LYMAN'S TRIGONOMETER.

There is a wide contrast between the accuracy of engineers' field instruments and the draughting instruments used in the office. It is when the field notes are brought to the office, the engineer's troubles begin. His drawing boards warp; his rulers bend, or have not parallel edges; his rolling parallel rulers wear their wheels unequally; his T squares are never square; his glass triangles will not prove four times round a circle; his paper protractor is badly divided, or shrinks in one direction and is awkward to use; his horn, brass or ivory semicircles are wretchedly manufactured; his protractor makes holes in his paper, and is always in the way, and, if taken up, cannot be put down again true to the meridian; his scales are difficult to read and subdivide by the eye, stick to the paper, or slip too easily over it; and his prick point makes oval holes instead of circular ones, and not exactly at the division line of his scale.

Working under these disadvantages, it is no wonder that the engineer at his office table loses the keen zest for accuracy which characterizes him in the field. His lines are all more or less forced to a conclusion, and he feels but little disposition to carry his topographical work a single rod beyond compulsion.

To remedy these defects, Professor Josiah Lyman, of Lenox, Mass., many years since gave his study and experiment to protractors and scales. This resulted in the invention of the trigonometer shown in the accompanying engraving. It is an ingenious and strictly scientific combination, uniting in one machine the protractor, base bar, sliding square or T, and sliding scale.

The original instrument has been improved so that the under surface, including base and arm, is brought into the same plane with the draughting board or paper upon it, thus enabling the draughtsman to lay it flat upon any part thereof.

A steel bar is arranged so that it may be instantly clamped upon either the side or end borders of the board, or at right angles (at any point) across the board, or diagonally at any required angle across any one of its corners, upon which the trigonometer slides and to which it is held by spring force.

The better class of instruments are provided with a vernier plate capable of being shifted to right or left 45° or less, and there clamped during any given operation. This arrangement, however, is applied only to that class of the instruments which is furnished with a tangent fixture for nice motion. But the same facility is practically secured to the other class by means of the steel bar just described.

A sliding square, either of whose arms (ordinarily of 15 and 6 inches in length respectively) may be held in contact with either edge of the protractor arm.

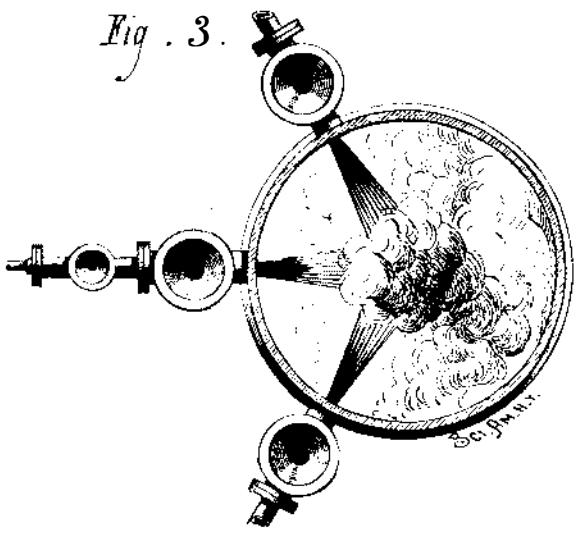
Triangular or trileaved scales may be used in connection with this instrument, being clamped by means of the springs S *p*.

The protractor plate, B, which constitutes the base of the trigonometer, is made of German silver or hard brass silver plated, about the twelfth of an inch thick, having a face usually 10 inches in length.

At an inch or a little less back from the face is inserted the pivot, P*v*, on which turns to right or left the arm of steel in two parts, namely, the attached part, *p a*, and the arm proper, P A. To the former is clamped the vernier plate, V P. This terminates in an arc, *ar*, of German silver, embracing about 135°, on whose limb are graduated two test marks, A *d*, A *d*, and corresponding with these two similar ones on the base plate underneath. By these the protractor plate is adjusted for clamping. The two parts of the arm are fastened together by the connecting screws, C, C, sufficient space between the arm proper and the protractor face being given to allow the instrument to play freely along the draughting or base bar, D B, at an angle of 55° or less. The arm proper is therefore readily detached from the other part, thus allowing another of different length to be readily attached in its stead.

On the limb of the protractor plate (graduated to half degrees, reading directly to minutes, or indirectly and reliably to half minutes) are two readings, the inner, giving the angle of the arm with reference to its meridian or zero line; and the outer, which gives the angle with reference to the protractor face. Hence every position of the arm indicates both the direct angle and the complement of the same. Therefore, in laying down the direct angle, the protractor arm only is required for guiding and operating the sliding scale; but in laying down the complementary angle, the sliding square is necessary; and this answers all the purposes of rectangular borders to the board.

