

or, at any rate is not employed, for the contact of the mind of the learner with the mind of the teacher. The lecturer ascends to his chair, recites or reads his stipulated discourse, and disappears with the mechanical routine of an automaton. The professorial staff, it might have been added, has as little internal unity as relationship to its classes. It is a concourse of atoms with no affinity except equality of stipends. To call the foundation a college is to use a manifest misnomer. It is as much a college as one at Oxford or Cambridge would be with the undergraduates and fellows suppressed, and the Master, Dean, Bursar, and Butler left to perpetuate the tradition. The Corporation of the City and the Mercers' Company are Sir Thomas Gresham's trustees, and derive very substantial advantages from his bounty.

"The inutility of the Gresham Lectures was recognised in the days of Dr. Johnson. Johnson lamented as bitterly as our correspondent that the able professors of Gresham College, which was 'intended as a place of instruction for London, contrived to have no scholars.' His explanation was that the professors lectured gratis, and grew indolent from the absence of pecuniary incentives to intellectual exertion. 'We would all,' he exclaimed with conviction, 'be idle if we could.' Permission to charge sixpence a pupil for each lecture would, in his opinion, have infused vitality into the institution; every professor would forthwith have grown 'emulous to have many scholars.' There could be no harm in administering his specific now. The good of a condition such as Gresham College has been reduced to it that any experiments may be tried upon it without excessive risk. But the failure of the foundation arises from deeper sources than those to which Johnson attributed it. Several of the present lecturers are notoriously of a temper and standing not to need a money bribe to urge them to do their duty. The Dean who is the Divinity Professor delights in occasions for ecclesiastical exegesis. He would rejoice to find a way of gathering five hundred receptive hearers to listen to the theological expositions he throws away on a meagre fraction of the number. Another Dean was Senior Wrangler, and is abundantly competent for the geometrical themes he has to discuss. The subject of civil law is committed to a most capable jurist. The Professor of Music is able elsewhere without any endowment to attract to his classes a large paying audience. The blame, as our correspondent concedes, does not lie with the lecturers, who only slumber in concert with their classes and their patrons. It must be imputed to the gross contempt which has been shown for all the conditions of educational success. Their founder intended his seven professors to be professors in a College which he did not survive to create. He died at the age of sixty, still immersed in public affairs, and before attaining the leisure for carrying out his idea of an 'epitome of a University in London.' Accidents for which it would be useless to condemn his trustees would have prevented them, had they otherwise been well disposed, from accomplishing his ambitious programme. His estate, so far as it was appropriated to the purpose, proved insufficient for the complete endowment of a College and its staff. A collection of lectures was left as it were in the air. For a time they appeared to have procured favour in spite of their disadvantages. In the nature of things they could not keep it permanently. They were without soil to take root and sprout in. The error of all concerned has been that the want was not supplied by incorporating either them in something else or something else in them. Last century was a period of educational, though not of intellectual, stagnation. Gresham College only languished in company with many other Colleges better furnished with the gifts of fortune. The present age has witnessed a revival of zeal for instruction by methods in which the Gresham foundation might have been turned to the greatest service, and has been turned to none. While London, and, most of all, the City, was careless of

learning, it was no reproach to the managers of Sir Thomas Gresham's bounty that they converted it to no account. The absurdity is that for years the town, from its centre to its outskirts, has been crying out for educational appliances, and that Gresham College is suffered to remain as futile and superfluous as ever. Half-a-dozen institutions have been erected in or by the City to effect the objects for which Sir Thomas designed his foundation. For any one of them it would have been the most admirable nucleus; it would have afforded a starting point, and have bestowed the dignity of old descent. Thus it would have gained at last the reason for existence it has been craving in vain for a couple of centuries.

