF THE PHARMACOPŒIA OF THE U. S. OF AMERICA.

PHILADELPHIA, 1883.

CHARLES LATIMER, ESQ.—

My Dear Sir:—Your letter was duly received, but I have been so much occupied that until now I have been unable to answer it.

You ask, "what proportion of druggists in New York, Philadelphia and Boston or other cities, use the metric system?"

To the best of my knowledge and belief the metric system is not in use to any extent worth naming among the druggists of New York, Philadelphia, Boston, or any other cities of the United States. Occasionally in this city (and I suppose the same is true of New York and Boston) the druggist receives a prescription written in metric terms, by some physician who is desirous of appearing smarter and more learned than his fellows, and who, to accomplish his end, takes upon himself a considerable amount of trouble. In my own experience of many years, I think I can truly say I have not received so many as one in each thousand prescriptions written metrically. Moreover, about *one fourth* of hose which I have received have contained mistakes.

I have the metric weights and measures, and am prepared to put up such prescriptions, but I think very few of the druggists here or elsewhere are thus provided, and consequently when they receive metric prescriptions are compelled to translate the quantities into English weights and measures, thus running additional risks of making mistakes.

In regard to the United States Pharmacopœia being entirely metric, your friend Dr. Smith is mistaken.

According to instructions given by the Pharmacopœia Convention, which met in Washington in 1880, the following rules were adopted by the Committee of Revision:

"All measures of capacity have been abandoned and quantities are expressed in parts by weight, except in the case of fluid extracts." Here the rule was adopted of making from a specified weight of drug, a measure of fluid extract that would exactly equal the measure of that same weight of distilled water; and since, unfortunately, no such nice relation exists between English weights and measures, recourse was had to the French terms "grammes" and "cubic centimetres."—one hundred grammes of drug being used to make one hundred cubic centimetres of fluid extract. (A cubic centimetre is the measure of a gramme of distilled water, or in other words a "fluigram.")

"Whenever it is necessary to employ definite expressions of weight, as, for instance, when it is directed that a pill-mass is to be divided into pills containing a certain weight of one or more constituents, this weight shall be expressed both in apothecaries and in metric weight."

Thus the following is the formula for

Pilulae Opii.
Pills of Opium.

	GRAINS.	GRAMMES
Powdered Opium, one hundred grains	100	6.50
Soap in fine powder, twenty-five grains	25	1.62
	125	8.12
To make one hundred pills		100

Beat them together with water so as to form a mass, and divide it into one hundred (100) pills.

These are the only instances in which the Pharmacopœia can be said to be metric; and whether these changes from the old established form will be acceptable or not to the Professor of Medicine and Pharmacy, time will show. Yours Respectfully,

A. B. TAYLOR.

CLEVELAND, O., September 27, 1883.

CHARLES LATIMER, ESQ.—

Dear Sir:—It was probably Addison who had the idea that the marble block in the studio of the artist had beneath its rough exterior the exquisite proportions of the human form, and all that was necessary to bring it out to view was the chisel of the skillful sculptor.

The Pyramid also contains a hidden treasure, but it differs from the block of stone in this: The chisel has done its work. The great structure, complete in all its proportions, was born of the architect's brain long centuries ago. But, like the marble, it contains somewhere in its massive proportions a hidden treasure—a message from the pre-historic ages to our own times, which, as in the case of the little book of the Apocalypse, no man seems to be able to read. In the vestibule of its treasure-house we have intimations of its importance; and what we have been able to decipher teaches us that the highest minds in those old days were not so near the "missing link" as the Evolutionists would have us believe. They seem to have known, with Job, that the world was hung upon nothing;

that it bore a certain relation to the great orb of day; that it swung around him in the aerial spaces, and spun on its own axis then as now; that it knotted off the days and years with the same precision then as now, and that the chord of gravitation by which it held fast to the sun was of the same length then as it is now.

So much of the message we have thus far been able to read. We have made out some of the letters, but have not, as yet, found the key. On the outside, along the base and across the diagonals, are there intimations of something more to be found within. But in our further researches we have not been very successful. The long, dark passages, the mysterious caverns, the lofty galleries and the polished stone rooms have mocked at all inquiries, and no theory has yet been broached which explains the facts. Perhaps we have unwittingly begun at the wrong end. In the article read last night by W. H. Searles, Esq., there was a suggestion in relation to the granite leaf which may lead to more important results. Why is it that the approach to the King's Chamber is thus obstructed? The investigator gropes his way downward and upward through the long, dark passages and the lofty gallery, to find it barred most mysteriously in the little ante-chamber by this leaf. The ends are not masoned into walls like other portions of the work, but hang loosely in grooves, and the stone is divided into two portions, which are carefully matched together. Does it not seem as if this was the lodge where the porter dwelt to keep guard over these passsages, and that our investigators had failed to knock at this door to obtain the key! Here are these loose leaves standing directly in the way, as the angel hedged up the way of Baalam. One of them, indeed, thrusts out a boss as if asking to be lifted, and if the investigator would put his ear close, and call softly on the porter that dwells within, he would probably hear him say:

"If you wish to know the secrets that I hold, do not seek them by crawling underneath or leaping overhead, but stop and get the key."

