Journal of the Society of Arts.

FRIDAY, MARCH 23, 1860.

EXHIBITION OF INVENTIONS.

The Twelfth Annual Exhibition of recent Inventions will be opened at the House of the Society, on Monday, the 9th of April next.

EXHIBITION OF PICTURES BY THE LATE SIR WILLIAM ROSS, R.A.

The Council have it in contemplation shortly to hold an Exhibition of the Works of this Artist at the Society's House.

Her Majesty the Queen, and H.R.H. the Prince Consort, President of the Society, have graciously consented to contribute to the Exhibition from the Royal Collection.

Any persons having in their possession works by Sir William Ross, are earnestly requested to communicate immediately with the Secretary of the Society of Arts.

EXAMINATIONS, 1860.—NOTICE TO LOCAL BOARDS.

The following circular has been issued :—

Society for the Encouragement of Arts, Manufactures, and Commerce,
John-street, Adelphi, London, W.C.,
16th March, 1860.

DEAR SIR,—I am directed to draw your particular attention to Par. 11 of the Examination Programme, and to suggest that your Local Board should now make arrangements for holding the Previous Examination :—

"11.—The Previous Examinations must be held by the Local Boards sufficiently early in the year to allow the results to be communicated to the Council on or before the 10th of April, 1860, *i.e.*, four weeks before the 8th of May, the day fixed for the commencement of the Society's Final Examinations."

I shall be obliged by your informing me, *without delay*, whether you expect to have any candidates desiring to be examined in Music, as, if so, I will furnish you with a form of test to be used at the Previous Examinations, as mentioned in paragraph 86 of the Programme.

I am, dear Sir, yours faithfully,
P. LE NEVE FOSTER, *Secretary*.

SIXTEENTH ORDINARY MEETING.

WEDNESDAY, MARCH 21, 1860.

The Sixteenth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 21st instant, W. B. Carpenter, Esq., M.D., F.R.S., in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Arnold, Augustus Walter.	Rolls, J. Gouldsmith.
Burnell, George Rowdon.	White, H. C.
Goodwin, Josiah.	Whitehead, Charles.

The following Colonial Institution has been taken into Union since the last announcement :—

South Australian Institute.

The Paper read was—

ON A NEW METHOD OF OBTAINING CRUSTS OF ARSENIC AND CRYSTALS OF ARSENIOUS ACID, WITH OTHER SUBLIMATES; AND INCIDENTALLY, ON A NEW CLASS LENS AND MICROSCOPE.

By Dr. GUY, of King's College, London.

I ask the attention of the Society this evening to a series of adaptations and inventions, bearing on the practice of a minute chemistry, and the use of the lens and microscope; incidentally also on a new method of mounting photographs, and on some new forms of museum apparatus, with which I have had something to do in the way of suggestion.

As the simple chemical manipulations of which I am about to speak have for their aim to prepare a new class of objects for examination by the lens and microscope, and as the other suggestions to which I have alluded have either grown out of the use of a disc of glass, instead of the usual microscopic slide, or imply the substitution of the one for the other, I will begin by saying a few words about these discs of glass.

For some years past I have been in the habit of using these discs, and of late especially, on account of their convenience for comparative chemical experiments on the small scale. They are almost necessary for sublimates obtained by heat, and very useful when we wish to obtain a number of crystalline deposits from solutions at the same time. A great many of these discs can be put under one bell glass, and protected from the intrusive London dust.

It is a very small matter to speak of, but I may state here, that for these minute chemical operations I find a little instrument, consisting of a spear-shaped piece of common window-glass, mounted in a wooden handle, more convenient than the common glass rod. It acts as a spatula, a coarse filter, and a good drop at the same time. You can put a small quantity of a salt on a piece of window-glass, rub it down with the flat side of this glass spatula, suck up the clear solution by the capillary attraction of the two surfaces of glass, and then drop a large or small drop from the point. I send round a specimen of this very simple chemical tool. I may add that in using the common solutions for these small experiments, I always employ a drop bottle of the form which I now send round. It is a hollow tube drawn to a point, and ground as a stopper into the neck of a bottle; a small hole at the top of this tube converts it into a pipette.

To the other and more important use of the glass disc, (I mean for obtaining sublimates by heat,) I shall allude presently, after I have spoken of the size of the disc, of the mode of adapting it to the microscope, of similar discs made of other materials, and of the art developments to which the use of it has led.

I annex a section of the disc and holder, Fig. 1.

The circular disc of glass is an inch in diameter and by dropping it into a wooden holder, of the shape and size of the common microscope slide, with a central circular aperture bordered by a sunken ledge, it is readily adapted to microscopic use.

I have also made some use of circular discs of the same size turned out of wood, bone, or ivory, and thought at one time that some advantage might accrue from reviving the old-fashioned fixed microscopic cell, with its two circles of talc and ring of brass wire; substituting glass for talc, retaining the wire, and adapting the disc to the microscope by means of the universal holder just described. As I have altered my opinion upon this point, I will only add that I have lately found a new use for these cells, of which more bye and bye.

Fig. 1.

It occurred to me, also, to try rings of gutta percha, turned out of tubes of that material, and I thought that, on a larger scale, and in conjunction with larger discs of glass, they would form good museum cells for flat objects. My plan was to attach the glass discs to the gutta percha rings by heat, after placing the object between the glasses, and then to fill the space with liquid through a wedge cut out of the ring, which wedge was afterwards replaced. I made some experiments with this liquid cell, and should, probably, have tried others till I succeeded, but that it occurred to me to have recourse to my friends, the Messrs. Powell, of Whitefriars, who soon superseded my experiments in this direction by blowing a museum or specimen cell, with an excellent flat surface. The object is introduced by an opening at the back; the glass is filled with liquid, and corked, or otherwise secured. I am informed that a small glass of this kind has been adopted in the Museum of the Royal London Ophthalmic Hospital, and a specimen, which I place on the table, from King's College Museum, and which has been now mounted three or four years, shows that preparations may be so dealt with as to combine the desiderata of perfect display with very slow evaporation of spirit. When the weight of the glass and the small quantity of spirit required are taken into account, this flat specimen glass is certainly economical. Some elegant and useful forms, mounted on stoppered stems, have also been introduced, and, by the kindness of the Messrs. Powell, are now on the table.

The success of the Messrs. Powell in producing this flat liquid cell was so complete, that it occurred to me to show the excellence of the flat surface by means of a photograph introduced through the opening at the back. This photograph of the Crystal Palace, by Mr. Delamotte, is now on the table, with some good specimens of photographic chemicals, placed in small specimen glasses, by Messrs. Burfield and Rouch. This mode of displaying the excellence of the flat surface of these glasses, was the source of the elegant art of mounting photographs on glass, of which, in the shape of vases, and panels, and of pictures, opaque and transparent, you have so many beautiful specimens on your table.

I have made considerable use of the larger discs of glass for dry preparations. The object is placed between the two glasses, separated if necessary by a disc of paper, pasteboard, or gutta percha. It is then secured in a wooden cell, with central circular opening and ledge, for temporary purposes by a brass ring, after the fashion of the old microscopic mountings, or permanently by putty. There are some specimens secured in both ways on the table, and to show that they have the incidental advantage of being available for examination by the microscope, there are crystals of white arsenic and a crust of metallic arsenic mixed with crystals, under the microscope, and two specimens of microscopic poisonous seeds.

I now return to the small glass discs. I have stated that I have been in the habit of using them for microscopic purposes. I send you round specimens of objects mounted dry on those discs; I also send round some specimens mounted, by a friend, in Canada balsam, in the usual way; and I place on the table the simple modification of the instrument usually employed for making the circles of Brunswick black. Some simple arrangement for fixing the discs more securely will make it as easy to mount objects in this way on these discs as on the common microscopic slide.

I have said that these discs are serviceable for obtaining chemical sublimates, such as those of metallic arsenic and white arsenic, by heat. I think it quite possible that the habit of using these discs proved suggestive of the very simple modification of the common reduction tube of which I am now to speak.

For obtaining crystals of arsenious acid, or crusts of arsenic in medico-legal inquiries, the chemist uses a glass tube, of small bore, about three inches long, open at one end and sealed at the other. The tube has the proportions of the test tube I hold in my hand, but the bore is much smaller. This tube should be of German glass. It should be carefully dried before it is used, and the white arsenic, or the mixture of this with charcoal, or of the sulphuret of arsenic with black flux, or the metallic arsenic itself (the result of some previous chemical operation) must be introduced into the tube without soiling its sides. Then, having passed the middle portion of the tube through the flame of the spirit lamp, the flame is applied steadily to the sealed end. The white arsenic in sparkling eight-sided crystals, or the crust of the metal, collects on the sides of the tube about an inch or so above the sealed end.

This operation is a delicate one, and many minute precautions must be observed in order that it may be satisfactorily performed; and, when the crystals or crusts have been obtained, they are certainly not in a favourable condition for further examination and identification. When, for instance, the crystals of white arsenic are small, they are not readily identified by lens or microscope upon a rounded surface with a sharp curve, and streaked with lines in the length of the tube.

The number of precautions to be observed, and of fallacies to be guarded against in this mode of procedure, led me to adopt the modification which I am about to describe. In the place of a small reduction tube of green glass, three inches long, I use a larger specimen tube, about three-quarters of an inch long, of common white glass. Into this short tube, from which the moisture is readily driven off, I introduce the white arsenic, the metal, or the mixture. I place the tube in a vertical position and support it there by letting it fall into a circular hole punched in a sheet of copper or drilled in a slab of porcelain. This holder may be supported either on a frame attached to the spirit lamp (in which case it should be made to turn over the flame or from it) or on a common retort holder, the spirit lamp being removed at will. The specimen thus adjusted and fixed is then heated to expel the moisture it contains, and the substance to be operated on is dropped into it from the point of a penknife. A disc of common window glass, thin, white, and free from defects or scratches, is then dried and heated in the flame of the lamp, and placed upon the mouth of the tube. On heating its contents, the crystals or crusts are deposited partly on the sides of the tube, and partly, but chiefly, on the flat disc of glass. The coating of the glass disc may then be examined by the lens or microscope, and may be treated, in every respect, as an ordinary microscopic object.

As my object this evening is to describe apparatus, and not to enter into details of chemical manipulation, I will content myself with going through this simple process with white arsenic, using for this rough class experiment a larger tube of the length of the specimen tube itself, and I will send round the crystals for your inspection. Minute details respecting this simple chemical manipulation will be out of place here, but, I must add that, for some purposes, especially when I wish to transfer small quantities of the metal, arsenic, or antimony from porcelain to glass, I improvise a short tube by placing one of the square perforated bits of glass, used for making liquid cells for the microscope over the object to be transferred, cover it with the glass disc and proceed as before. In this way the crusts of arsenic and antimony yielded by Marsh's test, may be transferred from the porcelain to the glass, and examined under the microscope.

I will illustrate the delicacy of this method which I have been describing by an extract from a paper on the subject, published in Dr. Beale's Archives of Medicine, No. iii., 1858.

