SCIENCE IN THE THEATER.

Stage mounting has now become one of the most complex and refined of arts. The spectator, in fact, is no longer satisfied, as of old, with a vain illusion that his imagination is called upon to complete, but he requires a semblance of reality capable of giving him the sensation of the genuine thing, and, naturally, all hands, the impresarii, machinists, scene painters, etc., put their wits to work (in most cases with success) to gratify his taste. Each new spectacular piece reveals to us some novel innovation, and, in truth, it is an occupation not without interest or utility to study the modifications and improvements that have been made in time in the same scenic effect.

Let us take, for example, the representation of fires, in the theater. Formerly, as in Mignon, or in the Prophet, some flames of lycopodium and some red Bengal lights sufficed to satisfy everybody. Great improvements have been made since, and in recent years the skillful stage mounters of the opera house have twice shown us (first in Sigurd, and but a few days afterward in the Magian, Mr. Massenet's new opera) conflagrations that have been improved to such a degree as to be capable of vying with real fires, as far as effect is concerned. In this regard, the setting of the Magian is particularly remarkable. We are at the last act of the drama. The temple of Djahi is in ruins. The Turanians have burned it. Alone stands intact the triumphant statue of the goddess, before whom, like smoke of incense, rise puffs of bluish vapor from the rubbish. The Magian Zarastra contemplates the pile of debris with horror, and near him stands Anahita, the queen of Turan. Meanwhile, the priestess of the temple, Varedah, mortally wounded and lying prone upon the earth, revives and, seeing Zarastra triumphant near her rival, invokes the Djahi in a burst of fury. The latter obeys her voice. The fire, which is still smouldering under the ashes, breaks out again. At first, the smoke becomes more intense, and its spirals, on rising in the air, become tinged with red. Then the flames soon reappear along the cornices that are still in place, the statue gives way, the fire extends by degrees, and the stage is soon nothing but an immense glowing brazier, in which sparks are crackling, flames are flickering and smoke is curling.

Now what is the secret of this wonderful stage mounting? It will be recalled that in Sigurd the effect obtained is produced by jets of steam to which a rose color is given by means of Bengal lights. The steam under pressure enters through large conduits running under the stage and escapes through small tubes soldered to the supply pipes and traversing the stage floor. The maneuver is executed by operating a cock. The inconvenience of the process lies in the loud strident noise made by the steam escaping into the air.

In the Magian, where the orchestra music at the moment of the fire is relatively soft and low, this circumstance would have been most annoying. It therefore became necessary to find a means of producing the steam in abundance, while at the same time preventing noise being made by its escape. The difficulty was happily surmounted as follows: The steam generated by a boiler is here again led by pipes as in Sigurd; but instead of its being allowed to escape through a thousand narrow orifices, it is made to pass into special apparatus—large boxes in the shape of an isoceles triangle connected in pairs at the two extremities of the same supply pipe. These boxes, which are fixed by the apex opposite the base of the triangle, have, at their point of attachment, considerable thickness, which gradually diminishes in measure as the wide part of the apparatus is approached. At the base of the triangle the thickness is greatly reduced, so that the steam, which is distributed throughout the whole extent of the box, escapes without any noise, and throughout its width, through a narrow orifice between the two faces of the apparatus. In the interior of the boxes there are pieces of felt, the principal object of which is to absorb the drops of water carried along mechanically (Fig. 1).