This instrument may be applied to all problems for obtaining the varied lines and angles in architecture, or the construction of bridges or other similar works, with the sizes, forms, and position of all timbers, blocks of wood, stone or iron connected therewith.

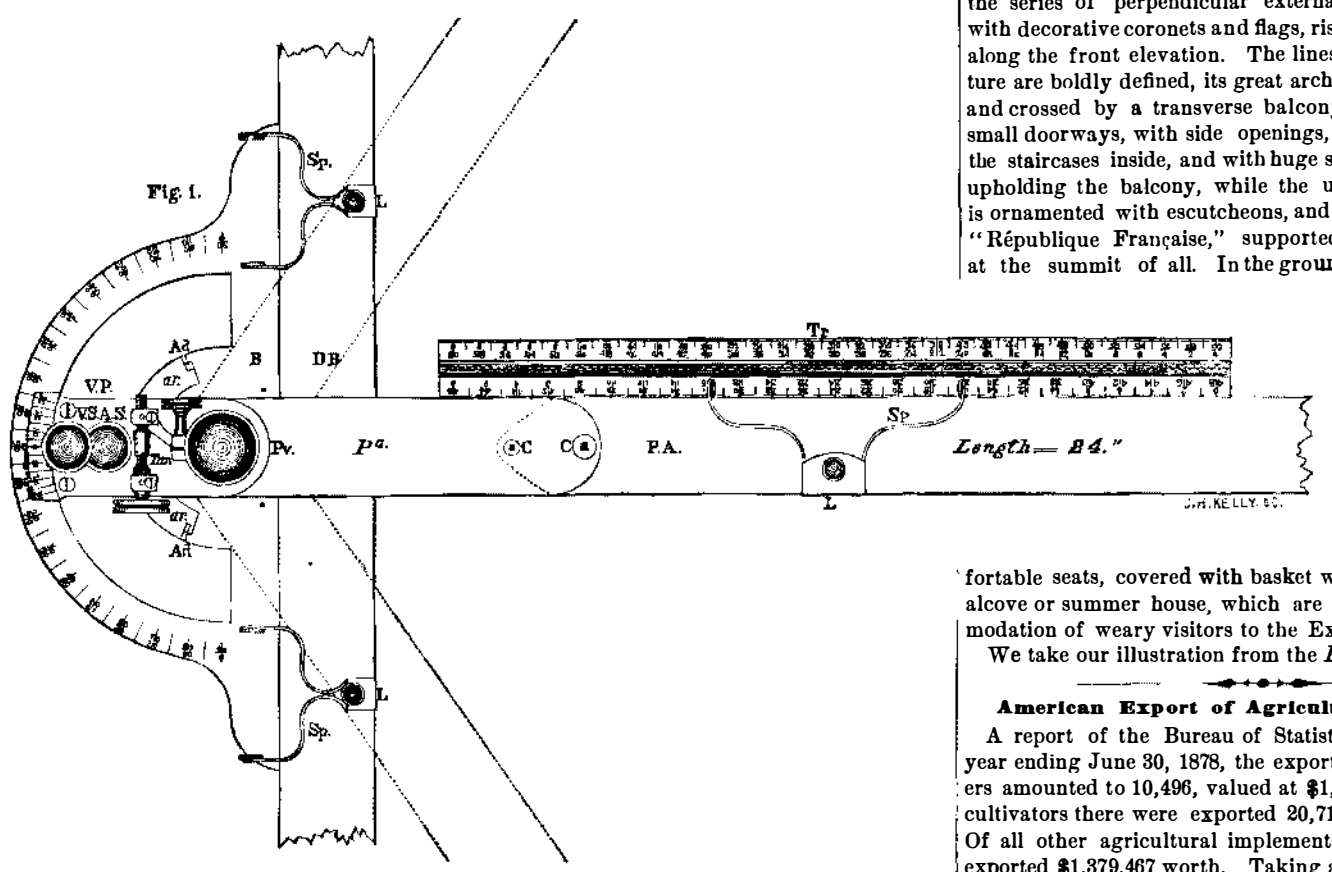


HORIZONTAL SECTION OF AMALGAMATOR.

For the use of engineers in cross sectioning excavations of earth or rock, for railroads or canals, or any other similar work, it is convenient and expeditious. The same is true of its application to military fortifications, as well as in the construction of machinery in the navy yards or other public works. When known by mariners, it will often supersede the use of the tables in their daily labors.

It is also applicable to the mensuration of heights and distances, and especially to the projection of eclipses and other calculations connected with astronomy.

With the greatest facility and accuracy, therefore, may any desired operation of triangulation be effected or trigonometrical problems solved by the use of this instrument.



LYMAN'S TRIGONOMETER.