"Four small slips of microscopic glass, each bearing a minute fragment of a crust of arsenic, were weighed in an assay balance, and found to weigh respectively 0·280, 0·230, 0·137, and 0·141 of a grain. The slips having been carefully heated in a small specimen tube three-quarters of an inch long, suspended in a metal holder, yielded distinct circular mists, and lost respectively 0·003, 0·003, 0·001, and 0·001 of a grain; so that two of the crusts weighed each the three hundred and thirtieth part of a grain, and each of the two remaining crusts the thousandth of a grain. Examined by the lens, all the mists were found to consist of brilliant detached points, distributed evenly over the surface, which under the microscope could be readily identified as octahedra. Both the mists yielded by the thousandth of a grain could be easily resolved into octahedra, under an eighth power of the microscope, and one of the two, by the successive removals just described, was found to consist of crystals, which could not be less numerous than 250,000,000 to a grain of metallic arsenic, a number which I believe to be greatly under-estimated. Successive experiments with minute qnantities of metal, apparently not exceeding the thousandth of a grain in weight, all yielded the same decisive result: so that I feel justified in stating that by this simple method a crust of less than the thousandth of a grain of metallic arsenic may be identified with ease and certainty."

I shall perhaps commend this plan to the Society if I state than one of the very earliest results accruing from the use of it, was the discovery that metallic arsenic when deposited from its vapour, on cooled surfaces, presents itself in the form of globules. This fact is partly of importance as giving extension and precision to our knowledge of the properties of a most important poisonous substance, and partly as connecting arsenic with other elements with which it was already known to have analogies, I mean sulphur, mercury, and selenium, which, like arsenic, are deposited in a globular form. There are specimens of all these substances under the microscope as well as of some other sublimates obtained in this manner. I need scarcely add that this method gives great facilities for examining the crystals of arsenious acid, which, though usually described (and correctly) as right octahedra, sometimes assume the shape of right prisms, and occasionally, though only rarely (as I have ascertained), the form of the cube.

This is all that the time at my disposal will allow me to say on this modification of the common reduction process. I have still two new adaptations to speak of, one relating to the lens and microscope, the other to the preparation and display of a certain class of microscopic objects. I will describe the first under the title of a "class lens" and "class microscope;" the second I shall call an illuminated cell.

I had long wished to have a lens and microscope so arranged that I could first fix the object to be examined, then adjust the focus, and then send it round to a class of pupils for inspection; for I know by experience how difficult it is, in the common use of the lens, to make the two hands and the light co-operate to a distinct view of the object under examination. Having explained my wishes to Mr. Baker, of Holborn, two days sufficed to place me in possession of what I required. He made me the instrument I now send round for inspection, in which I have not thought it necessary to make any change. He also converted two eye-pieces, which I happened to have in my possession, into class microscopes on the same principle. The construction of the class lens is sufficiently explained by the annexed woodcut, Fig. 2, in which the central figure represents a short brass tube mounted on a handle; the figure to the left, a Coddington lens, inserted in a screw, which, working in the handle, adjusts the focus; and the figure to the right, a cap with female screw, which fits the male screw shown in the handle.

The object, mounted on a glass disc, is dipped into the circular cup represented on the central figure, and it is then fixed in its place by screwing on the cap.

Some of the class lenses are made with a slot, to receive the common microscopic slide, so that the instrument is equally adapted to the disc and to the slides.

It is obvious that this instrument is well adapted to the examination and display of transparent objects. The power is quite sufficient for the identification of crystals of arsenious acid of the size usually obtained, and of other crystals deposited from strong solutions. It is also quite sufficient for the identification of the poisonous microscopic acids, displayed as transparent objects, that is to say, in the form of cuticle. But as it was obvious that the

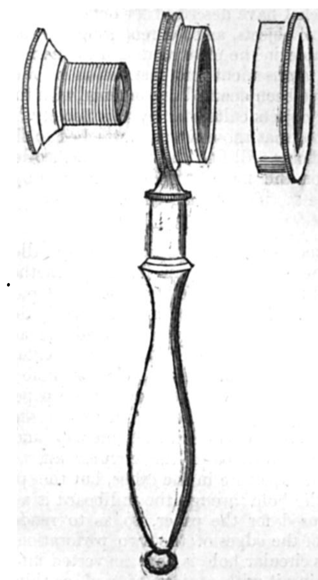

Fig. 2.

instrument, whether used for scientific or popular purposes, would be limited in its use if it were not fitted to opaque objects, I have devised an illuminated cell, which supplied this defect. The cell is shown in section in the woodcut, Fig. 3, in which the curved line represents a circular piece of common tinsel, moulded into a concave form by a small pestle and mortar of box-wood, and with a small central aperture. The silver surface of the tinsel is turned towards the object, mounted on a small disc of black paper, attached to a disc of microscopic glass. The disc of glass is attached by a paper label to the surface of one of the wooden discs, of which I have already spoken, while a small piece of microscopic glass, mounted on another label, fills the central opening of the reflector disc. The second label is attached to the other surface of the wooden disc. This illuminated cell is dropped into the cup of the instrument, with the aperture of the reflector towards the eye, and the object turned from it, and secured in its place, in the manner already described. The illumination thus obtained is found to be sufficient for the complete identification of such objects as microscopic seeds, or for the effective display of popular objects. That this is the case, the specimens I now send round will prove. They are best seen by sloping the instrument so as to look a little from the light, and to cause it to enter the enclosed space obliquely.

Fig. 3.

The lens has been, at my suggestion, placed in a box with the usual microscopic instruments, discs of glass, and gummed labels, to which pieces of microscopic glass are attached. By moistening these labels, objects may be secured to the dics of glass with almost the facility of postage stamps.

I have to add that Mr. Matthews, of Portugal-street, Lincoln's-inn, has devised an ingenious portable instrument, which may be used either as a microscope or telescope, carried in the hand or fixed on a small compact stand. The microscopic portion of the instrument has the same arrangements for fixing the object as the class lens; for the glass discs, the circular cup; for the common microscopic slide, the slot. The instrument is on the table. It seems well-adapted to medical and medico-legal uses.

I must not detain the Society any longer with matters which may seem trifling to some of its members. But I will conclude by expressing a hope that the simple apparatus which I have described for obtaining a new class of microscopic objects, and for rendering the common lens more available in the class room and in the field, and for purposes of amusement and instruction at the fire-side, may not have been deemed uncongenial with the practical and popular objects cultivated by this Society.

I trust, too, that those who are attached to the study of forensic medicine will find the many medico-legal specimens now on the table sufficiently interesting to repay them for the sacrifice of their time.

At the conclusion of his paper, Dr. Guy called the attention of the meeting to an ingenious method of displaying minute natural history objects, adopted by Mr. Charlesworth. This method may be briefly described as follows:—A magnified drawing is made of any minute object, and the paper upon which the drawing is made being cut to any required size, a circular hole is punched with a gun punch between the edge of the paper and the drawing. A piece of millboard, cut to the same size as the paper, is then punched in the same way, and the paper fixed upon the millboard, the circular aperture in one being over the aperture in the other, but the punch used in making the hole through the millboard is a size larger than that used for the paper, so as to render an exact adaptation of the edges of the two perforations unnecessary. This circular hole is next converted into a cell, by simply backing it with a piece of card or thin millboard covered with black paper, and the object is then carefully fixed with gum upon the centre of the dark ground. The drawing is then glazed and bound with paper at the edges, the paper margin being made wide enough to admit of such writing upon it as may be required. The depth of the cell must, of course, be adapted to the depth of the object by using millboards of various thicknesses.

Minute objects, which in public museums are often lost to general visitors, are made instructive by this plan, while at the same time their perfect security against dust or ordinary accidental injury is secured.

DISCUSSION.

The Chairman said he was sure the Society would feel deeply indebted to Dr. Guy for the interesting paper with which he had favoured them, and which presented a great number of points for discussion. The special application of the microscope which Dr. Guy had brought before them that evening—that which had given the title to his paper—and which was undoubtedly of the greatest importance, was its application to the detection of minute quantities of arsenic, either as arsenious acid, or as a sulphide, and the easiest mode of obtaining these in the form best suited for microscopic inquiry had also been pointed out. No doubt, it was a great advantage to get those deposits upon flat surfaces. In the use of the ordinary reduction tube the deposit was made upon the inner surface of a small cylinder, and in that case, if they submitted it to the action of the microscope, they could only have a small portion in focus at once; and practically speaking nothing more powerful than a hand-glass had been usually applied to the examination of these deposits. That was because the form of the tube made it difficult to apply the microscope to it with advantage. Dr. Guy's method was to use a short tube, and to place a disc of glass across the open top of it to receive the sublimate. While speaking of this subject, he would mention another application of the microscope to the detection of minute quantities of chemical substances; and that was in determining whether mmonia was exhaled from animal bodies in an ordinary state of health, in their breath. It had been asserted that such exhalation did take place, though this had also been denied. Within the last few years, however, a series of experiments had been made by Dr. Richardson, by an arrangement very similar to that which Dr. Guy had now brought before them. The plan of Dr. Richardson was to take a tube with a rather wide orifice, shaped like a trumpet, with a bulb below it, the bulb containing a small quantity of hydrochloric acid. Across the mouth of the tube there was placed a slip of glass—(Dr. Guy would use a round disc)—and the breath was made to pass through this tube for some little time. The consequence was, if ammonia was contained in the breath, when it came in contact with the vapour of the hydrochloric acid, it would form chloride of ammonium, which would be deposited in the glass in the form of excessively small crystals. In this way it was shown that ammonia was exhaled in minute quantities from the breath, especially in cases where there had been a surplus of nitrogenous food in the system. He did not mention this fact with a view to start a discussion upon the physiological circumstances under which exhalations of ammonia took place, but rather to show the value of this mode of application of the microscope to inquiries in which very minute quantities of substances were concerned, and the advantage that there was in getting the deposit upon a flat surface, instead of upon cylindrical tubes, which was the old method. Dr. Guy, in connection with this subject, had brought forward a number of interesting applications of the use of the circular disc. He (the chairman) had been so long in the habit of using the ordinary microscope slides, three inches by one inch, that the circular disc did not come so handy to him, as no doubt it did to Dr. Guy himself; and they were all more or less prejudiced in favour of their own methods. At the same time he did not uphold the old plan as that which was best, in fact he saw many advantages in Dr. Guy's system. With regard to the flat surface bottles which Dr. Guy had suggested the adoption of, there again he felt that there were great advantages. Vessels of that kind were most useful in museums. With regard to the new class lens introduced by Dr. Guy, he would remark that the principle employed was a useful one; but no doubt some such arrangements had been carried out by various persons for the purpose of class demonstrations, every one of which might have its own value. In the case of Dr. Guy the variation consisted principally in the application of the glass disc. He believed that many persons used a lens, screwing it into a socket and adjusting it by the turn of the screw. With regard to the illuminated cell recommended by Dr. Guy, he might mention that some very curious specimens of injections had been prepared in a somewhat similar way by Lieberkühn himself, which were in the museum of the College of Surgeons. Each specimen was mounted with its own concave reflector, known as the lieberkühn. Dr. Guy's adaptation of a piece of tinsel for the same purpose was a very great simplification, certainly a much easier method of obtaining a reflector than the grinding of a silver speculum.