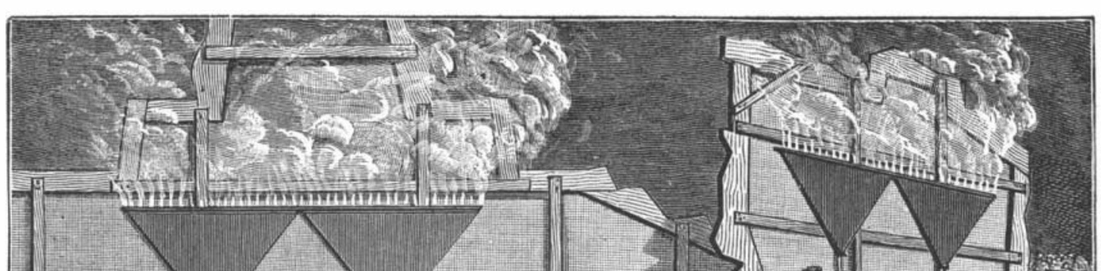

Fig. 1.—APPARATUS FOR IMITATING THE SMOKE OF A CONFLAGRATION ON THE STAGE OF A THEATER.

The advantage of this peculiar arrangement, which, at the opera house, was installed entirely by Mr. David, is that it permits of the disengagement of steam everywhere where it is necessary. These boxes, in fact, are easily manipulated by two men, and hooks fixed to their surface permit of attaching them at will, and in an instant, along a strip light or elsewhere, above the stage or on a level with it. After a simple coupling pipe has been connected with the steam conduit, the apparatus begins to operate.

In the Magian, twenty-nine of these double boxes are employed. Seventeen are distributed over the stage at different points and nearly up to the height of the soffit curtains. The twelve others are beneath the stage and the orifice whence the steam escapes and traverses the flooring.

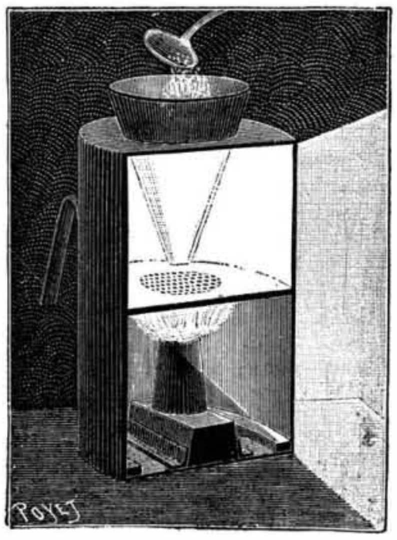

Fig. 2.—APPARATUS FOR IMITATING LIGHTNING.

This system of conflagration, the effects of which are heightened by Bengal lights, lycopodium flames, variously colored jets of electric light, and small pieces of fireworks designed to simulate the leaping of the sparks produced by the sinking of the statue, is not absolutely new. It has, in fact, already been employed at Dresden, and in the Theater de la Monnaie, at Brussels, in the mounting of Valkyrie. At Paris, for example, it has been notably improved by Mr. David. At Dresden, in fact, the boxes were of wood and allowed of the spreading of the steam, which soon filled all the parts beneath the stage. They are now made of galvanized iron, and leakages are impossible.

This new method of producing the illusion of a fire is not the only innovation made at the opera house *apropos* of the Magian. The method of imitating thunder has also been improved. In the third or mountain act, we see a terrible storm, the lightning flashes of which are as vivid and blinding as those observed in nature. They are produced in a very simple way, and are due to the sudden combustion, upon a highly heated grille, of a mixture of three parts of magnesium in powder and one part of chlorate of potash (Fig. 2). It is a similar process that is employed by photographers for taking instantaneous pictures at night. Combined with the flames of lycopodium, these magnesium flashes produce surprising effects of realism, and far exceed anything that can be obtained in this direction with the electric spark.—*La Nature.*

A SOCIETY of Philadelphia physicians, recently organized, has for its purpose the discussion of electro-therapeutics and the inducing of qualified practitioners to take up the subject on a scientific basis.

Action of Sulphurous Acid.

