self furnishes a certain quantity of electromotive force.

This pile, although of small dimensions, is capable of giving a large discharge and can be used for the production of light in small Swan lamps. For telegraphy and domestic uses, Mr. O'Keenan is constructing piles of small size (Fig. 2) in which the porous vessel that contains the oxide of lead is but about $1\frac{1}{4}$ inches in diameter and $3\frac{3}{4}$ inches in height. The zinc is in the form of a thin plate. These elements have greater power than the Leclanche pile, and do not polarize so quickly.

For applications to electric lighting, the elements are made with porous flat vessels (Fig. 3), and are connected for quantity. The number of these vessels varies per element according to the discharge to be obtained. The plate of zinc constituting the negative element is bent in a zigzag manner around the porous vessel.

When this pile is exhausted it may be recharged like an accumulator, but the period of formation is avoided. The liquid becomes electrolyzed, the zinc deposits electrolytically upon the zinc forming the negative pole, the oxygen reoxidizes the lead that has been reduced during the discharge, and the acid remains free in the liquid.

The retort carbon, placed in the middle of the binoxide of lead, prevents the formation of those local couples that we find in all peroxide of lead accumulators, and that form between the layer of oxide and the subjacent portion of metallic lead. This advantage is due to two causes, viz.: (1) The difference of potentials in a static state appears to be less between the peroxide and the carbon than between the peroxide and the lead. (2) The carbon cannot seize upon the oxygen of the lead oxide, while, under the same conditions, the metallic lead can partially reduce the peroxide and become converted into suboxide.

In short, this pile appears to practically present the following advantages: (1) Great electromotive power—2.4 volts before any polarization, and 1.8 volts after polarization. (2) No wear, except when the circuit is closed. (3) Low price—the materials entering into its composition making it a really cheap pile. (4) No disengagement of gas. (5) Reversibility. The pile constitutes a genuine accumulator having, so to speak, an unlimited duration, a feature that is of great advantage, especially for telegraphs. After a year or two of service, the elements might be recharged *en masse* by a dynamo machine, in order to put them in their primitive state.—*Le Génie Civil*.

THE HUNGARIAN HOUSE OF PARLIAMENT AT BUDA-PESTH.

THE opposite page, taken from the *Illustrirte Zeitung*, shows Prof. E. Steindl's design for the new House of Parliament at Buda-Pesth. The building will probably cost from \$7,000,000 to \$8,000,000 before it is completed. On the 23d of May last year the requisite bills were passed, and operations were begun shortly after.

The middle portion of the building projecting from the rear facade is the hall for the House of Lords. The cupola is to be erected above a high circular hall or vestibule, 65 feet in diameter, from which corridors lead to the two large halls at the right and left of the same, the said halls being distinguished from the rest of the building by high roofs and their four corner towers. They are 82 feet long and 72 feet wide. All the halls, rooms, corridors, etc., are to be ornamented very richly with marble, wood, and fresco paintings. The exterior walls are all to be erected of sandstone, and the interior or court walls of brick. The building is to be erected on the Danube quay, parts of the buttresses of the central and corner portions resting on the roadway of the quay.

SMILAX ASPERA.

THE smilax of which we publish an illustration is a very beautiful half-hardy evergreen climber well suited for conservatory decoration. It was sent to us by Mr. Burbidge under the name of *Smilax tamnoides*, but as we were unable to identify it with any species that has received this or a similar appellation, we applied to M. De Candolle, the monographer of the genus in question, who in reply to our inquiry says that it is one of the many forms of *Smilax aspera* allied to the forms *guinea* and *mauritanica*. If the plant is of considerable size (as we believe is the case), it is probably *S. aspera* var. *mauritanica*, but the gradations between the two forms are numerous. The group comprising *S. aspera* and *S. pendulina* is very distinct in having sessile fascicles of flowers arranged in long spikes. *S. aspera* is widely diffused in the Mediterranean region, Northern Africa, and India, and presents a well-marked swelling (in the dry state) at the apex of the leaf-stalk, while in *S. pendulina*, from Madeira, this swelling is not obvious, but the nerves of the leaf pass gradually in the stalk without the intervention of any swelling. The plant from which our figure was taken was grown in a cold greenhouse at Sutton, Co. Dublin, by Mrs. L. Lawson. It is, we are informed, planted out in a shady corner of a cool peat bed, and is trained up the side wall and roof. Its leaves are useful in all seasons for cutting, and they endure fresh in water for many weeks. The species of smilax bear their greenish male and female flowers respectively on different plants, the female flowers being succeeded by a roundish purplish berry.—*The Gardener's Chronicle*.