Dr. Letheby had great pleasure in stating that he had put into practice in his own laboratory the method employed by Dr. Guy for recognising the presence of arsenic in small quantities, and he, in common with all who practised toxicology, felt thankful for the introduction of any process which rendered the discovery of poisons simple and easy. When they looked at the state of things in this respect at the commencement of the present century, and saw how, little by little, the process had been simplified up to the present day, they must feel great satisfaction at the progress which had been made in the art or practice of toxicology. No farther back than the year 1815, when Donald was tried for the murder of his mother-in-law, in Cornwall, the tests given for the recognition of arsenic were such as made the proof of its existence so doubtful that a jury was unable to convict. A little while before that, the proof of the existence of arsenic by the metallic test, as described by Hahnemann, required ten grains of the poison to make it satisfactory as evidence in a court of law. They had gone on from that time until now improving the processes, and at the present moment they were informed that it was possible to recognise the presence of even the two hundred and fifty millionth part of a grain of arsenic. The first great improvement, after the process which required ten grains of arsenic for the discovery of the metal, was that of Dr. Black, who so perfected the method of reduction as that he could rely upon the recognition of arsenic when he had only a grain of that substance to operate upon; and when Dr. Christison avowed that he could detect the presence of even the 16th part of a grain, it was thought to be a marvel of toxicological skill, but that evening they were told how to discover the 250 millionth part of a grain. One great advantage of the plan brought forward by Dr. Guy was, that it was applicable to every reliable process that had been advanced for the discovery of arsenic during the last 50 years, and that too whatever might be the material operated upon. It was therefore a most important means for the recognition of arsenic in case of suspected crime. All the steps made in this direction were not only important to science, but they were still more important in a social point of view. They found that the crime of secret poisoning had been practised with so much dexterity that it required considerable skill on the part of men of science to expose it, and he regarded every step towards the simplification of the processes for rendering the recognition of poison more certain as an advantage, not only to the scientific world, but to the community at large. Another point to which he would refer was this, that the application of the microscope to the discovery of poison might be extended beyond the recognition of mineral poisons, as, for example, to the discovery of those poisons which too often baffled the chemist—he alluded to the organic poisons. Means were thus afforded of identifying the crystals of various alkaloids, especially when they were precipitated with appropriate reagents, and the process adopted by Dr. Guy would, in his opinion, elucidate that branch of toxicology, which, no doubt, was at the present time involved in obscurity.

Mr. WENTWORTH SCOTT said, that he considered it of great importance that the surface for receiving a deposit of either metallic arsenic or arsenious acid should not only be perfectly flat, but should also possess a tint suitable for showing the microscopic crystals well both by reflected and transmitted light. For this purpose and for some others he had had specially prepared small glasses coated on one side with a thin film of "*opal glass*," both surfaces being very brightly polished, which answered this object so well that he never applied porcelain to the same use. On these opal glasses, a specimen of which he submitted for inspection, the metallic deposit was admirably shown by reflected light, while crystals of arsenious acid were best seen by directing a powerful light through the opal, all the inconveniences arising from the great reflective power of many microscopic objects being avoided by its use. While upon the subject of arsenical deposit, he wished to a say a word against the ordinary form of Marsh's apparatus as supplied by philosophical instrument makers, which he considered as wholly unfit for researches of any practical importance; the bulbs—generally not more than an inch and a quarter in diameter—were far too small for the purpose intended, and he preferred to use a small Wolffe's bottle, fitted with a bulb-tube of more appropriate size. He thought, moreover, that one phenomenon, which he had observed in testing for arsenic and antimony by this process, had not been noticed in any work upon the subject, and that was, that when the animal matter, supposed to contain either metal, had not first been completely oxidised—more especially perhaps, when liver was being operated upon—a deposit was obtained greatly resembling arsenic, and with a distinct metallic lustre, but consisting in reality of carbon, or some peculiar carbonous matter, requiring a very powerful microscope to detect it. He had known many analysts who had been deceived by this appearance, and, although, of course no one ought to be content with a single test, in an investigation of any importance, still he thought that this point should be more prominently brought forward in our schools of science than it was. He had employed sulphuric acid and bichromate of potassa for oxidising, with very good results. He was sure that all chemists must feel indebted to Dr. Guy for the various ingenious appliances he had laid before them that evening, particularly the Lieberkühn arrangement. Some remarks had fallen from the chairman relating to the experiments of Dr. Richardson on the presence of ammonia in the breath, and on the great value of the microscope in detecting it. Having had the honour of being very intimately associated with Dr. Richardson in those experiments, he could fully corroborate the chairman's observations, and he had detected very minute quantities of ammonia in the breath and blood of animals—as little as the ·008 of a grain, and in some cases even less.

The CHAIRMAN remarked that as mention had been made of Marsh's process, he should he obliged if Dr. Letheby would give them some information, with respect to a modification of it, which he (the chairman) had found to be a very valuable one, and which he believed was first practised by Dr. Letheby himself, viz. the boiling the zinc which was to be afterwards used in Marsh's tube, with the solution to be examined, first acidulated with nitric acid.

Dr. LETHEBY, in complying with the request of the chairman, said that when the delicacy of Marsh's test was pointed out by Dr. Christison and other eminent chemists, and when, soon afterwards, Dr. Taylor directed attention to the great value of Reinsch's process, it then occurred to him that by using zinc in the place of copper, taking care that there was no acid present which would evolve arseniuretted hydrogen, that the delicacy of Marsh's test, might be combined with the certainty and facility of Reinsch's process. His plan was slightly to acidulate with nitric acid the liquid suspected to contain arsenic, and having raised it to nearly a boiling temperature he introduced the zinc into it, and in the course of a few minutes, if arsenic was present, the zinc became coated with black metallic arsenic. After a few minutes the zinc was removed and washed with distilled water, and used in the ordinary way for the generation of arseniuretted hydrogen, which was recognised by the usual reactions. He admitted that the process of Marsh for the discovery of arsenic in organic matter was, unless the greatest care had been taken to get rid of all the organic matter, open to many sources of fallacy; but who would venture to decide, merely from the appearance of a black deposit upon a piece of white porcelain, that that deposit was arsenic? It was necessary to follow out the reactions of the black sublimate and to convert it into arsenious acid; and here Dr. Guy's operation could be applied with great facility and advantage. One of the specialities of that process was that the arsenious acid was deposited upon a flat surface, and thus they could detect the nature of the substance, and place its identity beyond all doubt. He was not aware that his zinc process had been largely brought into practice, because so many simple tests were already in existence. With regard to Marsh's and Reinsch's tests, they were both open to one great objection, namely, that they failed to furnish evidence of the *quantity* of the poison found. In using Reinsch's test he had added copper day after day, to the arsenical liquor, and had not been able to get out all the arsenic. When this was desired, it appeared to him that the process of precipitation by sulphuretted hydrogen, as recommended by Christison, was the best; and then it might be followed out by the plan introduced that evening by Dr. Guy.

Dr. THUDICHUM said that one of the promised advantages of Dr. Guy's new method of obtaining crusts of arsenious acid was its applicability to medico-legal researches. He had paid great attention to the analysis for arsenic in particular, having, on the occasion of a late trial, examined most of the methods formerly or then in use, and he was compelled to say that he did not at present see at what stage of the proceedings Dr. Guy's method would come in usefully. The small reduction-tubes were at the present day only used for proving the identity of small granules of white arsenic found in vomited matters, or in the intestines, and they would never be superseded by Dr. Guy's short, wide tubes, which rather deserved to be called sublimation tubes. Would the manipulation of Dr. Guy offer any advantages for the discovery of absorbed arsenic? The analysis for arsenic had several stages, which might be described as follows:—1. Destruction of the organic matter. 2. Isolation of the arsenic. 3. Proving its identity. To these another step had to be added, which had been adverted to by Dr. Letheby, the determination of the entire quantity of arsenic present in the matters examined. Leaving out of the question those methods which employed copper or zinc for precipitating the arsenic upon, without first destroying the organic matter, methods which were uncertain, and never yielded the entire amount of arsenic present, there remained three methods for destroying organic matter, the old method of Rose, by nitric acid, of Wöhler, modified by Orfila, who used nitre, and of Fresenius and Babo, in which chlorate of potash and hydrochloric acid were employed. Rose's new method of distilling organic matter with hydrochloric acid must also be mentioned. It yielded all the arsenic in the form of arsenious acid in the distillate, while the other methods yielded arsenic acid. This latter had now to be reduced, and in all analyses the second step, namely, the isolation of the arsenic, had to be effected. This was done by employing sulphuretted hydrogen, sulphide of ammonium, and carbonate of ammonia. The use of this latter reagent, which separated arsenic in a most perfect manner from antimony, had, he believed, been introduced by Mr. Bloxam, of King's College. The sulphide of arsenic obtained was the form in which arsenic could be weighed. Now, although it was already pretty certain that a yellow sulphide obtained by the above analyses, could be only that of arsenic, yet it was proper and necessary to make certain of that point, and as arsenic in its metallic state possessed such properties that it could not be mistaken for any other of the 60 elements, metallic arsenic must be obtained. That could be done by various processes,—by oxydising the sulphide and putting it into a Marsh's apparatus, or by reducing it, according to Berzelius, with cyanide of potassium in a current of hydrogen; or, better still, by reducing it with cyanide of potassium and carbonate of soda, according to Fresenius and Babo, in an atmosphere of carbonic acid; for in the last case the greater part or the whole of the arsenic was obtained in the metallic state, while by the methods of Marsh or Berzelius considerable quantities of arsenic were lost, either remaining with the zinc in the former, or going away with the hydrogen in the latter. Any chemist having thus obtained a black metallic mirror, might and would rest satisfied that he had arsenic before him and nothing else. This arsenic should be kept for demonstration in the court of law. But supposing any person, desirous of further submitting this metallic arsenic to confirmatory tests (a proceeding entirely superfluous, and which he, Dr. Thudichum, would not adopt), then the question arose, would he employ Dr. Guy's method and obtain crusts of arsenious acid? He thought that no analyst would do so, for several reasons. Firstly, there were excellent tests which might be applied to the arsenic in the tube, whereby the smallest loss of substance was prevented. Thus, filling the tube with hydrogen, and driving the metal to and fro by means of gentle heat was one; another was filling the tube with sulphuretted hydrogen, and transforming the metal into yellow and red sulphide; a third was the negative effect of hydrochloric acid gas upon the sulphide. They could even transform the arsenic in the tube filled with air, into crystals of arsenious acid, without using Dr. Guy's method. This latter method, on the other hand, required the removal of the arsenic into a little wide tube, a most difficult proceeding, and afforded no security against loss during sublimation, the tube not being hermetically closed, while the tubes adverted to by the speaker were kept hermetically closed during the operation. Then, ultimately, they had a few crystals, to be looked at with the microscope. This test was not only less characteristic than any of the chemical tests by transformation, but was also quite unnecessary. He (Dr. Thudichum) had for years made endeavours to use the microscope as a means of diagnosis in chemistry, and he must say that every day convinced him more and more that that instrument was useless for the purpose of ascertaining the chemical nature of substances from their shape. This micro-chemistry might, he was afraid, lead to very serious errors. The very example adduced by the chairman in favour of that method, he would use as a proof of its fallacy. Crystals had, no doubt, been sometimes obtained from the breath by the means adverted to, but whether those crystals were chloride of ammonium, or of the many hundred substituted ammonias, or whether they contained any ammonium at all, there was not the slightest evidence to show. The appearance of crystals of the chlorides of all the volatile Amine bases was so nearly the same, that he (Dr. Thudichum) should despair of distinguishing them from each other by the microscope. In conclusion, he assured the meeting that neither Dr. Guy's nor any other method would discover the 250-millionth part of a grain of arsenic anywhere, as had been implied by what fell from Dr. Letheby. One five-millionth of a gramme of arsenic was the outside of what could be discovered at a time, as had been proved by the French Academy in 1840 on the occasion of the trial of Lafarge. Nevertheless the analysis for arsenic, if not the most easy and certain process in analytical chemistry, was certainly one of the most reliable and best understood, and if errors arose in the course of such an analysis, not the method, but the exetution was imperfect. To the medico-legal chemist Dr. Guy's method at present would not afford any advantage; but it was a beautiful, and, (as could be seen from the many fine specimens on the table), in the hands of its inventor, a highly successful mode of producing minute sublimates, not only of arsenic but also of other volatile substances, suitable for demonstration in lectures and for amusement at the microscope.