In plainer terms, it seems to your correspondent that the suggestion contained in the article to which I have referred is worthy of the serious consideration of those who would unravel the mysteries of the Pyramid. If there is meaning anywhere it should be here; and, for one, I am impatient to see the leaf lifted and the riddle solved.

Yours most truly,

SAMUEL G. ARNOLD.

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883 DEAN ST. BROOKLYN, NEW YORK, Sept. 20th, 1883.

Dear Sir:—I fear some of your men are beyond their depth, for in the last *International* I perceive that one finds room for nine signs of the Zodiac in the interior of the Great Pyramid. If he will find nine he should begin with Scorpio, for there the labors of Hercules Samson show that Messiah begins there to bear up all things, for in that sign where Ophinchus strangles a serpent by grasping him around the middle—the original of Hercules and Antæus—the ancients saw begun the labors of Messiah. There was formerly a lion there, as also an eagle and serpent; but this can scarce be explained in a letter. But Beswick is wild. His assertions have nothing behind them; each sign has always been 1-12 of a circle, or 30 degrees, and each was at times divided into three sections of 10 degrees each, called decani or tens. Miss Rolleston, whom many follow, mistakes for the decani a paranatellon upon each side of each sign, the sign not being divided at all. Astonishing mistake indeed. Astronomy has been corrupted during the middle ages, and so Aquila Antinous is inverted; the eagle is flying south while it should be north, for he is bearing man—(Gannymedes, the keeper of—ganna—the garden)—to heaven; and this, in astronomy, is the region about the north pole. There is truth enough in the Pyramid without adding unauthorized fancies. From the names of stars, as I recollect them in Mugh Beigh, the Arabs and Tartars were sometimes mistaken, and the moderns have followed them in too many cases. Our sacred astronomy—astrology,

if this name be preferred—is coeval with man; and yet our teachers tell us that all was invented on the plains of Chaldea, when many of the stars of the near south, belonging to either the zodiac or the galaxy, are not visible at all. The great authorities—as (e. g.) Bailly—tell us that all came from the east, and from the most remote ages of man, India was the primitive seat of man and the sciences; Chaldea is of yesterday. But if men were not allowed to speculate in book-making until they understand what they write about, there would be few books. I am glad to find Epstein in your last. His productions are always golden, and I have added him to the list of my best co-adjutors in the highest sacred studies. Yours truly in haste, ASAHEL ABBOTT.

Chas. Latimer, Esq., Cleveland, Ohio.

LETTER FROM EX-GOVERNOR OF IOWA.

WASHINGTON, D. C., October 15, 1883.

Dear Sir :—My very poor health for many months past must serve as an apology for my seeming neglect of your friendly notes, and the papers which you sent, giving reports of the interesting proceedings of your Institute.

I well remember my impressions when you first suggested the organization of your society at Cleveland, and desired that I should form a similar one in Washington—namely, that it would be a most difficult task to invest it with sufficient interest to keep it alive any very great length of time, that it would languish and die out for want of aliment, that is to say, the danger of supplanting our system of weights and measures by the introduction of the French metre was too remote and improbable to stimulate any protracted opposition to it. How delusive our impressions often are? Instead of this your society has steadily increased in power and usefulness until it has become in fact what it is in name an Inter-National Institute. This is evidenced by the fact that so many gentlemen of culture and science from different parts of the country are seeking membership therein, that they might participate in so good a work.

I now see that there is no better or truer wisdom than that which has been adopted by your society in disseminating correct information on the subject of weights and measures, and implanting principles and sentiments in the public mind in relation thereto which will in a great degree forearm the people in the conflict when it comes.

Your success, therefore, has certainly been remarkable, reflecting great credit upon yourself, your Institute, and the country at large. It only shows what a few earnest men can accomplish whose heart is in the work they have undertaken.

Now in connection with this subject I desire further to add, that inasmuch as it is a part of your theory that the true standard both of linear measure and of weight and capacity measure find an authoritative support in the symbolic teachings of the Pyramid of Gizeh, that wonderful pillar of stone which God in his word declares "shall be for a sign and for a witness unto the Lord of Hosts in the land of Egypt," a *further* and a more complete exploration of the same should be made one of the standing objects of your Institute. And if it is possible to organize a commission to visit that wonder of the world, with a view of a more exhaustive examination of its secrets and mysteries, it should be done under the auspices and by the direction of your noble Institute. This would give dignity and prestige to the enterprise that would command public attention, when a corresponding effort by outside individuals would attract but little notice. At all events the sense of your Institute could readily be taken on the subject by the introduction of a resolution by some member thereof to the effect, that to the ends and purposes of this Institute shall be added the further object of advocating and promoting the organization of an American commission to make a more thorough and exhaustive exploration of the Great Pyramid of Egypt, which shall be under the immediate supervision of your Institute. If such a resolution should pass, and a suitable committee of three or five persons should be appointed

to make known the great importance of such commission to the wealthy citizens of Cleveland, I cannot but think it would meet with a favorable response. If so it would be a great honor to your city, and the crowning effort of all her great enterprises. I was surprised to read, some time since, of the great number of wealthy men in your city, not only wealthy, but millionaires.