THE PHYLLOXERA AT THE TURIN EXHIBITION.

By P. LE NEVE FOSTER.

IT was a happy idea on the part of the organizers of the Turin Exhibition, during the International Congress on the Phylloxera, lately held in that city, to gather together in a small building, situated near the marine department, a collection relating not only to the natural history of this insect, which has caused such ruin in the wine-growing districts of France and other countries, but also the various plans that have been adopted for the destruction of this pest.

The *Phylloxera vastatrix* first made its appearance in Europe in 1863, at Pujault, in the department of Gard, and M. Planchon, of Montpellier, appears to have been the first naturalist to study the habits of this parasite. It was not, however, until the 18th August, 1879, that the phylloxera visited Italy, at Valmadrera (province

of Como), and in the following March was discovered at Rieti, in Sicily, while in the autumn of the same year it made its appearance at Porto Maurizio and at Messina. Like most insects, the phylloxera undergoes numerous modifications or metamorphoses during its existence, which may be said to be of two distinct characters, viz., that in the air, and that below ground. The principal phases in the life of this insect are, 1st, that of larva; 2d, as an apterous female egg layer; 3d, as a nymph; 4th, as a winged female; 5th, as sexual individual. In the first, it is microscopic, and of a yellow color; in the next, of larger size, and exceedingly prolific, and of a darker color. The female insect, which is larger than the male, during the months of August or September deposits on the leaves two or three eggs, and the little insects, as soon as they are hatched, puncture the leaves, and so cause excrescences or galls to be formed, in which the insects develop, and soon commence laying eggs; these eggs, in due time, give birth to young, which soon become egg-laying mothers, and, like the first, remain wingless; some of these travel down from the branches to the roots, where they obtain their nourishment at the expense of the vine. Five or six generations of these egg-producing mothers follow each other in succession, when some of the individuals begin to acquire wings, and commence to issue from the ground, and rise in the air, until the autumn, and spread to new vineyards, where they lay two or three eggs, and then perish. These eggs, in the course of a fortnight, produce sexual individuals, which appear to exist for no other purpose than that of reproduction, are without means of flight or of taking food. The female lays one egg, called a winter egg, which usually passes the winter unhatched, and is deposited in crevices, or under the loose bark of the old wood,

ers have been tried in due turn. Some viticulturists recommend the planting of garlic or hemp between the rows of vines, while the Academy of Sciences of Paris, in 1874, advised the spreading of sulphide of ammonia over the infected vineyards. The flooding of the vineyards, in order to drown out the insect, has also been recommended, and where it has been possible to apply such a remedy it has been entirely successful; but as vineyards are usually situated on hilly ground, it will be readily understood that this remedy is inapplicable in the majority of cases.

Another remedy that has been adopted, and which on account of the cost is clearly impracticable, is the substitution of sand for the earth in which the vines are grown, it having been found that the plants growing in a sandy soil are, to a certain extent, not attacked by the phylloxera.

The principal remedy, however, is the application of bisulphide of carbon, by injecting it into the ground, usually in a liquid state, by means of special implements that have been devised for the purpose, but great care must be taken to regulate the quantity in order to effect the object, and without injuring the vines. In any case this method is very costly, besides it being necessary afterward to manure the plants before they completely recover from the effects of the attack.

In many cases the wisest course to pursue is to destroy the vineyard entirely, to cultivate the land with care, and then to replant it with vines capable of resisting the attack of the phylloxera.

The cultivation of the American vine, many varieties of which are proof against the assaults of this pest, has found a large number of partisans, it having in many cases given highly satisfactory results, some varieties, such as the Jacquez, Herbemont, Cornucopia, Othello,

SMILAX ASPERA, VAR.—FLOWERS GREENISH-YELLOW, FRAGRANT.

the young of which either go directly to the roots and form root-feeding colonies, or gall-inhabiting colonies on the leaves. The last occur only in the form of apterous females, and are not essential to the propagation of species, and do, as compared with the root-inhabiting type, but little damage.