The importance of a knowledge of the effects of sulphurous acid on the human organism has been of late very much increased by the frequency with which this agent is now employed for the preservation of wine and vegetables. It is known that after animals have been poisoned by breathing air impregnated with sulphurous acid, the highly irritating properties of the gas are manifested by the injected state of the blood vessels of the mucous membrane of the respiratory tract where the sulphurous acid has come in contact with it, the blood of the viscera being found dark and coagulated. Also that animals that are not killed recover very rapidly, but after a few days show signs of bronchitis and pneumonia and die. The subject has recently been examined by Dr. L. Pfeiffer, who in some experiments employed sulphurous acid in the form of neutral sulphite of sodium, and not in the free state, so as to avoid the caustic action. He found that both warm and cold blooded animals recovered very rapidly from an almost moribund condition, which showed that there must be either very rapid elimination or a chemical change into some harmless substance. Experiments instituted with the object of elucidating this point showed that 96·5 per cent of the sulphite was eliminated by the kidneys as sulphate, the remaining 3·5 per cent only as sulphite. When a large quantity of sulphite had been administered, it was nearly all eliminated in five hours.

Dr. Pfeiffer believes that when vegetable feeders are made to breathe air containing free sulphurous acid for some considerable time a reduction of the alkalinity of the blood is induced. In animals breathing air containing from one to three parts of sulphurous acid per thousand, intense inflammation of the tracheal and bronchial mucous membrane was produced, also inflammatory foci in the tissue of the lungs, the blood in the capillaries becoming black and coagulated. Injections of a 5 per cent solution of sulphurous acid into the stomach set up very extensive and severe gastritis, not only all the coats of the stomach itself being affected, but also the superficial portions of neighboring organs, as the liver and diaphragm, death occurring in from three to five minutes. It is suggested that this rapid and far-reaching action may be due to the disengagement of the gas by the heat of the stomach, so that it diffuses itself much more rapidly than a liquid could do. Dr. Pfeiffer finds that in some wines there is as much as eight parts of sulphurous acid, probably as bisulphide of lime, in 100,000, and that in preserved vegetables, such as are used in the army and on board ship, there is often a very appreciable quantity either free or combined with alkalies, this being especially the case with preserved asparagus.—*Lancet.*

A Plague of Grasshoppers.

Portions of Cheyenne County, Wyom., are covered by grasshoppers. For three weeks they have been hatching out, and myriads cover the prairie for miles just west of First View. A strip of land ten miles wide and extending in a southeasterly direction across the entire county is completely hidden from view by the insects. They meet with considerable difficulty in crossing the railroad, and consequently settle upon the track, causing the wheels of the engines to slip, so that it often requires two engines to pull the trains over these places. The extent of territory they cover is not known, but they are said to extend over all the land between First View and Limon Junction, and as far south as the Arkansas River. As yet they have done no damage to crops or grass, being too young. By the time they are able to fly or damage crops they will be well out of Colorado into Kansas.

A New Gold-colored Alloy.

An alloy of copper and antimony in the proportion of 100 to 6, is made by T. Held, by melting the copper and subsequently adding the antimony, and when both are melted and intimately mixed, fluxing the mass in the crucible, with an addition of wood ashes, magnesium and carbonate of lime, which has the effect of removing porosity and increasing the density of the metal when cast. The alloy can be rolled, forged, and soldered in the same manner as gold, which it very closely resembles when polished, the gold color being unchanged, even after long exposure to ammonia and acid vapors in the atmosphere. The cost of the alloy in the ingot is stated at about 25 cents per pound.

The Faraday Centenary.

A brilliant audience assembled on the afternoon of June 17, at the Royal Institution, London, to hear Lord Rayleigh deliver the first of the two lectures appointed in honor of the centenary of the birth of Michael Faraday, the second of which, given by Professor Dewar, was to be delivered the following week. The Prince of Wales, president, was in the chair, and there were also present many distinguished people and eminent men of science.