I have made the foregoing suggestion because I have heard but little of the commission lately. I am afraid it is dying out. It ought not so to be. In common with many others I have a strong conviction that there is another undiscovered chamber, the contents of which will convey to the world matters of the greatest interest and gravity, and that the American commission with you at its head can find it. Your Institute cannot do a better thing than to work for the creation of such a commission. Kindly yours,

R. P. LOWE.

TO CHARLES LATIMER, C. E., CLEVELAND.

LONDON, ONT., September 26, 1883.

My Dear Sir:—I am looking forward with much pleasure for your work on the "Unveiling of Isis." The writing in Sais, "I, Isis, am all that was, or is, or is to be, and no man hath me unveiled," is very biblical in its tone and language, as given in Exodus and the Book of Job (Shem): "I am that I am," and, "Cans't thou find out God?" To our cherished myths of Greece and Rome, some *very* learned men recently applied such epithets as Goths ! Vandals ! Iconoclasts! the best names for them, without rhyme or reason but giving naught better in return; not like Dr. Seiss, who has healed the wounds from the axes and hammers of these reckless destroyers. Seiss has taken us gently and kindly by the hand and led us quietly back to the days before the flood (an age looked down upon by some wiseacres of the present time) to those giants of intellect taught by God himself, filled with the wisdom from on high, with that wisdom which we have all yet to study and know more perfectly in heaven—if man would but lift his eyes up, away from the dust of earth, and see the crown of glory above his head, and in the act contemplate more intimately the heavens, would he not with fervor exclaim: "The heavens declare the glory of God"—showing forth his handiwork, in that he has garnished the heavens with the old gospel story, the story of "the serpent and the cross," throughout the signs of the Zodiac from Virgo to Leo—those pictured heavens whereon are shown the cherished myths of schoolboy days, now cheering with sublimer thoughts our footsteps to eternity. When shall we visit those mansions of the planets, and how shall we walk and converse there and let our conversation be in heaven. Ah ! some day we shall know even as we are known. In the meantime do you, my dear sir, lead us back, as Dr. Seiss has done, he to those ancient of ancients; you to those ancient days of old Egyptian lore, exploring in rocky tombs and buried cities and temples painted and bedecked in glowing colors bright to the present hour; with lotus e'en as if just plucked fresh from the banks of the Nile. Take us with you into that sacred spot where mighty Pharaohs swore before On on Isis' altar to preserve the ancient "weights and measures" intact. How came these Egyptians to hold the weight and measure so sacred—which God so solemly particularized to Moses hereafter? In the all hail beginning, when everything as finished was pronounced "very good," then man sat at the feet of God and learned of Him and transmitted this heavenly knowledge down to Noah, and from thence to the patriarchs after the flood. Whilst man feared God and walked in his ways all was well, but at the confusion of tongues at Babel (how know we what dire confusion took place?) the germ of all the myths throughout the world, forgetting the truth and worshipping the created for the Creator, truth became so mixed up with fable that it is only now we see, as in a glass, darkly even yet.

These are wondrous days of searching and finding out—the glorious voice ringing out from granite blocks from the witness to the Lord in the land of Egypt, and the whispering echoes of Jacob's blessing on Ephraim and Manasses pronounced so many thousand years ago, and now, reverberating from rock to rock, striking on Sinai and loudly tuning its harps on Mt. Zion, making the chalk cliffs of old England glisten more brightly and the mountains and forests of America laugh and sing for joy at the finding of Israel and the return and reunion of all. But yet, as I said before, we see but darkly, but the silver lining of the cloud is becoming daily brighter, and ere long will relight Israel back to glory, and Egypt shall no longer threaten, neither shall Assyria, but both go hand in hand with Israel in modern tongue, England and the United States, Germany and Egypt. Can these things be? Wait, I say, upon the Lord.

I follow you through your pages with infinite delight, and who knows what the apparently Guardian Sphinx's still, stony face may also proclaim?

Yours in very truth most truly,

To CHARLES LATIMER, ESQ., C. E., Cleveland. J. L. DAMPIER.

BOLOGNO, July 26.

**Learned Sir:*—I thank you heartily for the gifts with which you have honored us from time to time, and principally now for your memorandum upon the subject of the Prime Meridian.

I am of your opinion that it would be better to let it pass through the meridian of the Great Pyramid, than through the frozen desert Alaska, through Washington, or through Greenwich. In my opinion, however, it would be still better to adopt the meridian of the Isla del Ferro, introduced by Ptolemy. To place it conventionally, fix it at 20° west of the Observatory of Paris, as the German geographers practically do now. This would be then a thing very useful for the different countries which would establish their respective local time, so that their time would always differ an exact hour or half an hour. For example, suppose that the Prime Meridian should be that of the Great Pyramid, the time of the Astronomers of every country and the local time of all Egypt and all Asia Minor and of all European Russia shall commence at midnight through the Great Pyramid on universal time. The civil time of Italy, of Germany, of France and of Sweden shall commence precisely at two o'clock, (universal time); the time of Great Britain to commence at three o'clock, or at half-past two, etc., (universal time).

Accept the assurance of my highest consideration. QUIRICO FILOPANTE.

THE OBSERVATORY, SOUTHPORT, BIRKDALE, October 16, 1883.