Mr. WENTWORTH SCOTT would claim the indulgence of the meeting for a few moments longer, as he wished to make some cursory comments upon the observations of the last speaker. He must refer Dr. Thudichum to Dr. Richardson's Essay on the Blood, wherein it was distinctly stated that the presence of no particular ammonia had been determined. All that was sought to be proved was, that the solubility of the fibrine during life was due to an exceedingly minute quantity of an ammonia or volatile alkali of some kind. Every chemist was aware of the immense number of ammonias that existed, chiefly eliminated by the splendid researches of Hofmann, and of the very great similarity of appearance which the crystals of their chlorides presented under the microscope, but no one of any experience in such matters could for a moment mistake the chlorine compound of an ammonia for the chloride of anything else. He believed that a special ammonia was present in the blood of each distinct animal or class of animals, and trusted that the day was not far distant when this point would be determined. It might, perhaps, be unwise to speak of experiments as yet very imperfect, but he was under the impression that a methyl-ammonia was the solvent peculiar to the blood of sheep. He could not agree with Dr. Thudichum as to the uselessness of the microscope in medico-legal and other inquiries. He considered that it was an instrument of very great value, and one which no chemist could well dispense with. As regarded the processes he (Dr. Thudichum) had spoken of for the detection of arsenic, &c., they were all very well when there were five or six grains of the metal present, but were much too complicated when only very small quantities could be expected. Everyone would allow that simplicity was the chief point to be held in view in these matters, and here the microscope was an important aid. He would mention, in conclusion, that if the organic substance under consideration were carefully dried at a very low temperature, and then treated with absolutely pure benzole, the whole of the fatty matter could be extracted, and the oxidation process would then be comparatively easy.

Dr. GUY, in replying upon the discussion said he was sorry that it had branched off into a subject which he had not intended to introduce before the meeting. His only object was to present a few mechanical arrangements which might be adapted to medico-legal purposes according to circumstances, and it was not his intention to lead to a discussion of a chemical nature, with regard to the various tests applicable to the discovery of the existence of arsenic. He felt indebted to his friend Dr. Letheby for the opinions he had expressed upon this subject, and upon another occasion he should be prepared to discuss the objections which had been made by the other gentlemen who had spoken. He begged to correct a misapprehension into which Dr. Letheby had fallen. He had not stated that so small a portion of arsenic as the two hundred and fifty millionth part of a grain could be detected. What he had said was, that the thousandth part of a grain would yield crystals, each of which might be calculated as weighing the 250 millionth of a grain. He begged to differ from Dr. Thudichum as to the value which he had put upon mechanical tests of this description. He did not hesitate to say, irrespective of all preceding steps or stages of the investigation, that if he found upon a glass disc, used in the manner he had described, a dew or mist of crystals which were resolvable under the microscope into octahedra, there was no doubt in his mind that what he had upon that glass was arsenious acid. Strychnine was obtainable in the form of octahedra, but not as a mist upon a piece of glass produced by sublimation. This could only be a result from the presence of arsenious acid. He also wished to correct a misapprehension that this process was only applicable to the recognition of metallic substances. It was as applicable as the ordinary reduction-tube to all kinds of sublimates. It was nothing more than the substitution of a short tube for a long tube and covering the open end with a piece of glass.

The CHAIRMAN then proposed a vote of thanks to Dr. Guy for his valuable paper.

The vote of thanks was then passed.

The Paper was illustrated by experiments, showing the mode in which the apparatus invented by the author was employed for obtaining sublimates; also by a collection of microscopes and microscopic objects contributed by Mr. Baker, and various specimens of museum cells and photographs mounted on glass, contributed by the Messrs. Powell. Specimens, mounted by Mr. Charlesworth's method, above described, were on the table.

The Secretary announced that on Wednesday evening next, a paper "On the Prevention of Forgery, arising from the Alteration and Falsification of Bankers' Cheques, Notes, &c.; with a Description of a Method of Manufacturing Writing Paper having the property of rendering Common Writing Ink Unalterable by Time or Fraud," by Mr. Robert Barclay, would be read. The paper will be illustrated with a variety of specimens. The chair will be taken at eight o'clock.

BUILDING CONSTRUCTION.

The following paper on this subject was set at the last Examination, held by the Department of Science and Art, for certificates in Science. Examiner, T. Bradbury, Esq.:—

(ONE DAY. SEVEN HOURS ALLOWED.)

[The different materials to be indicated by colours—as lake for brickwork, yellow for timber, Indian ink for stone, and blue for iron.]

A very substantially built warehouse, 110 feet long, 43 feet broad, with a basement story 7 feet high, and four stories above ground each 9 feet high in the clear, the warehouse to be divided into two by a cross party-wall 40 feet from one end: the whole basement story to be covered with groined arches on square brick piers, the ground floor to be paved with stone, laid on concrete on the back of the groining.

The upper floors of the larger division to be of girders carried on cast iron columns with bridging and flooring joists, and elm flooring boards, provision being made by trimming for a cast iron winding staircase to rise the whole height of the building; the roof to be a queen post roof with tie-beams, principals, &c., to allow a centre garret lighted by skylights in the roof, which is to be slated. There are to be two small rooms partitioned off on the ground floor, each with a fire-place, one for an office, the other as dwelling room for a porter.

The smaller division of the warehouse to be built fire-proof throughout, the floors to be of sheet iron plates laid on cast iron frames supported on the flanges of iron beams, resting on iron columns; the roof to be of iron, open to the upper story, one iron door in a stone frame in each story to be the only communication between the divisions; two windows with iron frames in stone in the front and back wall of each story of this part.

The larger division to have also two windows with wooden sashes and frames set in reveals, and a door in each upper story in the front wall next the street, with a drawbridge platform for landing goods from carts, the door to be closed by the platform when raised. An iron swing crane on stone corbel at the upper floor.

SECTION I.

Prepare the following drawings to represent the above warehouse.

1. A plan of the basement story with the piers for the groined arches.
2. A plan of the ground floor with the two dwelling rooms.
3. A complete cross section to show the walls, floors, roof, &c., with the party wall.

SECTION II.

1. A plan of the timbers of one floor with a section. (The flooring joists need be shown only in one compartment.)
2. A plan of the beams, frames, &c., of the iron floor, with detailed sections to show the constructions.
3. The timber truss for the roof, with plan and sections to show the framing.

SECTION III.

1. The elevation of the front next the street.
2. A longitudinal section from end to end, showing the windows, &c., in the back wall.
3. A drawing for the spiral staircase, with detached detail figures, to show the connexions of the several castings.

SECTION IV.

1. A working drawing of the entrance door, showing its frame, cill, pannelling, &c.
2 A drawing of one of the iron window frames and sashes.
3. A drawing of the wooden sash and frame for the office, showing the frame, boxings, shutters, &c.

SECTION V.

1. A section of the blocking course, gutters, and beams,

wall plates, and framing of principals into the tie-beams, &c.

2. A drawing to show one of the cast-iron pillars to carry the floor, to show how it carries the girder, and is also bolted by stirrups to the cap of the pillar in the story beneath, also the section of the iron girders, their mode of carrying the frames, &c.

3. A drawing of one door, with drawbridge platform, shewing the mode of raising and lowering it, its construction, and how it is to fit into the frame partly to close the door when raised, the rest being shut in by a flap shutter.

SECTION VI.

1. Write out a specification for the brickwork throughout.

2. Write out a specification for the timber and joiners' work.

3. Write out a specification for the stone and iron work.

N.B.—Each candidate to make his drawings and specifications accord as far as they go.

SECTION VII.

1. Draw a timber truss for a foot bridge of 30 feet span, with a cross section of the bridge.

2. Draw a timber truss for a partition of 30 feet span to have two doors in it, and to be independent of support by the floor beneath.

3. Design the centering for an elliptic stone arch of 60 feet span, and 18 feet rise, showing the mode of striking it gradually by withdrawing wedges.

SECTION VIII.

1. Show two or three modes of scarfing timber beams of long bearing.

2. Show how you would strengthen such a beam by an iron truss without cutting into the beam.

3. Show by the plans, of two courses at least of each, the bonding of brickwalls from one brick to three bricks thick.

SECTION IX.

1. Show by a section and part elevation the construction of a wharf wall built on piles, faced with granite, with retaining counterforts, with timber fender piles to keep off vessels.

2. Show the framing for an octagonal wooden spire 35 feet high, to be raised on a church tower 12 feet square.

3. A chimney 130 feet high to stand detached, to have four openings into it below ground with occasional courses of masonry, a granite coping, and provision for a lightning conductor.

INVENTIONS IN WOOLLEN MACHINERY.

On Monday, the 12th of March, a meeting of the Leeds Woollen Manufacturers' and Merchants' Association was held at the offices of the Chamber of Commerce, Leeds, for the purpose of receiving some information with respect to a new machine for certain processes in the manufacture of woollen cloths, invented by two French gentlemen, M. Tavernier and M. Vouillon, which is described by the patentees to be capable of "converting slivers or rovings as they come from the carding engine by felting and friction into threads suitable for weaving, without the intervention of any spinning machine."

M. TAVERNIER attended the meeting, and stated that the machine had been shown at an Exhibition lately held at Rouen, and a special gold medal had been awarded to it by the Emperor of the French, at the request of the manufacturers from nine departments. Several of the machines, it was stated, were at work in France, and amongst the merits ascribed to the invention were, that it prevented the necessity of the use of oil and sizing in the preparation of the raw material for weaving, besides, of course, superseding the necessity of spinning machinery. M. Tavernier further stated that by this machine a saving of thirty per cent. in the quantity of wool used in making cloth, as compared with the ordinary process, might be effected. He exhibited some threads which had been produced by it, and invited the members of the Association to see the principle of the invention practically manifested at the establishment of Messrs. Taylor, Wordsworth, and Co., machine-makers, Leeds.

The Association appointed a deputation to inquire further into the merits of the invention, and to test its practical utility by having a quantity of wool worked up with one of the machines (which M. Tavernier stated that he would have ready in the course of a month), then manufactured into cloth, and properly finished, in order to see whether the patent produced the threads successfully, and whether they at all depreciated in value either by this or any subsequent process necessary to perfect the manufacture of cloth.