We take the following from the London *Times*:

Lord Rayleigh yesterday performed an extremely difficult task with the mastery that was to be expected from so eminent a physicist and mathematician. It is not easy to talk, before an audience composed in part of the leading scientific men of the day and in part of the interested but entirely ignorant public, about problems which are elementary to the one and hopelessly recondite to the others. It is still less easy to summarize, in a fifty minutes' lecture, the life work of a great discoverer, and to show during the time, by half a dozen experiments, how his discoveries have borne fruit. This, however, was what Lord Rayleigh had to do. He attempted nothing biographical, and did not even try to sum up the effect of Faraday upon his generation. What he did was to take four or five lines of investigation specially dear to the master, and to show how he started on those lines and how his successors have followed him. The beauty of some of the experiments was remarkable, particularly of one where a small electric lamp was made incandescent by being brought, not into contact with, but into the mere neighborhood of a current—an experiment which Faraday himself would have rejoiced to see as the legitimate development of his great discovery of the induction of electric currents. Another showed an aluminum coil leap a couple of feet into the air when the current touched it, others showed the interaction of electricity and light, and these and several more were proved to be directly traceable to Faraday's discoveries of sixty years ago.

The story of Faraday's life has been often told during the twenty-four years that have passed since he died, especially by Dr. Bence Jones and Professor Tyndall. But people's memories are short in these days of crowding events, and we may pause for a moment to recall some of the incidents of that career. He was a man of the people; his father, he once said, was a smith, and he himself, one of a family of ten children, was early compelled to earn his living. He was born in September, 1791, at Newington Butts, and during Michael Faraday's boyhood the home was removed to Jacob's Well Mews, near Manchester Square. Not far off was the shop of a stationer and bookbinder, one Riebau, in Blandford Street, and to him the lad was presently bound apprentice, remaining in that position for eight years, till he was twenty-one. But his tastes lay rather with such science as he could pick up from books than with the art and craft of bookbinding, and at length the opportunity came for him to leave the one for the other.

Sir Humphry Davy's last lectures at the Royal Institution took place in the spring of 1812. A friend had given young Faraday a ticket for them, he went, made notes, and afterward boldly sent his notes to the great chemist, begging that an opening might be found for him to give himself up to science. Davy replied kindly, and before the end of the year Faraday found himself engaged as a laboratory assistant at 25s. a week. The step had been taken. Little by little he conquered Davy's confidence, traveled with him to Italy and Switzerland, learned much from him, and in Geneva gained great profit from the talk and the writings of the elder De la Rive. In 1816 he began to write, and in 1820 we find him contributing a chemical paper to the transactions of the Royal Society.

At the age of thirty, in 1821, he married Miss Sarah Barnard, and at the same time was formally received into the Sandemanian Church, one of those curious sects which in England have for two centuries, at different times, secured the attachment of even eminent men. From the time of his marriage, while still assisting Davy, he made steady scientific progress, and began to take his place in the ranks of the discoverers. In 1825 he discovered the compound called benzol, out of which he might, had he been so disposed, easily have made a fortune. In 1831 came his first discoveries in the world of electricity, to which Lord Rayleigh yesterday confined his attention, and at forty years of age the ex-bookbinder found himself the honored equal of the leading scientific men of the day. This was the year of his discovery of the induction of electric currents, out of which all his other electrical discoveries flowed. Ten years of incessant activity followed, and at the end of the period Faraday's health gave way. But he recovered after a period of rest, and from 1845 to 1867, the year of his death, his activity as a discoverer, experimenter, and lecturer was boundless.

Electricity, magnetism, light, sound—these were one side of the regions that he explored; chemical problems were another, and bridging the two were the quasi-metaphysical problems of the nature of matter and force, which exercised his highest curiosity, as they must always exercise that of the natural philosopher who cares for what lies beyond phenomena. These speculations, however, he did not often introduce into those famous lectures which made and kept him known to so wide a circle. His pre-eminence as a lecturer has passed into history. "Among all lecturers heard by me," wrote the late Sir Frederick Pollock, "he was easily the first. Airy, Sedgwick, Owen, Tyndall, and Huxley belong to the highest order, but there was a peculiar charm and fascination about Faraday which placed him on an elevation too high for comparison with others."