My Dear Sir:—I regret that owing principally to the state of my health my attention has lately been taken a good deal from Pryamid matters, and that I have not sooner been able to reply to your very kind letter of September 11.

With respect to the two measures used by the architect of the Pyramid, I think it is not at all unreasonable to suppose "that there are two heights and bases, and that one of these may refer to the weights of our race correlated with the weight of the earth," but I have not yet given the question that attention which it seems to merit.

I had written thus far when your letter of October 1 came to hand, enclosing Mr. Dow's remarks, from which it appears I did not make my meaning sufficiently clear, and

* Letter from Prof. Quirico Filopante, University of Bologno, Italy, to Prof. C. Piazzi Smyth Astronomer Royal Scotland.

it will, I think, be better, as Mr. Dow kindly suggests, to say "P representing the number of Pyramid inches in any given distance, and B the number of British inches in the same distance." From Mr. Dow's copy of the first equation, it appears there is an omission of +2 in the denominator of the fraction. The equation is:

$$P = B - \frac{B}{412.1318\ \sqrt[5]{100} + 2}$$

The correction of the length of the King's Chamber by the use of the equations is precisely similar to the numerous cases which occur in scientific investigation, in which closely approximate values are used to determine the law from which the true values are afterwards derived. Taking Mr. Dow's length of the King's Chamber, 412.529612 original British inches, the equation gives 412.131889 as the length in Pyramid inches, and if we substitute this in the equation, no sensible effect is produced upon the final result. Mr. Dow will therefore see how the "assumed" can differ from the "obtained" value, and that it is quite unnecessary to assume that two Pyramid inches were used by the architect. Whether the equations represent with strict exactness the true relation between the Pyramid and the original British inch may, of course, be questioned, but if not, they may perhaps be of use in pointing out the way in which the strictly true relation is to be sought.

I have read Professor Stockwell's valuable paper with much interest, but his results indicate that the moon's period is less likely than the sun's to enable us to determine the epoch intended to be represented by the Pyramid. Sometime ago I obtained several equations giving closely approximate values of the moon's mean period; these I will look up and revise, and if I find any of the results of sufficient interest, I will forward them to you.

I have occasion to leave home to-day for a short time, and must therefore reserve further remarks for another letter on my return. I have the honor to be, sir,

Yours very faithfully,

JOSEPH BAXENDELL.

Charles Latimer, Esq., C. E.

EDITORIAL NOTES.

WIRE GAUGES.

The subject of wire gauges—or gages, as Webster properly gives it—is exciting more interest in England than in this country. A new gauge has been prepared by the Board of Trade, which has received the royal sanction, and an order in council has made its use—to the exclusion of all others—obligatory after the 1st of March, 1884. This new gauge is substantially the old Birmingham gauge, which is in general use all over the world, but differing enough from the Birmingham to create endless confusion.

It is to be regretted that a so well-informed body as the English Board of Trade should have given their official sanction to a movement which, though intended as a corrective of existing evils, will only add to them. The new gauge has already been severely attacked by manufacturers and dealers in plate and sheet metal, and measures are proposed for having the order set aside.

Most of our readers are probably not aware of the perplexities surrounding this question of gauges. Some one in the remote past constructed a gauge—it may now be called the Birmingham, the London, the Partridge, or some other name—for his own use, perhaps in an arbitrary manner, which gauge doubtless has served as a basis for the dozen other *standard* gauges now in use. Unfortunately no two of the gauges agree, and none of them have uniform graduations; while, owing to the difficulty of constructing gauges with arbitrary graduations, gauges from the same manufacturer do not always coincide with each other. As a matter of course, in this chaotic state of the gauge question, endless confusion was the result in making orders, unless the decimals of an inch are given in the order of the particular thickness of metal or wire required. It was to remedy this state of affairs that the English Board of Trade have promulgated the new gauge, making it the *legal* standard of the empire. But, as before stated, the Board of Trade has failed to produce a satisfactory gauge, or one that will meet the requirements of trade.

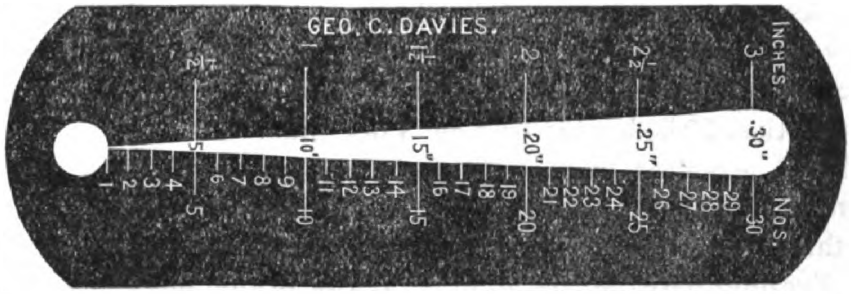
To make this subject more clear to the non-technical reader, it may be well to mention that these gauges are constructed generally in three forms: a round disk of steel 1-16 of an inch thick, from 2 to 4 inches in diameter, with notches filed or milled in the edge for the different widths of gauges—say from fifty hundredths of an inch for 70, the largest, to one one-thousandth for No. 50. Another form is made of an oblong piece of steel, say 1¼ inches wide and 4 or 5 inches long, similarly notched, for the different gauges. Another form much used by manufacturers is made of a sheet of steel somewhat wider, longer and thicker than the last, with a triangular piece cut out of half an inch at the base, extending

upward to within an inch or so of the other end. The inner edges are planed or filed perfectly true, with the gauge marks on the margin at such points as will indicate the required decimals of an inch in the proposed gauge. As a matter of course the methods of construction of the gauges renders exactness almost impossible.