The President of the Association, Mr. DAINTON LUPTON, subsequently brought under the notice of the meeting an invention of another French gentleman, M. Sylvester, for manufacturing cloth, the principle of which consists in wrapping a woollen thread round a cotton warp. A sample of cloth made by it was exhibited, which the inventor had stated could be manufactured seventy-two inches wide at 3s. per yard. The components of it were said to be :—

Cotton thread	26 per cent.
Pure wool..................	10 ,,
Mungo of good quality	30 ,,
Mungo of ordinary quality......	35 ,,

Several of the members of the Association, after examining the specimen produced, said that it was exceedingly cheap if it could be manufactured at the price stated, and none could be made like it in Yorkshire for the money.

It was stated, however, that the principle of the machine was by no means new, having been tried in this country in connexion with other branches of manufacture, and failed.

It was further added, that hitherto the French cloth manufacturers had not been able to compete with the English in low-priced goods.

Eventually it was agreed that the President should request M. Chevalier to examine one of the machines in France, and favour the Association with his opinions as to its merits.

MAGNETO-ELECTRIC LIGHT FOR LIGHT-HOUSES.

Professor Faraday in a lecture delivered at the Royal Institution on Friday the 9th of March, says:—"By means of a magnet, and of motion, we can get the same kind of electricity as from the battery; and under the authority of the Trinity House, Professor Holmes has been occupied in introducing the magneto-electric light in the lighthouse at the North Foreland; for the voltaic battery has been tried under every conceivable circumstance, and I take the liberty of saying it has hitherto proved a decided failure. Here, however, is an instrument wrought only by mechanical motion. The moment we give motion to this soft iron in front of the magnet, we get a spark. It is true in this apparatus it is very small, but it is sufficient for you to judge of its character. It is the *magneto-electric* light, and an instrument has been constructed consisting of a number of magnets placed radially upon a wheel—three wheels of magnets and two sets of helices. When the machine, which is worked by a two-horse power engine, is properly set in motion, and the different currents are all brought together, and thrown by Professor Holmes up into the lantern, we have a light equal to the one we have been using this evening. For the last six months the North Foreland has been shining by means of this electric light—beyond all comparison better than its former light. It has shone into France, and has been seen there and taken notice of by the authorities, who work with beautiful accord with us in all these matters. Never for once during six months has it failed in doing its duty;—never once, more than was expected by the inventor.

It has shone forth with its own peculiar character, and this even with the old apparatus—for as yet no attempt has been made to construct special reflectors or refractors for it, because it is not yet established. I will not tell you that the problem of employing the magneto-electric spark for lighthouse illumination is quite solved yet, although I desire it should be established most earnestly (for I regard this magnetic spark as one of my own offspring). The thing is not yet decidedly accomplished, and what the consideration of expense and other matters may be, I cannot tell. I am only here to tell you, as a philosopher, how far the results have been carried, but I do hope that the authorities will find it a proper thing to carry out in full. If it cannot be introduced at all the lighthouses, if it can only be used at one, why really it will be an honour to the nation which can originate such an improvement as this,—one which must of necessity be followed by other nations.

"You may ask, what is the use of this bright light? It would not be useful to us were it not for the constant changes which are taking place in the atmosphere, which is never pure. Even when we can see the stars clearly on a bright night it is not a pure atmosphere. The light of a lighthouse, more than any other, is liable to be dimmed by vapours and fogs, and were we most want this great power, is not in the finest condition of the atmosphere, but when the mariner is in danger, when the sleet and rain are falling, and the fogs arise, and the winds are blowing, and he is nearing coasts where the water is shallow and abounds with rocks—then is his time of danger, when he most wants this light. I am going to how you how, by means of a little steam, I can completely obscure this glorious sun, this electric light which you see. The cloud now obsuring the light on the screen is only such a cloud as you see when sitting in a train on a fine summer's day; you may observe that the vapour, passing out of the funnel, casts as deep a shadow on the ground as the black funnel; the very sun itself is extinguished by the steam from the funnel, so that it cannot give any light; and the sun itself, if set in the lighthouse, would not be able to penetrate such a vapour.

"Now the haze of this cloud of steam is just what we have to overcome, and the electric light is as soon, proportionally, extinguished by an obstruction of this kind as any other light. If we take two lights, one four times the intensity of the other, and we extinguish half of one by a vapour, we extinguish half of the other, and that is a fact which cannot be set aside by any arrangement. But then we fall back upon the *amount* of light which the electric spark does give us in aid of the power of penetrating the fog, for the light of the electric spark shines so far at times, that even before it has arisen above the horizon twenty-five miles off, it can be seen. This intense light has therefore that power which we can take advantage of,—of bearing a great deal of obstruction before it is entirely obscured by fogs or otherwise.

"Taking care that we do not lead our authorities into error by the advice given, we hope that we shall soon be able to recommend the Trinity House, from what has passed, to establish either one or more good electric lights in this country."

Home Correspondence.

ON TOWN SEWAGE.

SIR,—Being one of those who, from want of time, were not able to join in the discussion of Mr. Alderman Mechi's paper "On the application of Town Sewage to a large agricultural area," &c., I beg to submit to the readers of the *Journal* a few observations on some of the points at issue.

With regard to Mr. Alderman Mechi's illustration of the applicability of dilute town sewage for agricultural purposes, founded on the fact that the average annual manuring per acre of the cultivated land of the United Kingdom is acted upon by a much larger proportion of water (in the form of rain-fall) than is the human excretal matter in town sewage, surely little need be said. I may, however, mention in passing that, adopting Mr. Alderman Mechi's own figures, both as to the area of land under cultivation, and as to the number of animals of various descriptions yielding manure to it, I think he underrates the average manurial matter per acre when he reckons it from the data in question, as equal to that of two sheep only. There would, besides, be the whole of the unconsumed litter and of the purchased manure of all kinds to take into account in any such calculation. Even then, in the sense supposed by Mr. Mechi, "the ordinary farm manurial resources" are not diluted in anything like the degree he assumes, beyond the point of dilution of the excretal matters, &c., in town sewage. But, granting that they were so, just for the sake of argument, I am sure I need not tell Mr. Alderman Mechi that such a fact would have no direct bearing on the question of the utility of dilute town sewage for agricultural purposes, and none whatever on that of its economical application.

Let us suppose, however, with Mr. Mechi, that the excretal matters of two individuals of a mixed population will be equal to those of his two sheep, and that, whilst those of the latter will, on his view, be diluted with about 2,600 tons (26 inches) of rain, those of the two individuals will be mixed with only 160 tons of water. Now, the excretal matters of the two individuals, if brought to about the same condition of dryness and non-putrescence as the best Peruvian guano, would correspond very nearly, both in weight and in money value at the present ratio, to 1 cwt. of that imported manure. But the question we have to consider in regard to the town sewage is, not whether, supposing we could get the excreta of the two individuals on to the acre of land at the cost of, say, 13s. 4d., if in the portable form of guano (that is, the lawyer's fee of 6s. 8d. for the excrement of each individual), we should then be glad to have them acted upon in the soil by an extra 160 tons (1·6 inches) of rain coming from heaven both gratis and piecemeal; but it is surely whether, if the 13s. 4d. worth of constituents were mixed with 160 tons of water in London (or some other large town), the farmer could then get them delivered on to his land at a cost equivalent to their assumed value.

But to leave this point. Taking together Mr. Mechi's paper read before the Central Farmers' Club a few weeks ago, and that read at the Society of Arts on Wednesday last, I think I represent his views correctly when I say that, taking the population of London at 3,000,000, and the amount of sewage per head per annum at 80 tons, he proposes the whole should be distributed over 500,000 acres. For the sake of simplicity and brevity, I shall confine myself on the present occasion to indicating, from one particular point of view, some of the conditions and requirements involved in the accomplishment of such an end; and I shall endeavour to do so in such a manner as to aid in providing a starting point for the consideration of those who may wish to form an estimate of the practicability, in a remunerative point of view, of the distribution of the sewage of London over such an area.

Adopting the figures just quoted, the excretal matters, &c., of six individuals of the mixed population, of both sexes and all ages, would be appropriated to each acre of land. The constituents of the excreta of these six persons, if brought to the same condition of dryness and non-putrescence as Peruvian guano, would be worth as much as three cwt. of that substance—say 40 shillings, or 480 pence. But these 480 pence worth of excretal matter (at the rate of 80 tons per head, per annum, of water supply and rainfall), would be distributed through 480 tons of water. It is obvious, therefore, that we have only to suppose the cost of distribution of the sewage over 500,000 acres, to be at the rate of one penny per ton, and the manure of each acre would, on such a supposition, cost for distribution alone, 480 pence, or forty shillings—that is to say, exactly the estimated value of the constituents if taken to, and put upon the land, in the portable condition of guano. There would then, on this supposition of cost of distribution, and taking the estimated value of the constituents of manure as above assumed, be no margin whatever left for payment to the citizens for their manure. It is for those who propose the investment of capital for the distribution of London sewage over such an area, to show at what cost they could accomplish their end—all difficulties and charges taken into consideration. They must also consider on the one hand, how far manurial constituents will maintain their present estimated money value, when such a large additional quantity is brought into the market; and, on the other hand, how far the fact of the constituents being distributed over the land in a large bulk of water, would increase or diminish their value.

But so far as the experience of liquid manure farms can be called to our aid, the conclusion would be that the sewage would yield the most produce if applied either exclusively to grass land, or, in the case of rotation, almost exclusively to the grass crop of the course. Now 500,000 acres is certainly much more than would be necessary to receive the sewage of London if the whole were under grass. Let us, then, for the sake of argument, suppose that it were under a four-course rotation, and that, in accordance with the experience of the most successful Ayrshire liquid manure farms, the whole, or nearly the whole, of the liquid, were put upon one-fourth of the land (the grass-crop) each year. We should then have costly arrangements for the distribution over 500,000 acres, at the rate of 480 tons of liquid per acre, per annum, whilst only 125,000 acres would receive the liquid each year, but at the rate of 1,920 tons of liquid per acre. It may be asked, would the advantages derived by the three other crops of the course, either from the occasional direct application of sewage to them, or from their following on the broken-up sewage-manured grass land, compensate for a somewhere about four-fold expenditure for distribution?

Supposing this question were answered in the negative, the obvious conclusion would be, to confine the distribution to grass-land. Nor do I think there need be much doubt that, if the application were so confined, the area might be considerably below 125,000 acres, to secure the maximum crops over a given area. The area here supposed would imply that about 2,000 tons of sewage, containing the excreted matters, &c., of about 24 individuals (equal in present estimated money value of constituents to about 12 cwts. of Peruvian guano), are to be applied to each acre of grass-land. But the question arises, whether it would not be more economical to limit the area of distribution at the cost of what might otherwise be considered as a waste of manurial matters. Concluding that it would be so, Mr. Lawes has suggested that, in this point of view, it might possibly be found desirable to apply, as a maximum, the enormous amount of 10,000 tons of dilute sewage per acre annually. This, taking a population of $2\frac{1}{2}$ millions, and 80 tons of fluid per head annually, would require an expenditure for distribution to only 20,000 acres; and, at the rate of 3 millions of population, 24,000 acres. He at the same time stated, that the exact point at which, in a certain sense, waste of manurial constituents would be compensated by limitation of area, could only be settled by actual experience. In regard to this point, it should be borne in mind, however, that when the area is limited beyond the point at which a given amount of manurial constituents is the most productive, they cannot then be estimated at the same rate of value as when they are used in the proportion of their maximum productiveness.