"Tastes of benefactors in distant ages do not always agree with the popular inclinations of the present. Reluctance on the part of trustees to deviate from the will of the men they represent is to be excused, though it cannot always be allowed to block the road to reform. When, however, a founder has let posterity into his confidence, and the application of his gifts clearly conflicts with his own views, it argues strange perversity or default of mental elasticity not to perceive where genuine respect for his wishes should lead. Without a framework in which they could be set and mutually co-ordinated, the Gresham Lectures cannot possibly do what the founder desired them to do. The public spirit of the City would not refuse to take up and finish the work which Gresham sketched out if it could be secure that his original instalment of beneficence was no longer wasted as now. Already it has been endeavouring to fill up the gap by its own exclusive exertions. The City of London College, the courses of the University Extension Society, lectures at the London Institution, the Technical College, Middle Class Schools, and not a few institutions besides, are spontaneous efforts of the past dozen years to work out the original idea of Sir Thomas Gresham. The proper City of London College is Gresham College. Around it as the centre all the other educational instruments of the City ought naturally to group themselves. Not the most punctilious conservatism could reprobate the Corporation and the Mercers' Company if they would use the authority they possess, and seek fresh authority, to aid in the promotion of that general result. Gresham College, as it is, has been for centuries, and is doomed to be, a burlesque of collegiate life. Its lectures must be equally dead whether delivered in a dead or a living tongue. Its choice is between becoming something more or something less than it is now. If it cannot develop, it had better cease to be."

ELECTRICITY AT THE INVENTIONS EXHIBITION

THE International Inventions Exhibition is intended to illustrate the progress of invention during the period that has elapsed since the last Great International Exhibition in this country in the year 1862. Accordingly we find under Group XIII. electricity ranged under twelve classes, entitled respectively, generators, conductors, testing and measuring apparatus, telegraphic and telephonic apparatus, electric lighting apparatus, electro-metallurgy and electro-chemistry, distribution and utilisation of power, electric signalling, lightning-conductors, electro medical apparatus, electrolytic methods for extracting and purifying metals, electrothermic apparatus. Under such a classification there is no doubt that the Exhibition might have been made thoroughly representative of the wonderful progress that has taken place in this branch of science, both in its theory and practice, during the last twenty-three years. The reason that it is not so is twofold: electricity has had of late years many exhibitions dedicated to itself—those of Paris, Vienna, and Sydenham; and it was quite impossible in such an exhibition as the Inventions, where so

much has had to be compressed into so little space, to indicate the progress of invention in each class of each group. If, however, electricity is not represented in this way, it is in another way, and that is through the medium of one of its special applications—that of the electric light. Electricity thus forms the light and life of the whole Exhibition after sunset, and in this connection we would view it on the present occasion.

Those who visited the Health Exhibition last year will not notice any great change in the internal illumination beyond the more extensive use of the electric light and its greater steadiness, but will observe that an alteration has been made in the garden lighting, to a description of which we propose to confine this article. In place of the numerous attendants who, a little before darkness set in, were to be seen last year lighting one by one the little oil lamps which, in their coloured glasses, were scattered all over the trees and lawns, an observer discovers at half-past eight or a little later a gradual diminution in the darkness of the evening, and the eye becomes gradually sensible to the fact that the architectural features of the buildings are becoming clearly defined, and by degrees are actually illuminating surrounding objects, whilst at the same time the lawns and shrubberies, the parterres and trees, and even the ponds of water and waterfalls assist in the general illumination with light of every shade and colour. Where before all was darkness, there is a scene of bewildering enchantment: fountains play and throw up into the air, now high, now low, solid sheets of illumined water and spray of mingled water, dust, and light, at one moment of golden hue, at another of the loveliest magenta; while when the silver light of the electric arc alone illuminates the fountains, broken by some magic power below into waterdrops, all the prismatic colours of the rainbow are observable, and, revelling in the beauty, one wonders how it is all brought about.

In what is known as the tower, Sir Francis Bolton has before him a plan of the gardens with switches on it, enabling him to turn the lights on or off, or to increase or diminish their intensity at his will. One of the switches controls the effects in the upper garden, another those in the lower garden, a third commands the statue of the late Prince Consort, a fourth and fifth the illumination of the east and west quadrants and east and west arcades respectively, whilst a sixth controls the external lighting of the conservatory. Four switches on the lower portion of the switch board enable the operator to raise or lower the intensity of the light; the first altering it from $\frac{1}{4}$ to $\frac{3}{8}$, the second from $\frac{3}{8}$ to $\frac{1}{2}$, the third from $\frac{1}{2}$ to $\frac{3}{4}$, and the fourth from $\frac{3}{4}$ to full power.