When first attacked, the vine shows no signs of infection, as the insect is only visible by aid of a lens, and the vegetation does not suffer for the first year. If, however, the roots are carefully examined, small excrescences of a whitish color will be observed, and these are caused by the puncture of the insect, and it is in these that the root-dwelling type lives, multiplies, and hibernates, and it is in consequence of these wounds that the roots become no longer capable of furnishing nourishment to the vine. During the second year, the plant begins to show signs of decline, the vegetation languishes, the shoots cease to grow, the leaves become pale in color, and the scanty bunches of grapes rarely come to maturity; and, finally, the insect having exhausted the plant, abandons its lodgings for a more suitable one among the neighboring healthy vines, and the injured plant, the roots of which are no longer capable of performing their natural functions, usually dies during the third year.

Among the many plans which have been suggested and tried, in order to get rid of this pest, but none have as yet really given satisfactory results, and this is easily explained from the fact that any agent employed for the destruction of the phylloxera must penetrate at least one meter deep into the ground in order to reach it, and while capable of killing the insect must, at the same time, do no injury to the vine. Carbolic acid, petroleum, sulphide of lime, flowers of sulphur, subacetate of copper, tobacco juice, carbonic acid, chloride of lime, and a variety of other insect destroy-

and Canada, being grown for the direct production of grapes, while others, comprising the different varieties of the *Vitis Riparia* and *Vitis Rupestris*, viz., York's Madeira, Solonis, Vialla, Jacquez, Oporto, and Taylor, are planted, and serve as stocks to be afterward grafted with the different kind of grapes suitable for the particular district and for the special description of wine it is desired to produce.

The Italian Government have done all in their power to encourage the cultivation of the American vine, and for this purpose obtained from America a quantity of seed, of which 6,760 lb. was distributed, since 1879, among the various local agricultural societies and private vine growers.

The Minister of Agriculture has assigned five gold medals, ten silver, and twenty bronze to exhibitors in this section, and the Direction of Agriculture exhibits an important collection of maps, showing the districts invested with the phylloxera, drawings, photographs, and a quantity of reports and other pamphlets relating to this insect, and besides this, samples of the various tools and implements used for destroying the infected vineyards, as well as those employed for the injection of the bisulphide of carbon.

The Minister of Agriculture also shows an important monograph with diagrams illustrating the various processes adapted to the manufacture of the bisulphide of carbon by the methods of Peroncelli, Giraud and Aubert, Gally, Cazalet, and Deiss. The first manufactory of this substance in Italy was at Oneglia and Pisa, and at the beginning of the present year there were four factories in Tuscany, six in the southern provinces, three in Sicily, and one at Milan, making in all fourteen establishments, containing seventy retorts, of which sixty are in use for about eight months during the year. The process principally adopted is that of Deiss; the

quantity of sulphur required for each furnace of four retorts is from six to eight quintals (12 cwt. to 16 cwt.) per day, and which in 240 working days produce from 1,800 tons to 2,000 tons of bisulphide of carbon, a large quantity of which is being used in other industries, and some is exported to Tunis.

The Italian Government have purchased, since 1880, all the bisulphide of carbon required for the treatment of the vineyards in the localities ravaged by the phylloxera, from Italian manufacturers, the quantities and value being as follows:

	Quintals.	Lire.
1879	26.78	1,279.00
1880	1,314.24	58,878.05
1881	1,461.75	56,205.87
1882	1,986.48	72,996.26
1883	5,886.35	200,818.05
1884	1,085.20	37,528.20
Total ..	11,760.80	427,701.43

The Minister of Agriculture of France (Ecole Nationale d'Agriculture of Montpellier) has sent a quantity of photographs, maps, reports, books, etc., respecting the phylloxera, besides models, diagrams, preparations, roots, and dried specimens of vines illustrative of the damage done by this insect; a variety of drawings, photographs, and examples of grafting in various stages; a large quantity of tools and implements used for grafting, among the best of which may be mentioned those of Trabua, Petit, Saint-Cristole, and Guisquet; a collection illustrating the resisting qualities of the American vine, commencing with the seed, microscopic and other preparations of the roots; samples of wine produced from American grapes; drawings, photographs, and implements illustrating the various systems adopted for the destruction of the phylloxera, viz., by the bisulphide of carbon method, the sulpho-carbonate of potassa method, sulpho-carbonate of lime method, as well as those of other insect-destroying substances; the treatment of vineyards by flooding, and that by the use of sand, with specimens and analysis of sands in which the vines resist the attack of the insect, and specimens, with analysis, of those in which it does not.