In view of the perplexities surrounding this question, the Ohio Auxiliary Society, as is right and proper, have taken up the matter, and at one of the meetings in March last, a paper discussing the subject was read by Mr. George C. Davies of Cleveland. In this paper Mr. Davies took the ground that all these gauges were not only defective in the irregularity of their gradations—the diameters of the numbers varying largely in different parts of the scale; that the intervals being arbitrary and proceeding irregularly, could only be made with the best of appliances in the most skillful hands; and further, that the numbers in all the gauges in use were mere abstract terms conveying no definite idea of the diameter of the gauge.

To remedy these defects Mr. Davies proposed a new gauge radically differing in its numbering from its predecessors—the numbers, instead of running from the largest to the smallest sizes as in all the old gauges, run from the smallest to the largest—the gradations to be uniform and the numbers to give the hundredths of an inch in the gauge. For example, No. 4, 9, 15, etc., are 4, 9, 15 hundredths of an inch, so that a person making or receiving an order will know exactly the decimals of an inch in the number named. We give below a cut of Mr. Davies' proposed gauge. It will be seen that the mode of construction is such as to insure the utmost accuracy, at the same time enable any one with a scale graduated in hundredths of an inch to test the correctness of the gages. In theory this gage is made with two straight edged pieces of metal say one inch wide and five long, two ends placed in contact the others half an inch apart. If one of these edges is divided into fifty parts, it is evident that such division will be exactly one one-hundredth of an inch further from the opposite side than the number next above and below it. Of course any wear on such a gage can readily be detected and guarded against. As

this gauge possesses apparent merits, it is to be hoped that those interested will give it earnest consideration.



INTERNATIONAL WIRE AND SHEET METAL GAUGE, AS PROPOSED BY GEORGE C. DAVIES.

STANDARD TIME.

The efforts of Mr. Sandford Fleming in regard to Standard Time have finally been crowned with success, though not so fully as the author of this great movement had expected. W. F. Allen, editor of the *Traveller's Official Guide*, and secretary of the Time Convention, has been a great worker in pushing this work practically and deserves credit from the country and especially from the railroad fraternity for having brought the whole matter to a successful issue for trial, for it is yet an experiment.

The agitation of this subject began in Montreal, at a meeting of the American Society of Civil Engineers three years ago, when Mr. Sandford Fleming presented it, claiming the necessity of establishing a standard time for the railroads and the importance of adopting a prime meridian, and since then it has been presented to different societies and debated and finally acted upon favorably by the majority of the railroad superintendents of the country, resulting in the present movement by the adoption of five meridians in this continent under the new system—fifteen degrees or one hour apart: 60° the Inter-colonial, or Labrador and Prince Edward's Island time; 75°being the eastern meridian and Philadelphia time; 90° the central meridian or New Orleans time; 105° the mountain, or exactly the Denver

time, and 120°, crossing near Carson City, the Pacific time. All the watches of the whole country are to be of the same minute and second, but differ one hour for each meridian. The city of Cleveland takes central time, or St. Louis or New Orleans time, twenty-eight minutes slower than local time and one hour slower than Philadelphia or New York time.

Great accuracy will result from this movement, as every watch will be set by telegraph to the same minute and second. In this arrangement Greenwich is the prime meridian. Should the Pyramid hereafter be adopted as the prime meridianof the world the change will be but five minutes except in hours, the Pyramid being two hours and five minutes east of Greenwich.

The unanimity with which this arrangement has been adopted by all railroad companies is an earnest of its success. A convention called international has been held at Rome, deciding upon Greenwich as prime meridian. We reserve that matter for future criticism inasmuch as this assembly has recommended to England the advisability of joining the Metrical Convention.

Mr. Edward L. Wilson, a member of the Institute, recently gave a series of illustrated lectures at Case Hall, under the management of Mr. J. F. Ryder. The subjects were, "Egypt and the Egyptians," "An Arabian Nights' Entertainment," "Picturesque Palestine," "Nile Tombs, Temples, and Travel," "The Taking of Petra," "New Pictures of Old Places." The lectures were illustrated by over five hundred stereoptican views, taken by Mr. Wilson, with his own photographic camera, during six months' wanderings in the countries of the far East.

