ELECTRIC LIGHTING.

The problem of electric lighting is far from solution at present, and the popular enthusiasm and belief in the future of electricity as a means of general illumination has received some severe checks. The late accounts from Paris show that gas still competes successfully with the electric light for street purposes. The company, however, which is striving to introduce the new method of lighting are still sanguine of ultimate success, and the city authorities of Paris, anxious to stimulate discovery in such a popular direction, are still willing to encourage by small concessions and aids the plans of the inventors. Mr. Preece, a prominent English electrician, proves mathematically the impossibility of the ultimate subdivision of the electric light—the problem upon the solution of which so much inventiveness is now bestowed. The results of his mathematical analysis show that, beyond a certain limit, when n lamps are in the circuit the total light becomes diminished by $1 + n$, and the light emitted by each lamp becomes diminished by $1 + n^2$. This limit is reached by the Gramme machine when five Jablochkoff candles are placed in the circuit, and by the American Wallace-Farmer machine when six of their plate carbon lamps are burning at the same time.

The owners of the Brush machine, also of American make, claim that they have lately made a machine which maintains seventeen or eighteen lamps on the same circuit with an expenditure of only thirteen or fourteen horse power. This statement, however, should be accompanied by accurate tests, which do not appear to have been made. Mr. Preece maintains that this partial success has led many sanguine experimenters to believe in the ultimate subdivision of the electric light—that is, the maintenance of many small lights equal in intensity to four or five ordinary gas burners. He believes that such ultimate subdivision is an impossibility.

Mr. Schwendler, Superintendent Electrician of the Government of India, also has been making experiments upon the same subject, and arrives, from a practical point of view, at the same conclusion which Mr. Preece has reached from mathematical analysis. Mr. Schwendler thinks that each dynamo-electric machine or generator of electricity should maintain but one light, for it is only when one light is maintained by the generator that it is economical. Used in this way he finds that the unit of light produced by electricity is at least fifty times cheaper than the unit of light produced by combustion of coal, when the expenditure of power is alone considered. Endeavors to divide the electric light into a large number of small lights, however, he regards as futile; for nobody would be willing to pay for the luxury of such lights. These results seem to show that inventors should turn their attention to the production of small generators, one for each light, instead of to the problem of subdivision of the lighting effect of one current. The number of new lamps to be used in electric lighting increases each day.

M. Ducretet immerses several carbons in a column of mercury, and as the current burns away the carbons the difference of density produces a thrust which brings the carbons to their points of application in proportion to the amount they are consumed.

Mr. Wilde, in England, has shown that one can dispense with the fusible substance between the carbons of the Jablochkoff candle, for he places in his lamp the carbons at a slight angle, or parallel with each other, and the voltaic arc is repelled always to the tips or ends of the carbons. This is in accordance with Ampère's law, which shows that a current in a movable conductor is repelled by the parts of the current which approach and recede from it. In this case the voltaic arc itself is the movable conductor. The methods which have been criticised above all depend upon the production of the electric light between carbon points. The plans for utilizing electricity as a lighting agent by means of the incadescence of carbon in nitrogen, or the incandescence of platinum or iridium wire, have not been successful up to the present time, and are open to the same theoretical and practical objections as the method now in use.

One of the great difficulties in the way of solution of the problem of electric lighting is the want of training of the inventors and experimenters in accurate quantitative scientific work. Companies may be formed and great enthusiasm created by what are apparently great discoveries; but inventiveness must be supported by accurate tests made in a scientific manner to prevent the ruin of the stock companies; or rather of those deluded ones who have risked their money. Scientific men have often been too skeptical; but conservatism has great strength where money questions are involved.

A Revolution in Stone Cutting.