The Minister of Public Works, Portugal, contributes a collection of reports and regulations respecting the spread of this pest in that country.

The Swiss Government also send a collection of reports, regulations, and other books relating to the phylloxera, together with maps of the infested localities, instruments of and tools used for the inspection of vineyards, etc.

The School of Viticulture, of Alba, shows a variety of tools and implements for grafting and pruning vines, as well as those used for the application of sulphur, a variety of maps, pamphlets, herbariums, diagrams illustrating the various diseases to which the vine is subject, herbariums of American vines, models and microscopic preparations for the study of the phylloxera.

The schools of viticulture and winemaking of Avelino, Corneigliano, Grumello del Monte, and numerous other institutions, exhibit important collections, etc., illustrative of the various diseases which affect the vine, and the numerous parasites which infest it, as well as tools, implements, etc., of every description.

One of the most interesting entomological collections is that of M. F. Richter, of Montpellier, who exhibits twelve slides for the microscope to illustrate the different metamorphoses of the *Phylloxera vastatrix* (Planchon); six slides of the *Phylloxera quercus* (Boyer); *Phylloxera coccinea* (Heyden); *Phylloxera corticis* (Kaltenbach); *Phylloxera punctata* (Lichtenstein); *Phylloxera acanthochoerms* (Kollar); *Aploneura lentis* (Passerini); and of the *Phylloxera salicis* (Lichtenstein). Besides various preparations in spirits of wine of the galls on the leaves and excrescences in the roots.

Samples of grafting shown by other exhibitors; among them may be mentioned M. Blanc, of St. Gilles (Gard), who shows samples of fifteen different ways of grafting.

Most numerous are the systems proposed for grafting, among which the whip graft (*griffe anglaise*), which is recommended as one of the best by the congress lately held in Turin; the Champin graft also is advocated by numerous viticulturists; while grafting by "approach" may be found advantageous in many cases.

The American vine has become of greater and of more comprehensive importance, on account of its now well established phylloxera-resisting qualities, and it is now grown largely, both in Italy and France, as a grafting stock for European kinds, as well as being largely planted for direct production. The Count di Roasenda exhibits wine made in 1883, from the Solonis, Concordia, York's Madeira, and Elsinburg varieties of the American grape. Dr. Garroni, of Varese, wine made in 1882 and 1883, from the York's Madeira grapes. Signor Borghi, of Varese, also sends samples of wine made from York's Madeira, Clinton, and Vialla.

An important exhibit is that of Dr. Rizzetti, who, besides a collection of 75 varieties of the American vine cultivated in the grounds, shows a collection in pots of 50 seedlings of the *vitis rubris*, and 50 seedlings of the *vitis riparia silvestris*, sown last May; also 27 plants of Italian varieties grafted on American stocks. A herbarium containing 80 specimens of American vines, with a descriptive catalogue which cannot fail to be of great interest to the viticulturist. In addition to these are exhibited 80 different varieties of seed of American grapes, and a number of slides prepared for the microscope, illustrating the power of resistance of the American against the attack of the phylloxera, as compared with that of the European sorts.

Dr. Rizzetti has established on the hills at Mongreno, a few miles distant from Turin, a nursery for raising this quality of vine, and has at the present time upward of 100,000 seedlings belonging to thirteen different species, viz., the *Riparia*, *Æstivalis*, *Labrusca*, *California*, *Candicans*, *Rotundifolia*, *Cinerea*, *Cord folia*, *Rupestris*, *Arizonica*, *Lincocumini*, *Monticola*, and *Rubia*, which last has only recently been introduced into Europe, and is highly esteemed on account of its resisting qualities. These thirteen species are subdivided into seventy-eight varieties, of which twenty-five varieties belong to the *Æstivalis* species, among which may be mentioned the Jacques, Herbeumont, Norton's Virginia, and York's Madeira, which last are especially adapted for the direct production of grapes, while the twenty-two varieties of the *Riparia* are suitable as grafting stocks for European kinds, and the other thirty-one varieties belong to the remaining eleven

species, which are all more or less suitable for planting in different localities.