The Philadelphia *Times* says: "Mr. Wilson's photographic tour in the East last year was the most extensive expedition of the kind ever undertaken, and the pictures he brought back with him well repaid his toil. The antiquities of Egypt are not a new field, but even the sphinx and the pyramids have a new solemnity in the superb views. After spending some time in Egypt, Mr. Wilson and his companions crossed the Red Sea

and took up their journey through the wilderness, following in a general way the path of the children of Israel southward to Mount Sinai; thence northward to the Gulf and into Edom and the rock cities, and thence to Palestine. The lecture last night was a plain, straightforward narrative of travel, just sufficient to connect and explain a series of some hundred views, many of which were marvels of photography, and presented scenes that have been described, but never thus pictorially presented. The views about Sinai and of the various spots celebrated in the Exodus were of especial interest, but still more so were those of the wonderful rock temple of Petra, a monument of an ancient civilization to which but few travelers penetrate, and of which photography has for the first time brought back a faithful record. Such an exhibition as this is more than a mere entertainment; it is a positive addition to knowledge, and the close attention with which the lecture was followed by a very large audience, attested at once the interest of the subject and the rare beauty of its pictorial presentation."

J. P. Weethee, of Millfield, Athens County, Ohio, has ready for the press two books, the subject matter of which cannot fail to prove highly interesting. The first has for its title, "The Coming Age—Its Nature and Proximity." The second work treats of the various phases of the Eastern question. Each book contains about 500 pages, royal octavo, and the price for each is $3.00. C. H. Jones, 138 Lake Street, Chicago, is the publisher.

The editors of this number of the Magazine regret that it was necessary to go to press before the proof-sheets of Mr. Casey's valuable article, "Pyramid Prophecies and Egyptian Events" could be received back from Ireland, whither they were sent for correction by the author. Mr. Casey makes a number of corrections and alterations from the reading of the article as received for publication, which, if they could have been made

before going to press, would have improved certain passages of his interesting paper. Where practicable, every writer for the Magazine should read the proof-sheets of his paper before publication.

A FEW WORDS ON THE LATE VENUS TRANSIT AND THE SUN DISTANCE.—This is the title of an interesting pamphlet, written at request for "The Ousel," the journal of the Bedford Grammar School, by Professor C. Piazzi Smyth, an old boy of that school. The article will be published in our next issue.

We bring forward in this number one of the most interesting, valuable and timely articles of Sir John Herschel, "The Yard, Pendulum and Metre," especially suited to our work, and we commend it to the careful attention of our readers.

The publisher regrets that in moving his office the paper of S. F. Gates, on "Some Strong Reasons for Holding our own Measures," was lost after having been set up.

WE give below a list of periodicals interested in the investigation of the scientific teachings and truths contained in the Great Pyramid of Gizeh:

THE BANNER OF ISRAEL,—A weekly journal, edited by Philo Israel, advocating the identity of the British nation with the Lost Ten Tribes of Israel. Many clergymen of the Church of England, the Astronomer Royal for Scotland, and other scientific men are contributors to this journal. Published by W. H. Guest, 20 Warwick Lane, Paternoster Row, London, England.

BRITISH ISRAEL AND JUDAH'S PROPHETIC MESSENGER,—A weekly journal devoted to the elucidation of prophecy and the identification of the British Nation with the House of Israel,

God's chosen People, His Inheritance. Published by John Heywood, 11 Paternoster Buildings, London, E. C. England.

THE HEIR OF THE WORLD,—A monthly magazine for advocating the identity of the Lost Tribes of Israel with the Anglo-Saxon race. Edited by George W. Greenwood, 266 Schermerhorn street, Brooklyn, New York.

OUR REST is a sixteen page monthly journal, published at $1 per year, devoted to the search for Bible truth and practical *every day* christianity. Special attention is given to the Second Coming and personal reign of Christ; the signs of the times; the Anglo-Israel question; the Anti-Metric Society; the Great Pyramid, etc., etc. OUR REST will furnish reports of the meetings of the Anti-Metric Society at Cleveland, and accounts of their work as the interest demands. *Short* articles upon these or kindred questions will be acceptable.

THE YOUTH'S EXAMINER is an 8 page illustrated monthly, published in the interest of our young people. Price 40 cents per year.

To new subscribers both of these papers will be sent from the time of receiving the subscription to January, 1885, for *only one dollar.* Address, C. H. Jones, 138 Lake Street, Chicago, Ill.

TRANSACTIONS OF THE OHIO AUXILIARY SOCIETY OF THE INTERNATIONAL INSTITUTE.

SEPTEMBER 12, 1883.

The two papers of the evening at the meeting of the Ohio Auxiliary Society, held September 12, were from Mr. Joseph Baxendell, astronomer, of the Observatory Birkdale, Southport, England, and Charles Casey, C. E., of Pollerton Castle, Carlow, Ireland. Mr. Baxendell divided his paper into three distinct parts: First was "Remarks on Mr. Dow's Reply to His Criticism of Mr. Dow's Paper;" second, "Length of the Seconds Vibrating Pendulum and True Length of Pyramid Inch;" third, "The Original Length of the British Inch and its Relation to the Pyramid Inch."

In discussing the second part of his paper, he finds from various deductions that the Pyramid inch is 1-989.2 longer than the British inch, which comes remarkably close to previous results. And in the last division of his paper he supports Messrs. Dow and Latimer in their theory that there were two different inches used by the architect of the Pyramid—one of which enables us to trace the relations of all the various parts of the Pyramid, and has special reference to the length of the year and of the grand gallery—and the other that which is closely indicated in Mr. Dow's equations and is related to the divisions of the circumference and diameter of a circle and which has reference to certain parts only of the Pyramid. But this second inch, he thinks, is not the present

British inch, since he finds that while the Pyramid inch is 1-989th greater than the present British inch, it is only 1-1036th greater than the inch indicated by Mr. Dow's equation; but then there can, he thinks, be little doubt that the length of the inch thus indicated is the original length of the present British inch.