A revolution in stone cutting seems likely to be accomplished by a machine invented by Mr. R. R. Atchison of this city. It is operated by steam power, equivalent to that of a single horse; but it does the work of a dozen or more men, within a given time, in this laborious and unhealthy occupation, with the greatest accuracy and perfection. Heretofore it has seemed an impossibility to substitute machinery for hand labor in the preparation of stone for costly buildings; but, after four years of unremitting thought and labor, Mr. Atchison appears to have accomplished that result. Few persons, except those engaged in building operations, can realize the amount of labor required to prepare a single stone designed for the walls of a substantial building, or the cost of the same. Days, weeks, and even months, are sometimes expended in the cutting of a single block to the requisite dimensions; and, of course, large buildings, such as the post office, require the labor of years for their completion. By the use of Mr. Atchison's machine, great blocks of granite or other stone are smoothed with about the same rapidity that iron is planed by the well known machinery used for that purpose. The tools for cutting, two in number, are arranged in a strong head piece attached to a moving platen, similar to the iron planing machine. This platen, with the head piece, is made to move forward and backward over the stone, and the tools, having a perpendicular, reciprocal, rotating motion, cut the surface at the rate of not less than 6,000 blows per minute. The rapidity of this motion is said to be of great value in the use of the tools—the wear being much less than in hand work. The cutting tools are semicircular in shape at the edge, and can be used constantly for three quarters of an hour without changing—thus one set of tools will make more than a quarter of a million strokes without resharpening. The machine is very simple in construction and very substantial, and it is likely that it will work as great a change in the present methods of stone cutting as the sewing machine has wrought in the manufacture of clothing, or the power loom in the manufacture of textile fabrics. By adapting a movable arm, the tools are made to cut irregular forms, such as cornices, mouldings, and letters, with as much precision as they cut plain surfaces. In view of the magnitude of the quarrying business throughout the United States, and the perfect adaptation of this machine to stone cutting of every description, there would seem to be little doubt that Mr. Atchison's invention will rapidly make its way into public favor as one of the great labor saving inventions of the times.—*Boston Herald.*

ANCIENT WORKS OF PERU.

The feats of modern engineering in Peru are unexcelled in this age of ambitious undertakings; yet they are more than surpassed, on their own ground, by works that have been abandoned, if not in ruins, for untold centuries.

Dr. E. R. Heath furnishes an amount of detail on this point that will surprise even those generally familiar with the fact that Peru was once densely populated by a people given to cyclopean undertakings. Only a few can be cited here; but these will suffice to show that nothing of modern times, not even our thousands of miles of railways and canals, can begin to rival the achievements of those mysterious people who have passed away, leaving only these gigantic monuments to tell of their capacity and power.

Ruins, some of them of enormous extent, are scattered along the entire coast line of Peru, a distance of 1,235 miles, while nearly every hill and spur of the mountains have on it, or about it, some relic of the past; and in every ravine from the coast to the central plateau, there are ruins of walls, fortresses, cities, burial places, and miles and miles of terraces and artificial watercourses. Across the plateau and down the eastern slope of the Andes, into the unexplored, almost impenetrable forest, still they are found, mutely testifying to the successive empires that rose, flourished, and decayed where the desert and wilderness now prevail. Even more imposing are the vestiges of human wealth and power among the mountains, now almost uninhabitable for their altitude and the severity of the climate. Here the explorer finds cyclopean structures of granite, porphyry, and other rocks, which have resisted the disintegration of time, geological transformations, earthquake shocks, and the destructive hands of warriors and treasure-seeker. The masonry composing these walls, temples, houses, towers, fortresses, or sepulchers, Dr. Heath remarks, is uncemented, held in place by the incline of the wall and the adaptation of each stone to its place, the stones having from six to many sides, each dressed and smoothed to fit its neighbor with such exactness that the blade of a small penknife cannot be inserted in any of the seams, whether in the central parts entirely hidden, or on the internal or external surfaces. These stones, selected with no reference to uniformity in shape or size, vary from one half cubic foot to 1,500 cubic feet solid contents, and if in the many millions of stones one could be found to fit the place of another it would be purely accidental. In the wall of the center of the Cuzco fortress there are stones 13 feet high, 15 feet long, and 8 feet thick, and all were quarried miles away.

At Tiahuanaco, a few miles south of Lake Titicaca, there are stones in the form of columns, partly dressed, placed on line at certain distances from each other, and having an elevation above the ground of from 18 to 20 feet. In the same line there is a monolithic doorway, now broken, 10 feet high, and 13 wide. The space cut out for the door is 7 feet 4 inches high, by 3 feet 2 inches wide. The whole face of the stone above the door is engraved. Another, similar but smaller, lies on the ground beside it. These stones are of hard porphyry, and differ from the surrounding rock.

At Quelap some extensive works have been lately examined. Here is found a wall of dressed stone, 560 feet wide, 3,660 feet long, and 150 feet high. The lower part is solid. Above this is another wall, 600 feet long, 500 feet wide, and the same height as the other, 150 feet. Over both walls are niches, 3 feet long, and 1½ feet wide and deep, containing remains of those ancient inhabitants, some naked, others enveloped in shawls of cotton of distinct colors, and well embroidered. Their legs are doubled so that the knees touch the chin, and the arms are wound about the legs. The wall has three uncovered doors, the right side of each being semicircular, the left side angular. From the base an inclined plane ascends almost insensibly the 150 feet of elevation, having about midway a sentry box of stone. In the upper part there is an ingenious hiding place of dressed stone, having upon it a place for an outlook, from which a great portion of the province can be seen. Following the entrances of the second and higher wall, there are other sepulchers like small ovens, 6 feet high and 24 in circumference; in their base are flags, upon which mummies reposed. On the perpendicular, rocky side of the mountain on the north side is a brick wall having small windows 600 feet from the bottom. No reason for this, nor means of approach can now be found. The skillful construction of utensils of gold and silver that were found here, and the ingenuity and solidity of this gigantic work of dressed stone, are reasons for assigning it a pre-Incal date.