It cannot for a moment be doubted, that an enormous increase of produce would result from the application to the land of the excretal matters of our town populations; and certainly, least of all, could those doubt it, who, like Mr. Lawes and myself, have devoted so much time and labour in investigating the chemical and agricultural bearings of the subject, Nor can it be doubted that these excretal matters, even when distributed through the enormous bulk of water as in town sewage, would, if judiciously applied, enormously increase the produce, particularly of certain crops. But is there, in these admissions alone, any basis upon which to conclude that the increase of produce would be obtained remuneratively?—Certainly not. All the evidence that can be adduced, showing the enormous increase of agricultural produce from the use of dilute liquid manure, is utterly irrelevant to the question, in a commercial point of view, unless it can, at the same time, be shown that such an increase can be obtained at a profit. The question of the application of town sewage, is, in fact, one not of increase of produce alone, but of increase of produce at a given cost. It is for those who believe that the increased production can be obtained at a profit, to prove the strength of their convictions, and the trustworthiness of their data, by largely investing their own money in a scheme for its accomplishment. And whether they succeed in making or in marring their own fortunes, the nation will owe them a deep debt of gratitude.

Should it happen that the excretal matters of our town populations cannot at all, or only in small proportion, be rendered profitable for agricultural purposes, when once diluted with the enormous quantity of water which our modern sanitary arrangements require, we shall have to decide between the loss of this large source of manurial constituents, and some plan for collecting them more nearly in their natural state of hydration than they occur in London sewage—in which there are about 4,000 parts of water to 1 part of the dry substance of human excretal matter! True it is, that each individual dwelling is the most perfectly cleansed of its own excreta by the use of large volumes of water; but this is not all gain, even in a sanitary point of view, so long as the excretal matters are thus carried into the nearest river, polluting the water perhaps of the immediate population, and also of all it may pass before it finally reaches the sea. We cannot, however, conceive of any exigency that would justify a return to the old cesspool system. But if it should be maintained that chemistry and mechanics, conjointly, cannot suggest a plan for collecting the excreta of our town populations, at once in a portable and in an innocuous form, it must at the same time be granted, that they have at present been no more successful in carrying them off by water, without simply removing them from one sphere of mischief to that of another, discharging them unused into the sea, or both.—I am, &c.,

J. H. GILBERT.

Harpenden, St. Alban's, March 9th, 1860.

Sir,—Mr. Mechi, in his remarks concluding the discussion upon town sewage, objected to my having put a value for grass of only 7s. per ton, saying that "mangold wurzel was worth 14s. or 15s. per ton, and grass was worth more." I will acknowledge this to be true, if the value of it is considered *per mensem* instead of only per annum; if it is taken for those months when irrigation will produce grass where otherwise none would be obtained. This I believe to be a valuable point in the liquid farm manure system, but there is a possibility of the liquid being put on at a cost too great to pay. Also, if you take the value of grass in particular localities it will be fully worth that sum. Near London it is frequently sold for £1 a ton. But is it worth more than what I have stated for meat-producing purposes? and I was forced to allude to it as such in my argument, when I was speaking of Mr. Dickenson's recommendations, and Mr. Telfer's and other men's practice, and I said that it was easy to show by figures that there could be no great profit, but rather loss, in the system of pipes, hose, and jet,—even with their amazing crops. Root crops are put down by nine farmers out of ten as not returning more than from 6s. to 7s. 6d. per ton. At a meeting of the Oxford Farmers' Club it was "put and adopted 'That in the opinion of this club 7s. is the value of a ton of Swedes, 5s. of white turnips, and 8s. of mangold wurzel;'" and "grass land," says Mr. J. C. Morton, when averaging the value of grass for meat production, "worth 30s. per acre rent, may be supposed to yield 8 tons of green grass per acre per annum; and this may be able, by careful consumption, to produce £3 3s. in beef, at 6d. per lb." This, I think, will prove that I have not under-estimated grass. For my own part, I would be very glad if the contrary was the truth, as it would add to the value of my proposition for the application of town sewage to grass land. Certainly for the grass near London, which I propose to be grown by sewage irrigation, I take an estimate of a high value for the crops.

Mr. Sidney says, "Mr. Halkett had valued sewage at 2d. per ton. There was one ton of solid sewage to 600 tons of London liquid sewage. A ton of solid night soil could be delivered in Kent for 10s. In 600 tons of water, at 2d. a ton, it would be worth just £5, and he was at a loss to understand how 10s. worth was made into £5 by adding water." The answer is a very easy one; the liquid part is much more valuable than the solid, and in night soil the liquid part has mostly drained away and been lost. Professor Way says that 84 to 89 per cent. of the total ammonia (nitrogen) in the sewage exists in the soluble state. To give a fact in confirmation, I may state that at Rugby, where the portion of the daily sewage which may not be wanted by Mr. Walker is filtered through tanks, and flows into the river, the solid part, which is obliged to be used upon the land, is considered hardly worth the cartage. The value of this solid must be much less, therefore, than even 10s. a ton. But what is the value of solid and liquid before it is allowed to be lost. Dr. Hofmann, who was commissioned to examine the sewage, says, "The following are valuable in an agricultural point of view:—nitrogen, 6·7; phosphoric acid, 1·8; potash, 1·0; organic matters 30·7; total, 40·2 grains per gallon of sewage. The total solid matter per ton, taking guano at £11, would have a money value of £6 0s. 3d.," instead of 10s. He adds, "The money value of sewage, therefore, is 2d. per ton. These numbers are, to a certain extent, confirmed by the calculations of the value of the solid and liquid excrements of the whole population of London. The foundation of this calculation is confirmed by the analysis of a variety of specimens of sewage made by ourselves and by others. The chemical composition of the sewage of Edinburgh, and also that of Leicester, differs little from that of London." Again, I say, facts prove the chemist right, for, although the solid parts alone are not of great value, the solid and liquid together at Edinburgh have raised land, before nearly worthless, to a value (estimated by a jury at 33 years' purchase of the rent for the grass) of no less than £660 per Scotch acre, or £528 per imperial acre, and the annual interest upon the outlay is 100 per cent.

The value which I have taken for London sewage and liquid manures is that of the most eminent chemists in England, and in all the cases which I have yet examined, I must say that their analyses are perfectly in accordance with the increased growth of the crops. For more upon this question I must refer to my pamphlet, which may be had at Ridgway's, Piccadilly. I will only give two examples, and these extreme ones, to show that, whether strong or weak liquid is used, such is the case. Mr. Dickinson, who had 14 years' experience of irrigating with liquid manure, recommended no less than the enormous sum of £25 per acre for two years manuring in guano and nitrate of soda, to gain the same results as from the strong liquid manure, namely, one part of horse urine to from two to four parts of water, which he used. The value of this liquid, according to M. Bousingault's analysis for horse urine, would be about 40 pence per ton, and about 100 tons per annum per acre used to be put on, giving a value equal to £33 per acre for two years. My second case is at Milan, with so weak a sewage as one having six times more water, and a value of about one-eighth of that of London, or a farthing per ton, and where 8000 tons are put on in the year, practice has found that there is a difference of £4 8s. per acre advantage to those meadows irrigated with sewage over those with plain water; and solid manure is, therefore, constantly put to the latter, but never is any put to the former.

In irrigation of land, the commercial considerations to be taken into account when proposing the application of farm liquid manure, sewage, or plain water are quite different. The usual confusion of ideas among several speakers respecting these three, was evident last meeting. It will be observed above, that the difference in the manurial value of Mr. Dickenson's at 40 pence per ton, and that of Milan at a farthing per ton, is positively greater than that between guano at £12 10s. per ton and farm yard manure at 5s. per ton—or, in other words, greater than 50 is to one, which is the proportion between the two latter. The same reason, therefore, which holds good that farm yard manure cannot be carted 20 miles without the absorption of its entire value in cartage, while guano may be carted very much further because it would take 50 times 20 miles=1000 miles before its entire value would be lost in cartage, and it can profitably be freighted by ship from South America, is the reason why a great difference must be made in the consideration of the conveyance of these liquids. While the system of steam, with hose and jet, is the only one practicable for arable land, farm liquid manure may be allowed to be thus used, although it costs, according to Mr. Mechi, 2d. per ton to deliver the liquid. But with weak sewage it can only be put on, as at the Edinburgh meadows, by steam and gravitation, and where it costs but one-thirtieth of the above, namely, 1d. for fifteen tons. This, therefore, I maintain must be the system for the London sewage.

I am, &c., P. A. HALKETT.

Sir,—I quite agree with Mr. Rawlinson, that "a great question like that of the application of town sewage must be settled by stern reality and practical investigation, and cannot be forwarded by mere assertion;" but when he says that my statements as to the liquid manure farms "ought not to go forth to the world as truth," I think I have a right to give and ask for some explanations. Mr. Alderman Mechi has, he told us, "circulated gratuitously, among some hundred Institutions connected with the Society of Arts" a pamphlet, which, after being printed, he read at a meeting of our Central Farmers' Club. (Had the paper been in MS., I have no doubt Mr. Mechi would have modified some of the statements.) In that pamphlet he distinctly states that the liquid manure theory he recommends had been, and was being, profitably carried out by Mr. Kennedy, at Myremill, and by Mr. Telfer, at Cunning Park. That is to say, he reprinted a statement that had been quoted repeatedly during the last seven years by the advocates of pump and underground pipe irrigation.

There is no doubt about the extraordinary green crops that these gentlemen formerly produced; crops of grass and hay quoted, at a celebrated Tiptree Heath gathering by a visitor, with the view of "covering British farmers with shame" at their short grasscrops, to quote Mr. Mechi.

In answer to Mr. Mechi's illustration of liquid manure success on the Scotch farms, I stated, on the authority of eminent Ayrshire agriculturists, that Mr. Kennedy, a wealthy banker, after expending thirty thousand pounds on his farm, of which eighteen thousand was lost on farming, retired from farming, and in 1857 let his Myremill on lease. "The present tenant only uses pipes, which are laid over the whole 300 acres, for washing guano into a small part devoted to Italian rye grass." That is the first case. Next I will take Cunning, Mr. Telfer's. His farm was, perhaps, the neatest and most productive dairy farm of its size in the kingdom, yet for two years before the farm was discontinued the famous ryegrass crops were replaced by early potatoes. Finally the farm was sold.