Mr. Casey's paper in reply to an article by Professor Proctor on "Pyramid Prophecies and Egyptian Events," was a valuable production and was listened to with much interest.

The Astronomer Royal for Scotland, Professor Piazzi Smyth, in a recent letter read by the secretary, expresses himself as much pleased with what Professor Stockwell has done in relation to the moon's period four thousand years ago, which was embodied in a paper read before the Society at its meeting on the 25th ult,, and hopes that he will communicate it to the Royal Astronomical Society of London, where they have just been finding an apparent error in their computations of the length of the solar day of the earth, but no one has ventured to carry it back more than five hundred years, and most of them are content to work within one-tenth of that time, while Professor Stockwell has gone back four thousand years.

The President read an extract from an article on the International Exposition now being held in Boston, which spoke in very high terms of a model of the Great Pyramid which is there on exhibition, the credit of which is due the untirlng efforts of Mr. Bisbee, the Secretary of the Institute, who has been working at it for some time. In addition to this letters were read from Mrs. Plumtre and Joseph Baxendell, of England, and Rev. James A. Upjohn, Neenah, Wisconsin, the author of two valuable books on "The Name Counted" and "The Nuumber Counted."

On account of want of time, the reading of a lengthy letter from J. L. Dampier, of Canada, was deferred until a subsequent meeting.

The following persons were elected members:

R. C. Oakley,	Roselle, New Jersey.
F. B. Dunn,	Elizabeth, New Jersey.
David B. Provoost,	Elizabeth, New Jersey.
Justus Morris,	Elizabeth, New Jersey.
B. Murtaugh,	Jersey City, New Jersey.
J. H. Worth,	Westfield, Retford, England.
Dr. F. C. Sibbald,	Sutton, Canada.
Sidney J. Sanford,	Barrie, Canada.
Theodore Faber,	Brooklyn. New York.

After discussing at some length the subjects presented, it was decided to continue the discussion on weights and measures at the meeting the 26th inst.

SEPTEMBER 26, 1883.

The Society met at 8 P. M. President Latimer in the chair. New members were elected as follows:

Edward W. Serrell,	New York.
E. V. Sidell,	New York.
A. B. Paine,	New York.
A. Hamilton Morris,	Elizabeth, New Jersey.
Charles G. Roebling,	Trenton, New Jersey.
John R. Emery,	Newark, New Jersey.

The most of these are distinguished engineers.

A letter was read from B. A. Mitchell, of Philadelphia, who suggests that the disasters of this year—cyclones in the west, plague in Egypt, earthquakes in Java, as well as minor calamities—are predicted in the passage leading from the Grand Gallery to the antechamber of the Great Pyramid.

A short letter was read from Piazzi Smyth in answer to a paper from one of the members. He emphasizes the fact that the quadrant passing through Paris cannot be taken as a measure standard as the peculiar shape of the earth makes other quadrants differ from this.

Thomas Holland, London, England, has been giving lectures to his brother Masons on what he terms "Pyramidal Free Masonry" and has paid particular attention to the granite leaf which he thinks covers the opening to other passages and to the ante-chamber, a diagram of which he has sent to the secretary of the Institnte, Mr. Lucian I. Bisbee, who made use of such diagram in his model of the Pyramid, now on exhibition in the Foreign Exhibition in Boston. Mr. Holland has written Mr. Latimer concerning this belief, and Mr. William H. Searles, who long ago asserted his opinion that the granite leaf probably held a revelation of the great structure, read a paper called forth by these lectures. He agreed with Mr. Holland that the leaf should be moved from its place but not because he expected the discovery of new passages thereby. He thought that the two portions of the leaf, which are so skillfully cemented together that careless travelers do not detect the seam, were two coffers, the one inverted over the other, and that in the receptacle thus made the architect had bestowed his plans of the structure, as we now place documents, etc., in a corner stone. Mr. Searles told of the inroads made upon the great monument by vandals of all ages in search of new passages, but he thought the designer and builder had locked up his secrets in this book of granite, where the skillful and not the rude destroyer should find them. These stones should be raised until the upper one was above the wainscoting and then it should be shoved aside. The cost would be little and the harm done nothing.

Mr. Davies read a paper in advocacy of weighing commodities of trade, such as grain, apples, potatoes, eggs, etc., instead of selling by count or capacity. This gentleman has appeared before the society before on this question, and thought that the recent act of the board of trade a vindication of his position. His paper was attentively listened to. Dr. Redfield combated the abolition of capacity measures. Man naturally and from primitive stages looked at size and judged of objects accordingly. The force of gravity was an after thought, and needed inventions of science for its measurement. Weighing was resorted to in a general way for dispatch and convenience, not for accuracy. At the railroad station even dry goods are weighed to determine the freight, but in stores they were sold over the counter not by weight but by measure. The doctor gave a very cleverly wrought theory of the different bones of the hands having especial offices in gaining a knowledge of objects with which it came in contact and went on to show that the same order was observed in the construction of the human form.