One of the most interesting features of the illumination, and that which perhaps causes the most wonder and bewilderment, is the play of the fountains. Below the island in the fountain is a water-tight chamber, about 5 feet in height and 20 feet square, into which one obtains access by first descending a ladder from the diving apparatus-house into a low arched passage, from which one ascends into the chamber. The roof of this is covered with water-pipes which convey the water from the main in all directions, the supply being regulated by screw valves; the five large jets are fitted with plug valves and levers, by the manipulation of which the dancing motion and breaking up into water-drops of the columns of water are effected. The average quantity of water expended per hour during a fountain display is 70,000 gallons. Under the five large water jets are five skylights, fitted with thick glass, below each of which is placed a wooden box, containing a powerful arc-light with the carbons set horizontally. Over the top of the lantern is a holophote, such as is used in lighthouses, by means of which the rays of light are concentrated, and projected upwards into and with the column of water, whilst their colours are varied by drawing sheets of stained glass across the lantern. The water is supplied at a

pressure of about 70lb. to the square inch, which is sufficient to carry it up to a height of 120 feet.

On one of the walls of the chamber is a board, on which are signalled the instructions from the tower, which are read off by an assistant to the staff. In this manner the various effects which more or less puzzle the spectators are telegraphed from the tower above, and carried out in the concealed chamber below.

The following are the number and distribution of the lamps, all of which are made by the Edison-Swan United Company, most of them being of 5 and 10-candle power, whilst a few of 20-candle power are used on the band stands and verandah of the conservatory:—

	Lamps
Conservatory	1418
E. and W. Quadrants	1584
E. and W. Arcades	1832
Upper Gardens	1550
Lower Gardens	2300
Albert Statue	336
Total	9020

There are fourteen miles of main and branch wires, nine miles of twin wire, and two miles of small connecting wire. On the buildings and on straight lines on the grass specially constructed wooden lamp-holders are used, in other places ordinary spring-holders. The current is generated by three Siemens B 13 self-regulating dynamos, each weighing about 11 tons, and each capable of maintaining 2000 (20-candle) lights at 300 revolutions per minute; the current of each being 500 amperes at an electromotive force of 250 volts, the weight of the armature being 3 tons. The dimensions of the machines are as below:—

	ft.	in.
Height including bed-plate	8	9
Length over all	8	0
Width	4	8
Diameter of armature	2	5
Length of armature	3	2

The four series coils, which are coupled in parallel, are wound with copper-wire 4-10ths of an inch in diameter, and the shunt coils, which are coupled in series, with wire of No. 9 standard gauge; the armature being wound with flat strips instead of wire. Each of the dynamos is coupled to a Goodfellow and Matthew's triplex compound engine of 200-h.p. indicated, two of the machines being easily capable of maintaining all the lights. The main current from the dynamos is led to a switch-board, in connection with which is an electro-dynamometer so arranged that there shall be no break of continuity. In each branch circuit is a fork working in the core of a solenoid, the prongs of the fork dipping into a pair of mercury contact cups. The solenoids are connected by wires with Sir Francis Bolton's room, and by their use he can raise or lower the fork out of or into the contact cups and thus turn the lights off or on as required. The return circuits enter into a single conductor, which is arranged with four sets of mercury cups and solenoids in series; around each set is a bye-pass containing a resistance of determined magnitude, so as to vary the brilliancy of the lamps as desired.

The works for the electric illumination of the gardens and fountains have been carried out by Messrs. Siemens Brothers, to the designs of Sir Francis Bolton. Considering that the instructions for the preparation of the machinery for illuminating the gardens were only given in February last, the result obtained at the Inventions Exhibition is evidence that electric lighting has now advanced to such a stage that orders may be given for very large installations and executed in a perfect manner in a very short space of time.