It was the burden of Sir William Thomson's and Sir George Stokes' speeches, which followed the lecture, that Faraday loved science for the sake of science. Had he chosen, he might, as we have said, have made a fortune out of benzol, he might have made several more out of other discoveries. But he felt that he had other work to do. It was a pretty story, that which Sir William Thomson told of him, that long after he had pointed the way toward electric lighting they brought him the Wilde lamp and he said, "I gave it to you a baby, you have brought it back to me a giant." The moment that he made his first great electrical discovery he felt that his path in life was marked out for him, and that he must give up the "commercial" work which till then had been bringing him in an income. He lived simply, with few wants and with no ambitions, except that of penetrating further and further into nature and laying her mysteries bare. Never was a more fruitful investigator, and yet never was there one who thought less of those "fruits" which Francis Bacon was for ever promising to the seekers after natural knowledge. All of us are now enjoying the material results of Faraday's researches. The electric light, the telephone, the Atlantic cable, are the direct outcome of his patient experiments. But it was not of these things he was thinking. His eye was fixed upon truth itself, and not upon the useful results that might come from the knowledge of it. The lesson of his life, indeed, may be almost said to have been expressed in Professor Huxley's words when, after speaking of the things of practical value which the physical philosopher sometimes discovers, he proceeds:

"Great is the rejoicing of those who are benefited thereby, and, for the moment, science is the Diana of all the craftsmen. But even while the cries of jubilation resound, and this flotsam and jetsam of the tide of investigation is being turned into the wages of workmen and the wealth of capitalists, the crest of the wave of scientific investigation is far away on its course over the illimitable ocean of the unknown."

Natural History Notes.

Domestic Serpents.—Rats have multiplied to such a degree in Brazil that the inhabitants rear a certain kind of snake for destroying them. The Brazilian domestic serpent is the *giboia*, a small species of boa about twelve feet in length and of the diameter of a man's arm. It is sold at from a dollar to a dollar and a half in the markets of Rio Janeiro, Pernambuco, Bahia, etc. This snake, which is entirely harmless and sluggish in its movements, passes the entire day asleep at the foot of the staircase of the house, scarcely deigning to raise its head at the approach of a visitor, or when a strange noise is heard in the vestibule. At nightfall the giboia begins to hunt, crawling along here and there, and even penetrating the space above the ceiling and beneath the flooring. Springing swiftly forward, it seizes the rat by the nape and crushes its cervical vertebræ. As serpents rarely eat, even when at liberty, the giboia kills only for the pleasure of killing. It becomes so accustomed to its master's house that if carried to a distance it escapes and finds its way back home. Every house in the warmest provinces where rats abound owns its giboia, a fixture by destination, and the owner of which praises its qualities when he wishes to sell or let his house.

Parasitical Plants.—At a recent meeting of the French Academy of Sciences, Mr. Chatin stated that these classes of plants seriously affect the sap of the trees, etc., on which they exist, destroying certain elements, and, on the other hand, producing new ones. For example, no strychnine is found in the loranthus grown on the *Strychnos nux vomica*, and no quinine in the botanophora of the cinchona; and, in the oak mistletoe, green instead of blue tannin is found. On the other hand, substances are found in parasites which do not exist in the trees on which they are found. Thus, mistletoe contains lime, and the dodder produces yellow and red coloring matters. In the broom-rape of hemp and milfoil a blue color is found; in that of the horseshoe vetch, a rich sulphur tint; and, in the broom-rape of thyme, an amethyst shade. The mistletoe and most other parasites contain fecula, which penetrates to the fiber of the wood. In short, all these matters are formed by the parasitical plants themselves.

The Chinese Alligator.—Two examples of the Chinese alligator have just reached the Zoological Gardens. They are the first that have ever been exhibited there alive. The alligator is so distinctively an American animal that the proof, so recently as 1879, of the species in China was extremely interesting. Nevertheless, the Chinese classics contain numerous references to the creature, and even pictures, which could be easily recognized as being a crocodile of some sort. It is to be hoped that the specimens at the Zoo will bear out the notion of the extreme longevity of the reptile. Its name is apparently used in certain parts of China in the same sense as Methusaleh in this country. Marco Polo wrote about this animal and recommended its gall as an excellent remedy for the bite of a mad dog and for various other complaints, so that it seems to have been the mediæval equivalent of some of our much advertised remedies of the present day. Curiously enough, the beast is even now made use of in Chinese medicine.