OCTOBER 10, 1883.

The Society began its proceedings at the usual hour, the President in the chair. The following persons were elected members of the International Institute:

C. F. Coburn,	Lowell, Massachusetts.
Mrs. A. E. Gates,	Chicago, Illinois.
Alice S. Emerson,	Buffalo, New York.
David Lawrence,	Boston, Massachusetts.
R. W. Davenport,	Boston, Massachusetts.
F. R. Kimball,	Boston, Massachusetts.
E. H. Stark;	Boston, Massachusetts.
Dr. Sarah M. Hill,	Glens Falls, New York.
D. G. Lang,	Concord. Massachusetts.
Mrs. Professor T. S. C. Lowe,	Norristown, Pennsylvania.
George Skillman,	Baltimore, Maryland.
Frank H. Field,	Brooklyn, New York.

Samuel Henshaw,	New Brighton, Staten Island.
Josiah Whiteman,	Tenants Harbours George, Me.
L. B. Mownry,	Stillwater, Rhode Island.
Lieutenant Wm. L. Buck,	Agricultural College, Miss.
Edward C. Frisbee,	Hartford, Connecticut.
C. Buncher,	Detroit, Michigan.
John Seiberling,	Akron, Ohio.
J. F. Ryder,	Cleveland, Ohio.

The President, referred to the loss the society has sustained in the death of one of its most earnest members, Rev. Dr. Bugbee, ex-President of the Alleghany College, Meadville, Pennsylvania.

Letters from numerous correspondents were then read.

Colonel Stephen M. Chester writes: "I feel a practical conviction that your society has found and adopted the means to attain the end that intelligent engineers have long but purposelessly groped for."

Mrs. E. Bedell Benjamin, a concise and logical writer, gave some pertiment suggestions with reference to the six hundred years cycle; the study of astrology and other kindred subjects.

Rev. Jesse H. Jones wrote respecting his lectures on the Pyramid at the Foreign Exhibition, Boston, and of the great success of Mr. Bisbee's model of that structure.

Letters from J. L. Dampier, of Canada, Mrs. A. E. Gates, of Chicago; Mrs. R. N. Hazard, of Missouri, and others were read.

A very able paper was read from Lieutenant C. A. L. Totten, U. S. A., "Why Anglo-Saxon Metrology Should not be Abandoned," showing, by statistics, that the English speaking or Anglo-Saxon nations control the commerce of the world and why should they give up their weights and measures for those of the French? The paper and letters read were discussed in an animated manner, after which the meeting adjourned for two weeks.

OCTOBER 24, 1883.

Mr. A. M. Searles presided at this meeting of the Ohio Auxiliary Society, the President being absent, and the following persons were elected members:

Hon. E. A. Wheeler, (life member)	Sharon, Pennsylvania.
Charles W. Gardner,	Garden City, Long Island.
P. S. Ross,	Jersey City, New Jersey.
E. D. Echols,	Sharon, Pennsylvania.
Howard L. Conard,	Columbus, Ohio.
James Hayes,	Sparta, Georgia.
Miss S. D. Wooley,	Buffalo, New York.
Miss Henrietta Paine,	Cleveland, Ohio.
Dr. P. Knowlton,	Tiskilwa, Illinois.

Mr. James L. Lawrence, Chairman of Committee on classification of Weights and Measures of the different States reported that he had received answers from six of the States and from the Territory of Montana in reference to their respective systems of weights and measures, and that they all are required to use the standards of the United States, and that penalties are attached to the use of any others. The Governor of Illinois sends a copy of the law of that State, in which is given the weight of twenty-eight different articles sold by measure. The Governor of Montana sends a list of fifteen articles sold by the bushel with the weight thereof, four of which differ from those of Illinois. It was expected that the Governors of each State and Territory would have supplied this information, but only the two mentioned have so far done so.

Professor Smyth speaks enthusiastically of the freedom from national prejudice exhibited by the members ot the Institute in their great work. The Professor promises the Society a biography of Sir John Herschel, from the Royal Astronomical Society of London, for the next number of the magazine, which will contain his portrait.

Ex-Governor Lowe, of Washington, strongly urges the organization of an American commission to make an exhaustive exploration of the Great Pyramid of Egypt, in which he thinks there are still undiscovered chambers and passages which, when found, will disclose much; and says it would reflect honor upon the city of Cleveland, and be the crowning effort of all her great enterprises, if such commission should be furnished with the necessary funds by some of her wealthy citizens. He congratulates the Society upon its steady growth and the fact that it now numbers among its members so many men from different parts of the world distinguished for scientific attainments.

Letters from Lucian Bisbee, Boston; Howard L. Conard, Columbus, O., and others were also read.

After considerable discussion of plans for the annual meeting, which will be held at noon, November 8, the meeting adjourned for two weeks.

Two very interesting papers—one the second instalment of "The Unveiling of Isis," by Charles Latimer, C. E., and the other the second instalment of "The History of the Great Pyramid," by Jesse Jones—are crowded out of this number of the Magazine and will appear in our next issue.—THE PUBLISHER.

JOHN TAYLOR,

GOWER STREET, LONDON,

Author of "The Great Pyramid: Why Was It Built? And Who Built It?"

And other Works.