Now it is possible that Mr. Kennedy's losses of three thousand a year for six years may have been occasioned by bad management and by bad farming, and not by the expenses of his three hundred acres of pipes, but we heard nothing of bad farming as long as it was supposed to show a specimen of the liquid theory. But the question is, Can anyone show that Mr. Kennedy ever made a profit? and if he did not make a profit, his example, with which our farmers have been so long taunted, is not worth anything. It is also possible that Mr. Telfer made a profit by his farm, and lost money only by his mercantile transactions. But I am otherwise informed. At any rate it will not be difficult to prove how the profits really stand, because full accounts must have been rendered to Mr. Telfer's creditors in bankruptcy. Anyone who will take the trouble to inquire among the Ayrshire farmers will find the opinion universal that Mr. Telfer ruined himself by growing extraordinary crops at a loss. If Mr. Rawlinson can prove the contrary, so much the better for the liquid manure theory. But, at any rate, with Scotch evidence that I had before me, I was justified in protesting against Mr. Mechi quoting, as examples of success and profits, Myremill and Cunning-park.

Another speaker, who followed Mr. Rawlinson, also accused me of misquoting Mr. Lawes in order to misrepresent him, "making him (Mr. Lawes) to say what he did not say." Let the following extract from Mr. Lawes paper in the *Journal* of the Society, March 9, 1855, p. 277, show whether I am exact or not. Mr. Lawes said "For corn crops an enormous supply of liquid manure is certainly not well suited. The influence of season fixes an easily reached limit to the produce of grain, which cannot much exceed £12 or £14 per acre. For market-gardens liquid sewage does seem well suited."

Mr. Chadwick, on that occasion, understood, as I did and do, that Mr. Lawes would not use liquid sewage for corn crops, for he said, "Mr. Lawes had spoken of sewage as best suited for grass lands. Now there was no warranty for this limitation. Sewer manure had been applied to cereals and every species of garden production with complete success." And two years later, Mr. Chadwick backed up his assertion by quoting Rugby and "three years' increasing crops, last year at the rate of 50 bushels an acre, by the use of sewage alone." But the readers of the *Journal* will remember that the Rugby example proved even more mythic and delusive than Myremill and Cunning-park, for the Scotch farms did get great crops of grass, while at Rugby the ten-acre plot tried with wheat failed utterly!

These reckless assertions and wild exaggerations of value and profit by liquid manure theorists are very much to be regretted, because there is no doubt it would be better in many instances, even if at some loss, to turn liquid sewage on chalk, sand, and gravelly soil, than to poison our trout streams and mill streams. But there is no chance of persuading towns to incur the needful expense as long as they are told that farmers ought to give great rents for a liquid which they only require a few times in the year.

In the rare contingency of such a dry season as 1859, liquid sewage, or plain soft water, might be invaluable, while in an average damp season it would be a perfect nuisance.

In this climate an artificial sun at about £5 an acre would pay the patentee better than an artificial rain-fall.

I am, &c., S. SIDNEY.

Central Farmers' Club, Bridge-street, Blackfriars.

THE ART TREATMENT OF GRANITIC SURFACES.

Sir,—I am much gratified by the kind expressions of Sir Gardner Wilkinson, in his letter read after my paper on the 14th, on the treatment of granite, and I am desirous to return to him, through your *Journal*, my best acknowledgments for it. I fully agree with Sir Gardner, that, "in the treatment of granite for monumental and ornamental purposes, we ought to be satisfied with no mere copy;" "that we require it to be original and English, and that no imitation of Egyptian work will satisfy or accord with English requirements and taste." I believe that my views, as expressed in my paper, show how fully I agree with Sir Gardner on this point, as I expressly separated the adoption of the incised method of the Egyptians in treating granite from the emblems they used, suggesting instead a national decoration by means of wholly new subjects, special to our own time and country, for this purpose. This agreement with the views of Sir Gardner Wilkinson and Mr. Bonomi, whose letter follows his, shows how fortunate I am in thus treating a subject founded on, although not servilely copying, Egyptian work, in accordance with two of our greatest authorities on this subject.

In the treatment of the obelisk as a feature of monumental art, I hope also that I am equally in accordance with the views of Sir Gardner, as I assuredly conceive that we should not copy Egyptian obelisks; but, on the other hand, gift the feature with a treatment analogous to that which the Greeks would have done had they adopted it, as I explained last May, in the Society's rooms. As a mere feature of art, I conceive, of course, that the tall and pointed monolith, one phase of which the Egyptians adopted, is the common heritage of art, as finding its prototype in our "Needles, at the Isle of Wight," perhaps as celebrated as Cleopatra's needle, and in various of such natural formations and mountain "spicula" in our islands, or elsewhere.

The Egyptians, no doubt, arranged these features in pairs, "as vertical lines to contrast with the long horizontal character of their temples, where their effect was admirable," but this was by no means the only way in which the ancients employed them. Nebuchadnezzar, as Mr. Bonomi points out, put up one by itself on "the plain of Dura," and Semiramis did the same thing in her great city, in regard to one of greater height than any in Egypt, viz., one of 125 feet high, which she obtained in the mountains of Armenia, at least, so says Diodorus, and erected in a highway, as "a marvel to the world"; and this was also put up by itself. Jacob also put up one in Bethel, whence various of the solitary erect stones of record are said to have received the name of "Baituloi." Other nations also set them up, as the Assyrians, Phœnicians and Indians. Indeed, nothing can be more natural than to set up such features as marks and records; and, where permanence is the great object, as is likely to be the case, that they should be monoliths, and that records should be engraven on them, of which there are various ancient instances besides those of Egypt. Indeed, with all due deference, I am desirous to call attention to the fact that these features were, and are, far from being exclusively Egyptian.

I certainly conceive that their "pyramidia," or pointed tops, had better never be interfered with, as their form affords the best finial that can be invented. As regards the bases, assuredly they should be composed so as to harmonise with the surmounting form, but I see no reason for restriction beyond that. As to the treatment of the obelisk itself, (I use this name for the sake of brevity, as the recognised one) I conceive it capable of a great variety of treatment beyond what it has ever yet received. I see no reason why, for instance, the obelisk should not be fluted as well as the pillar; and on the occasion of reading my paper I exhibited two obelisks with a facial floral treatment, of a character which I believe is novel.

One great advantage which an obelisk possesses for monumental purposes is that it is complete in itself; that it is not like a column, a part of a building, removed from an edifice; also that it is not a feature of support, like a column, which wants something to carry, which has led to "mast-heading our admirals," and placing a portrait statue so high that its features cannot be distinguished. The use of obelisks would never lead to this. In their case the statue of the hero would be placed on a pedestal in front of the base of the obelisk, where it could be seen, while it would be his deeds alone which would be chronicled high in air on the granite shaft behind him.

But then such an obelisk should not be an Egyptian obelisk any more than it should be Egyptian granite. It should be British granite and a British obelisk. I believe there is quite as wide a field open for novelty in obelisks as there ever was in columns. Perhaps we might have a better name, for when we speak of obelisks we immediately think of Egyptian obelisks, for which there is no necessity. After all, obelisk is not a very dignified name. The term is not Egyptian, but Greek. Obeliscon means a little spit! "A commodity of good names," as our great poet says, "is wanted" in this case, or, at least, of one good name, among the advantages of which would be the getting rid of the idea of such a feature of art being necessarily Egyptian, for which I beg to submit there is no just reason whatever.

I am, &c., JOHN BELL.

Kensington.

MEETINGS FOR THE ENSUING WEEK.

MON. ......London Inst., 7. Dr. F. W. Pavy, "On Experimental Physiology."
Geographical, 8½. 1. Dr. Livingstone, "On Lakes Nyinyesi, or Nyassi, and Shirwa, Eastern Africa." 2. Baron de Bode, "Sketch of the hilly Daghestan, with the Lesghi tribes of the Eastern Chain of the Caucasus."
Medical, 8½. Clinical Discussion.

TUES. ......Royal Inst., 3. Professor Owen, "On Fossil Reptiles."
Civil Engineers, 8. Hon. John Wethered, "On Combined Steam."
Medical and Chirurg., 8½.
Zoological, 9. Mr. T. H. Stewart, "On the Anatomy of the Stomach of the Red Potamochere." Mr. J. Petherick, "On the Habits of *Balæniceps rex*." Dr. Crisp, "On the Blood-corpuscles of the Gigantic Salamander," and other papers.

WED. ......London Inst., 7. Dr. Spencer Cobbold, "On the Structure and Habits of the Mammalia."
Society of Arts, 8. Mr. Robert Barclay, "On the Prevention of Forgery, arising from the Alteration and Falsification of Bankers' Cheques, Notes, &c.; with a Description of a Method of Manufacturing Writing Paper having the property of rendering Common Writing Ink Unalterable by Time or Fraud."
Geological, 8. Mr. C. Moore, "On the so-called Wealden Beds and Reptiliferous Sandstones of Elgin." Mr. J. Lamont, "Notes about Spitzbergen in 1859."
Archæological Assoc., 8½.

THURS. ...Royal Inst., 3. Professor Tyndall, "On Light."
Royal Society Club, 6.
Antiquaries, 8.
Artists and Amateurs, 8.
Royal, 8½.

FRI. ....United Service Inst., 3. Col. MacDougall, "The Military Character of General Sir Charles Napier."
London Inst., 7. Professor Bentley, "On the Structure and Functions of the Nutritive Organs of Plants."
Chemical, 8. Anniversary.
Royal Inst., 8. Dr. Odling, "On Acids and Salts."

SAT. ......Royal Inst., 3. Dr. Lankester, "On the Relation of the Animal Kingdom to the Industry of Man."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

FIRST SESSION, 1859.

235. Army—Return.

Delivered on March 2nd, 1860.

51. Patriotic Fund—Return.
103. The Serpentine—Return.
109. Court of Chancery (Suitors' Fund)—Return.
114. East India, &c. (Transmission of Letters, &c.)—Return.
50. Bills—County Prisons (Ireland).
56. „ Ecclesiastical Vestments.

Delivered on March 3rd and 5th, 1860.

38. Duchy of Lancaster—Account.
107. Navy (Civilians)—Return.
108. Court of Chancery—Return.
115. Dublin Port—Account.
118. Channel Squadron—Return.
122. Portpatrick and Donaghadee Harbours, &c.—Return.
53. Bills—Coroners (No 2).
57. „ Representation of the People.
58. „ Representation of the People (Ireland).
Savoy and Nice—Correspondence respecting the proposed Annexation to France.

Delivered on Saturday, p.m.

124. Poor Rates—Return.

Delivered on March 6th 1860.

104. Annuity Tax (Edinburgh)—Return.
122. Paper Duty—Report of the Commissioners of Inland Revenue.
129. Electors, &c., (Cities and Boroughs)—Return.
130. Electors, Populations, &c. (Cities and Boroughs)—Return.
131. Population, Rating, &c. (Counties)—Return.
132. Parliamentary Boroughs, &c.—Return.
6. Election Expenses, &c.—Abstract of Return.
70. Local Acts (40. London and North Western Railway (No. 3)—41. Portsmouth New Railways, or Tramways, and Piers)—Admiralty Reports.
Superior Courts of Law at Westminster (Process, &c., of Pleading)—3rd Report of Commissioners.

Delivered on March 7th, 1860.

89. East India (Disturbances in Tinnevelly)—Return.
120. Mails (Canada and United States)—Return.
76. Local Acts (36. Vale of Clwyd Railway Extension—Foryd Bridge and Railway—37. Letterkenny Railway—38. Carrickfergus and Larne Railway—39. North Eastern Railway (Blayden and Conside Branches)—42. Milford Haven Railway and Dock—43. Montrose and Bervie Railway—44. Hayling Railways and Harbour—45. Conway, Llanrwst, and Bettws-y-Coed Railway)—Admiralty Reports.
Savoy and Nice—Despatch for Lord Cowley.