Notwithstanding the advantages offered by this description of vine, on account of its phylloxera-resisting qualities, it will be readily understood that viticulturists in general will be loth to replace the vines in full produce in their vineyards with young plants, the yield from which, for many years to come, must be insignificant.

Mr. F. Cassetta, of Alba, meets this difficulty in the following way: By grafting on to existing Italian vines new roots of the American sorts, and that without disturbing in any way the economic conditions of the vineyard. To an existing vine he grafts on, as near the ground as it is possible, a scion of some American variety, which pushes rapidly with great vigor, and by the following spring this new shoot is sufficiently long to be bent down into the ground as a layer, leaving the extremity above the surface; this layer naturally soon takes root, and should the dreaded phylloxera make its appearance, it is only necessary to sever the vine from its old roots, and in this manner it continues to grow with great vigor on the young and healthy ones that have been prepared for it. The advantages offered by this system over that of the replanting of the vineyards with young American plants, to be afterward grafted with European sorts, cannot fail to be obvious to all viticulturists, for in the latter case many years must elapse before the new vines can be in full bearing, while in the former the wine harvest is not lost for a single year.

Signor Cassetta shows an Italian vine of the variety known as *Barbera*, with a graft of York's Madeira, made last May, to be layered next spring. Also a vine of the same quality grafted with York's Madeira in the spring of 1882, which graft was propagated as a layer in the spring of 1883, and in the month of May of the past year was separated from its old roots. During all this period the vine did not cease to produce the usual quantity of grapes.—*Jour. Soc. of Arts.*

ZINC IN DRINKING WATER.

By F. P. VENABLE, Ph.D.

THE increase in the use of galvanized iron, especially in the form of water tanks and pipes, has led to a re-opening of the question as to the possible injurious effects from the use of such water. It is a matter of importance, then, to us how far our knowledge extends on this subject, and I will collect here all of the known facts so far as I have been able to get at them.

The so-called galvanized iron is of course nothing more than iron dipped in a bath of zinc, and so superficially coated with it and to a certain extent alloyed with it. The character of the protection afforded the iron is galvanic (hence the name), the two metals forming a galvanic couple, so that under the action of any exciting liquid the zinc and not the iron is attacked. That zinc dissolves in potable waters has long since been shown by the experiments of Boutigny, Schaeffele, and Langonne. Distilled water and rain water dissolve it more readily than hard water. Especially is water containing carbonic acid capable of this solvent action. So much may be taken up that the water becomes opalescent and acquires a distinctly metallic taste. It seems that by the action of water, hydrate and carbonate of zinc are gradually formed, and that this action is more rapid in the presence of certain saline matters, but is weakened by the presence of calcium salts.

As to the injurious effect of such waters, authorities differ. Fonssagrives has investigated the question, consulting the statistics of the French navy and the recorded experiments of others, adding, however, none of his own. The French government had, before this, appointed a committee to make special report on the subject, and the investigations of Roux, in 1865 and 1866, furnished evidence enough of possible injury to health from water stored in galvanized iron tanks to lead to an order from the Minister of Marine prohibiting the use of such tanks on board of ships of war. Boutigny attributed grave effects to the use of these zinc-containing waters, looking upon it as probably resulting in epilepsy. Fonssagrives, however, maintains that the zinc is not cumulative, and produces no bad effects unless taken in large doses.

Doubt is thrown on this position, however, by the fact that his assertions as to the limited solubility of zinc in ordinary drinking-water are not sustained by experiments. Without doubt such waters have been used for considerable lengths of time, and no injurious effects have been noticed. This may have been due, however, to the hardness of the water, and hence the small amount of zinc dissolved. Pappenheim states in contradiction to the assertion of Fonssagrives that zinc vessels are dangerous, and must be carefully avoided. Dr. Osborne, of Bitterne, has frequently observed injurious effects from the use of waters impregnated with zinc. Dr. Stevenson* has noticed the solvent action of rain-water on galvanized iron, and states that probably its continued use would cause injury to health. He recommends as a convenient test for the presence of zinc in potable waters the addition of potassium ferrocyanide to the filtered and acidulated water. Zinc gives a faint white cloud or a heavier precipitate when more is present. Dr. Frankland† mentions a case of zinc poisoning where well-water, containing much dissolved oxygen and but little carbonic acid, was used after passing through galvanized iron pipes. Professor Heaton‡ has recorded the analysis of a spring water in Wales, and a second analysis of the same water after passing through half a mile of galvanized iron pipe, showing that the water had taken up 6.41 grains of zinc carbonate per gallon.