Preference of Birds for Drab Nests.—Dr. C. C. Abbott says that in experimenting on the intelligence of birds he placed a number of pieces of woolen yarn—red, yellow, green, purple, and gray in color—near a tree in which a couple of Baltimore orioles were building their nest. The pieces of yarn were all exactly alike except in color. There was an equal number of threads of each color, the red and yellow being purposely placed on top. The birds chose only the duller colors, taking all of the gray and a few threads of the purple when the nest was nearly done.

Not a single thread of the red or bright yellow was touched, the birds seeming to instinctively know that such loud colors would make their domicile too conspicuous. Again he experimented by girdling the branches upon which nests were located, causing the leaves to shrivel and blow away. Although they had laid their eggs, the birds invariably left their nests. If the nests contained young when the leaves dried up, notwithstanding the exposure they would feed the little ones until they were able to take care of themselves.

The Starch of Plants.—It is generally believed that after the fall of leaves the reserve tissues of ligneous plants remain filled with starch until spring, the epoch at which this substance emigrates in order to serve in the evolution of buds, in the development of the root and the formation of a new layer of wood. The hibernal period is consequently considered that in which the amylaceous reserve is most abundant. It results from the researches of Mr. Emile Mer that such is not the case, and that in the vegetation of ligneous plants there occur two acts that up to the present have passed unperceived—one, a resorption of starch at the end of autumn, and the other a genesis at the beginning of spring, each of them having a duration of from six weeks to two months. It hence follows that winter, far from being the season during which the amylaceous reserve is the greatest, is precisely that in which it is the least.

How Animals Imitate the Strategy of Man.—Indian wolves have been seen to leave some of their number in ambush at points on the edge of the jungle, while others drove in antelopes feeding in the open ground beyond. But wolves, as a rule, hunt alone or in families, except when pressed by hunger. Wild dogs, however, habitually combine to hunt, and Baldwin, in his "Game of Bengal," mentions a case of four or five martins hunting a fawn of the "muntjac" or barking deer. But in real military organization and strategy, monkeys are far ahead of all other animals, and notably the different kinds of baboon. Mansfield Parkins gives an excellent account of the tactics of the dog-faced hamadryads that lived in large colonies in the cracks in the cliffs of the Abyssinian mountains. These creatures used occasionally to plan a foraging expedition into the plain below, and the order of attack was most carefully organized, the old males marching in front and on the flanks, with a few to bring up the rear and keep the rest in order. They had a code of signals, halting or advancing according to the barks of the scouts. When they reached the cornfields, the main body plundered while the old males watched on all sides, but took nothing for themselves. The others stowed the corn in their cheek pouches and under their armpits. They are also said to dig wells with their hands and work in relays. The Gelada baboons sometimes have battles with the hamadryads, especially when the two species have a mind to rob the same field, and, if fighting in the hills, will roll stones on to their enemies. Not long ago a colony of Gelada baboons, which had been fired at by some black soldiers attending a duke of Coburg-Gotha on a hunting expedition on the borders of Abyssinia, blocked a pass for some days by rolling rocks on all comers. This seems to give some support to a curious objection raised by a Chinese local governor in a report to his superior on the difficulties in the way of opening to steamers the waters of the Upper Yang-Tse. The report, after noting that the inhabitants on the upper waters were ignorant men who might quarrel with strangers, went on to allege that monkeys inhabited the banks, and they would roll down stones on the steamers. "The last two facts," the report added, "would lead to complaint from the English and embroil the Celestials with them, especially if the men or the monkeys kill any English."