Imposing as structures of this sort are, they are, after all, but secondary in comparison with the industrial labors of the ancient Peruvians. The density of the population and the nature of the country—probably also the gradual desiccation of the region by geological changes—made it necessary to terrace the sides of the mountains and ravines for cultivation. Estimating 500 ravines in the 1,200 miles of Peru, and 10 miles of terraces of 50 tiers to each ravine, which would be only 5 miles of 25 tiers to each side, there would be in this region 250,000 miles of stone wall, averaging from 3 to 4 feet high, or enough to encircle our globe ten times. Surprising as these estimates may seem, Dr. Heath is convinced that actual measurement would more than double them, for these ravines vary from 30 to 100 miles in length, and 10 miles of terracing to each is a low estimate. At San Mateo, a town in the valley of the river Rimac, 77 miles from the coast, where the mountains rise from 1,500 to 2,000 feet above the river, he counted 200 tiers, none of which were less than 4, and many were more than 6 miles long. Even at 4 miles, there would be at that point alone 800 miles of stone wall, and that only on one side of the ravine.

Readers of Prescott will recall the splendid description he gives of the great highway of ancient Peru, an undertaking compared with which Meiggs' railways are but child's play. What were those ancient toilers, whom Dr. Heath eloquently describes as a people capable of cutting through 60 miles of granite, transporting blocks of hard porphyry, of Baalbec dimensions, miles from the place where quarried, across valleys thousands of feet deep, over mountains, along plains, leaving no trace of how or where they carried them; people ignorant of the use of iron, with the feeble llama their only beast of burden; who after having brought these stones together and dressed them, fitted them into walls with mosaic precision; terracing thousands of miles of mountain side; building hills of adobe and earth, and huge cities; leaving works in clay, stone, copper, silver, gold, embroidery, many of which cannot be duplicated at the present day—people apparenty vying with Dives in riches, Hercules in strength and energy, and the ant and bee in industry?

Who were they? Whence came they? Whither have they gone? Who among our rising students will solve these problems?

The Sale of Machinery Hall.

A striking illustration of the difference between cost and value is furnished by the recent sale of Machinery Hall, the second of the mammoth structures erected for the Centennial Exhibition. It comprised a main hall 360 feet wide and 1,402 feet long, with an annex 208x210 feet. Its original cost was $634,867.48. Had there been any permanent use for such a building there, its value would have been fairly measured by its cost. But no one could use it there, and few could make use of it anywhere, except as old lumber. It was accordingly knocked down at public auction for the pitiful sum of $24,000, a firm of car builders being the purchasers. The Japanese pavilion was sold for $150.

A New Chemical—Siliciureted Hydrogen.

We have received from Dr. Theodor Schuchardt, of Goerlitz, a specimen of a new body which he calls silicium strontium. It is formed from the preparation of metallic strontium by electrolysis, but no particulars are given as to the substances present or the reaction by which it is formed. As received from Dr. Schuchardt, the compound is a gray powder with a slight odor resembling phosphureted hydrogen. When mixed with dilute hydrochloric acid, a rapid evolution of the spontaneously inflammable siliciureted hydrogen takes place. No particulars as to price are mentioned, but, if obtainable in quantity, this compound will probably be the readiest source of siliciureted hydrogen.—*Chemical News.*

TO INVENTORS.—THE GREAT WANT.

In a recent address by Professor Atwater, of Middletown, Conn., before the Farmers' Meeting at Concord, N. H., he said that the great want of agriculture at the present time is nitrogenous manures or fertilizers. This is the most costly element that the farmer has to buy. Four fifths of the atmosphere around us is composed of nitrogen; and the man that discovers a way of obtaining it from the air, at a small expense, will be the greatest material benefactor that the world has ever produced.

ACCORDING to Dr. Richardson, hot water at 120° Fah. will kill typhus germs, and soap acts as a poison to them. The remedy against typhus, then, is to be found in every house hold, and more's the pity if it be not applied. Considering the deadly nature of this fever, and the fact that 50,000 typhus germs will thrive in a space no bigger than a pin's head, it is clear, the *Christian at Work* thinks, that in such a matter a quart of prevention is worth several hogsheads of cure.

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