It renders unnecessary in all cases traverse tables, and for most purposes even logarithms, saving in all ordinary trigonometrical calculations half to three fourths of the time and labor. With equal facility outlines of lots or tracts of land or other irregular figures may be plotted. Another very essential use of the trigonometer is in the division or laying out of lands. For further information address Professor Lyman, as above.

THE FORSTER-FIRMIN AMALGAMATOR.

[*Continued from first page.*)

production of the amalgam being completed within one hour.

The inventors claim that by means of their apparatus a rapid and perfect amalgamation is effected at a low cost, thus rendering the working of poor ores profitable. Another advantage in this system is that apparatus which is already in use may be modified to partially or wholly conform to this system.

During a recent public trial of this apparatus silver ore was passed through a single amalgamator at the rate of 3,000 lbs. per hour; 99 per cent of silver and 97½ per cent of the mercury were recovered within an hour. During another similar trial ore was passed through at the rate of 3,600 lbs. per hour, 97·88 per cent of mercury and silver together were recovered in 45 minutes, and within half an hour (1¼ hour from the start) 97 per cent of the silver was crucibled; subsequently an additional quantity of amalgam was collected and treated, bringing up the result to fully 99 per cent of silver and 99½ per cent of mercury recovered. These trials were witnessed by eminent metallurgists and mining experts, who did not hesitate to express their satisfaction.

For further particulars see advertisement of the Forster-Firmin Gold and Silver Amalgamating Company, of Norristown, Pa., in our advertising columns.

The Poplar as a Lightning Conductor.

A fresh proof that the upper part of trees, especially of poplars, is an excellent conductor of electricity (which only rends or shatters the wood when it finds a passage in the trunk) is afforded by *Nature* in an account of the effects of lightning on an aspen (*Populus tremula*) situated in a wood near the château of Crans on the shore of the Lake of Geneva. The lightning chooses by preference the poplar as a conductor to reach the ground, and the case under consideration is a striking one, as the tree was surrounded by other kinds, particularly firs, taller than it. Two great branches, of 18 and 20 inches diameter, which surmounted it, were struck by the lightning, and led it to the ground without having received the least apparent injury, while the trunk below them was absolutely shattered. Other recent observations prove the preference of lightning for trees situated near the streams or reservoirs of water, so that the best conductor for a house is a lofty tree, a poplar especially, situated between the house and a well, a pond, or a neighboring stream.

THE PARIS EXHIBITION.

The main building, or Palace of the Exhibition, in the Champ de Mars, is represented in the engraving on the opposite page. This grand façade, raised above a prolonged terrace, with several approaches by steps, protected by curving balustrades, presents a central arched nave, of superior dimensions, with transepts extending far to the right and left, each terminated by a domed tower of four arched sides, which is supported by angle buttresses. This is the general form of the edifice, while its aspect is further relieved by the series of perpendicular external beams, surmounted with decorative coronets and flags, rising at certain intervals along the front elevation. The lines of the central structure are boldly defined, its great arch being deeply recessed, and crossed by a transverse balcony above the numerous small doorways, with side openings, which give a view of the staircases inside, and with huge scroll-shaped buttresses upholding the balcony, while the upper part of the arch is ornamented with escutcheons, and with the initials of the "République Française," supported by winged seraphs, at the summit of all. In the grounds on this side of the Exhibition Palace, along the broad graveled paths which cannot easily be overcrowded, there is ample space for a promenade in the fresh air; or a brief repose of body and mind can be enjoyed in the comfortable seats, covered with basket work to form a portable alcove or summer house, which are placed for the accommodation of weary visitors to the Exhibition.

We take our illustration from the *London News*.

American Export of Agricultural Machinery.

A report of the Bureau of Statistics shows that in the year ending June 30, 1878, the exports of mowers and reapers amounted to 10,496, valued at $1,018,916. Of plows and cultivators there were exported 20,710, valued at $154,977. Of all other agricultural implements and tools there was exported $1,379,467 worth. Taking all the exports grouped under the head of agricultural implements, the gain was nearly fifty per cent as compared with the same for 1877.

Dangers from Impure Potassium Iodide.

It appears from a discussion which took place recently at a meeting of the Society of Medical and Natural Sciences, at Brussels, that the greatest danger accompanies the administration of iodide of potassium containing a minute proportion of the iodate. Dr. Melsens, the learned Professor of Chemistry at the Veterinary School, in support of this statement detailed some experiments with dogs, in which these animals had rapidly succumbed after injection of iodide of potassium containing a mere trace of iodate. The question now to be solved is whether the iodate of potassium itself is a salt possessing such marked toxic properties, or whether its presence gives rise to a minute quantity of free iodine in contact with the blood. At all events, it is a subject that will undoubtedly attract a good deal of attention, and points at once to the absolute necessity of having for pharmaceutical use nothing but iodide of potassium that is chemically pure.

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