A similar instance of zinc-impregnated water has come under my own observation, and I append the analytical results. The water from a spring 200 yards distant was brought by galvanized iron pipes to a dwelling-house, and there stored in a zinc-lined tank which was painted with white lead. The water became somewhat turbid and metallic-tasting, and its use for drinking purposes was discontinued. Analyses were made after the pipes had been in use about one year. A somewhat full analysis of the spring water was made, under my direction, by Mr. J. C. Roberts. The analyses of water

from the tank and directly from the pipe I carried out only so far as zinc, iron, and tests for lead were concerned. The results are calculated in grains per gallon of 231 cubic inches:

Analysis of Spring.

Silica	2.45 grains.
Lime	0.23 "
Magnesia	0.17 "
Alkalies	0.43 "
Chlorine	0.35 "
Sulphuric acid	0.19 "
Carbon dioxide (calculated)	0.45 "
Total residue on evaporation	4.34 "

The tank contained 4.48 grains of zinc carbonate per gallon, with a trace of iron and no lead. Water from the pipe gave 4.29 grains of zinc carbonate per gallon and a trace of iron.

It is evident, then, when the dangerous nature of zinc as a poison is taken into consideration, that the use of zinc-coated vessels in connection with water or any food-liquid should be avoided.—*Journal of the American Chemical Society.*

BOTTLE EXPLOSIONS.

A WELL known method of loosening refractory glass stoppers is to heat the neck of the bottle to which they adhere, a plan which often results in liberating the stopper when all other means have failed. A warning against the method comes from Japan. Dr. Driver, the principal of the Imperial College of Engineering at Tokio, was attempting to open a bottle of trichloride of phosphorus in this manner, when, through some decomposition having taken place, the contents exploded, broke the bottle to fragments, and seriously injured one of the Professor's eyes. Should any photographer attempt such a plan with an ammonia bottle, for instance, results equally deplorable might readily ensue, unless great care were exercised in the manner of applying the heat and protecting the bottle.—*Brit. Jour. of Photo.*

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TABLE OF CONTENTS.

	PAGE
I. METALLURGY AND CHEMISTRY.—The Electro-Metallurgical Treatment of Copper Matte for the Extraction of Copper.—Method followed in the Sestri-Levante establishment.—Laboratory experiments.—With engraving of the Sestri-Levante establishment and 4 figures.....	7623
The Preservation of Iron by One of its Own Oxides.—By B. H. THWAITE.....	7625
The Spectroscopic Examination of the Vapor evolved in Heating Iron, etc., at Atmospheric Pressure.—By J. PARRY.....	7626
Zinc in Drinking Water.—Analyses.—By F. P. VENABLE.....	7638
II. ENGINEERING AND MECHANICS.—The Blanchard Furnace and Steam Generator.—1 figure.....	7627
The Forth Bridge.—On manipulating the material and building and drilling the great tubes of the Forth Bridge.—By A. S. BIGGART.—Two full pages of illustrations showing machinery used on the Forth Bridge.....	7627
Mud and Garbage Receiver and Lift.—1 figure.....	7631
Improved Compound Steam Engines.—The electric governor.—2 engravings.....	7631
A London Subway.—With map.....	7632
III. TECHNOLOGY.—On the Heating of Cars.—Heating by means of stoves, hot air apparatus, apparatus for burning agglomerated fuel, hot water heaters, etc.—2 engravings.....	7632
Fruit Canning in London.....	7633
IV. ARCHITECTURE.—The Hungarian House of Parliament at Buda-Pesth.—With full page engraving.....	7637
V. ELECTRICITY, ETC.—Electro-Chemical Rings compared with those obtained by Physical, Mechanical, or Chemical Way.....	7634
On Page's Electric Locomotive.....	7635
O'Keenan's New Electric Pile.—3 figures.....	7635
VI. HORTICULTURE.—The Phylloxera at the Turin Exhibition.—By P. LE NEVE FOSTER.—With engraving.....	7637

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* Chemical News, xlix., 107.

† Ibid., xlix., 115.

‡ Ibid., xlix., 85.