Delivered on March 8th, 1860.

125. Durham Diocese—Return.
85. Harbour, &c., Bills (8. May River Navigation—9. Watchet Harbour)—Board of Trade Reports.
59. Bills—Representation of the People (Scotland).
32. „ Bleaching and Dyeing Works.
60. Indictable Offences (Metropolitan District).
Civil Service Commissioners—5th Report.

Delivered on March 9th, 1860.

61. Bills—Paper Duty Repeal.
65. „ Universities (Scotland) Act Amendment.
15. Railway and Canal Bills (139. Great Northern and Western of Ireland—Kilrush and Kilkee Railway and Poulnasherry Embankment—Ulster Railway and Corporation of Belfast—140. Isle of White (Eastern Section)—141. Portsmouth New Railways, &c.—142. Manchester and Milford—143. Sirhowy Tramroad—144. Vale of Clwyd (Extension)—145. West Dorset—146. West Hartlepool Harbour and Railway)—Board of Trade Reports.

FIRST SESSION, 1859.

208. (A IX)—Poor Rates and Pauperism—Return.

Delivered on March 10th and 12th, 1860.

119. St. George's-in-the-East—Return.
121. Weymouth and Melcombe Regis Election—Minutes of Evidence.
136. Income Tax—Return.
32. Bill—Customs.
Italy—Further Correspondence (Part 2).

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March 16th*, 1860.]

Dated 2nd February, 1860.

268. W. Ingham and W. Hinchliffe, Armley, Yorkshire—Imp. in apparatus for applying steam and other vapours, gases, or fluids, to the production of motive power, and which may also be used for a pump or gas exhauster, or other similar purpose.

Dated 7th February, 1860.

322. P. Chartroule, 29, Boulevart St. Martin, Paris—Iodine inhaling means and apparatus for medical purposes.

Dated 13th February, 1860.

394. W. Clark, 53, Chancery-lane—Imp. in apparatus used for stretching, drying, and finishing woven fabrics.

Dated 14th February, 1860.

404. J. Arnold, Leys, Tamworth, Staffordshire—Imp. in the treatment of sewage matters for the manufacture of manure and in the apparatus for the same.

Dated 22nd February, 1860.

472. F. H. Lemoine, 47, Howland-street, Fitzroy-square—Imp. in the manufacture of waterproof-papers and pasteboards of every description.

Dated 23rd February, 1860.

493. R. A. Brooman, 166, Fleet-street—An improved method of producing documents suitable for bank notes and other instruments of value, in order to prevent forgery thereof. (A com.)

Dated 25th February, 1860.

530. C. F. J. Fonrobert, Berlin—Imp. in gilding and silvering silk and other fibrous substances. (A com.)

Dated 28th February, 1860.

542. R. Walker, Eccleston, near Prescot, Lancashire—Imp. in apparatus for preventing accidents in winding from mines, which apparatus is also applicable for other similar purposes.
544. Z. Wright, Upper Wortley, near Leeds—Imp. in machinery or apparatus for the prevention of accidents in mine shafts by the breaking of the rope or chain, or disconnection of the drum from the engine, applicable also to other hoisting or lifting machinery or apparatus.
546. G. Weir, Glasgow—Imp. in regulating steam engines, and in regulating apparatus for steam engines and other prime movers.
550. C. Parish and J. Lang, Preston, Lancashire—Imp. in looms for weaving.

Dated 29th February, 1860.

552. P. F. Lynch and J. Tynan, Liverpool—Imp. in the construction of boats, and in the use or application of certain novel arrangements and apparatus thereto.
554. B. Hargreaves and J. Heaton, Habergham Eaves, near Burnley, Lancashire—Certain imp. in looms for weaving.
556. J. M. Bryden and W. C. Bryden, Edinburgh—Imp. in mountings for window blinds.
558. G. Ranken, Bathurst, Sydney, New South Wales—Imp. in paddle wheels.
562. W. E. Newton, 66, Chancery-lane—Improved machinery for making or forming the teeth of combs. (A com.)
564. R. H. Collyer, 8, Alpha-road, Saint John's-wood, Middlesex—Imp. in the manufacture of pulp and in preparing materials for the purpose, and in apparatuses employed therein, part of the invention being also applicable to preparing materials for fibrous and textile manufacturing purposes.

Dated 1st March, 1860.

565. P. C. D. Destas, 212, Rue de Reuilly, Paris—A new engine working by wind or water.
567. B. Britten, Sydenham-hill, Kent—Imp. in projectiles.
569. W. Clark, 53, Chancery-lane—Imp. in machinery for "sizing" raw silk or other threads, and for cleaning the same preparatory to the sizing operation. (A com.)
570. I. Bonnet and J. D. Heid, Brussels—Imp. in planing machines for files and other metal objects, straight, curved, or otherwise.
571. J. Milnes, Gloucester—An apparatus for exercising the joints and muscles of the human body.
572. J. Driver, Keighley, and J. Jessop, Bradford, Yorkshire—Imp. in means or apparatus used in washing, wringing, and mangling fabrics.
573. D. Chadwick, Salford, and H. Frost, Manchester—Imp. in apparatus for measuring water and other liquids.
574. J. McCulloch, San Francisco, U.S.—Imp. in the reduction of gold, silver, and copper ores.
575. J. Collins, 28, Bennett-street, Stamford-street—Improved outside blinds and awnings.
576. W. H. Nash, 3, Matson's-terrace, Kingsland-road—Imp. in steam engines.
577. J. M. Blashfield, Stamford—Imp. in burning pottery and china ware, and in kilns employed for such purposes.
578. H. Bessemer, Queen-street place, New Cannon-street—Imp. in machinery or apparatus employed in the manufacture of malleable iron and steel.
579. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in gas regulators or governors.

Dated 2nd March, 1860.

580. G. Edwards, 4, Park-road-villas, Battersea, Surrey—Imp. in caissons and foundations for bridges, piers, and other structures under water.
581. P. M. T. O. C. Albites, 34, Rue Vivienne, Paris—Imp. in photographic apparatus.
582. B. G. Babington, George-street, Hanover-square—Imp. in means or apparatus for protecting the throat and chest from atmospheric influences, and which may also be employed as a protection to the mouth.
583. R. d'Argy, Blois, France—Imp. in apparatus for raising water.
584. J. W. Lewis, Coventry—Imp. in looms for weaving ribbons.
585. R. A. Brooman, 166, Fleet-street—Imp. in the construction of naves or bosses for wheels. (A com.)

Dated 3rd March, 1860.

586. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture of artificial fuel. (A com.)
587. J. Eccles, Blackburn, Lancashire—Imp. in machinery for the manufacture of bricks, tiles, pipes, and other articles formed of plastic materials.
588. X. Musty, 29, Boulevart Saint Martin, Paris—An improved apparatus for washing ores.
589. W. G. Ramsden, Liverpool—An improved boiler or apparatus for generating and super-heating steam, or heating water and other fluids under pressure.
590. W. Bauer, Munich—Imp. in apparatus for diving and for raising and lowering bodies in water, parts of which imps. are also applicable to other useful purposes.
591. W. S. Hale, Queen-street, Cheapside—An improved candle lamp.
592. W. E. Gedge, 4, Wellington-street South, Strand—A liquid or novel preparation to be applied to wools. (A com.)
593. W. H. Muntz, Millbrook, Hants—Imp. in the construction of ferry boats.
595. E. Humphrys, Deptford, Kent—Imp. in marine boiler furnaces and in feeding the same.

Dated 5th March, 1860.

596. J. Broel, Manchester—Certain imp. in the manufacture of soap. (A com.)
597. J. Sidebottom, Broadbottom, near Mottram, Chester—Certain imp. in looms for weaving.
598. C. Price, Wolverhampton—Imp. in locks and latches.
599. R. Smith, 114, West-street, Glasgow—Imp. in the preparation and production of colour matter.
600. J. H. Johnson, 47, Lincoln's-inn-fields—An improved ruffle and sewing machine for producing the same, applicable also to ordinary stitching. (A com.)
603. R. A. Brooman, 166, Fleet street—Imp. in the manufacture of pipes for smoking. (A com.)
604. W. Bridges, Birmingham—Imp. in the manufacture of elastic bands.
605. J. Howard, Bedford—An imp. in the construction of horse rakes.
606. W. E. Newton, 66, Chancery-lane—Certain imp. in window sashes. (A com.)

Dated March 6th, 1860.

608. T. Cox, jun., and W. Holland, Birmingham—An imp. or imps. in the manufacture of the stretchers of umbrellas and parasols.
610. W. E. Gedge, 4, Wellington-street, South, Strand—An improved machine for drying fecula. (A com.)
612. W. E. Gedge, 4, Wellington-street, South, Strand—Imp. in latches. (A com.)
614. J. Walsh, Stedalt, Balbriggan, Ireland—Improved machinery for cutting, tearing, crushing, or otherwise preparing for various useful and economical purposes furze, or gorse, straw, bean-haulms, turnips, bark, flax, or any other vegetable substances.
616. W. Buxton, Staveley, Derbyshire—Imp. in safety cages for mines.
618. W. R. Jeune, 4, Flower-terrace, Campbell-road, Bow, Middlesex—Imp. in fire lighters.

PATENTS SEALED.

[*From Gazette, March 16th*, 1860.]

March 10th.

2121. S. N. Rodier.
2124. E. H. Taylor.
2129. J. Wright.
2132. H. J. Warmolont.
2133. R. A. Brooman.
2136. J. Court.
2139. W. Weild.
2142. A. Lamb.
2150. G. D. Robinson.
2152. R. Davison.
2160. C. J. Parry.
2179. J. Villet-Collignon and L. George.
2198. E. T. Simpson.
2199. M. L. J. Lavater.
2200. P. Robertson.
2220. W. Clark.
2273. W. Hopkins.
2284. G. Gibson and J. Gibson.
2292. J. H. Johnson.
2366. W. E. Newton.
2389. J. Gordon.
2722. W. E. Newton.
48. T. Bellamy.
68. A. S. Bolton & F. S. Bolton.
122. J. H. Johnson.

[*From Gazette, March 20th*, 1860.]

March 20th.

2138. A. Manbré.
2155. T. Field.
2163. J. J. Bourcart.
2166. J. Gedge.
2168. J. Coey.
2218. W. H. Buckland.
2270. G. Long and J. Archer.
30. A. V. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, March 16th*, 1860.]

March 13th.

753. W. MacNaught.
793. W. Banks and J. Banks.
795. G. Perrott.

March 14th.

763. J. Wilkes, T. Wilkes, and G. Wilkes.

[*From Gazette, March 20th*, 1860.]

March 15th.

744. C. Askew, J. Askew, and H. Myers.
747. Sir F. C. Knowles.
754. W. M'Culloch and T. Kennedy.
757. J. Millar.

March 16th.

740. J. Moes.
775. W. G. Merrett.
824. S. Fox.

March 17th.

791. W. Moxon, J. Clayton, and S. Fearnley.

PATENT ON WHICH THE STAMP DUTY OF £50 WAS PAID WITHIN THE TIME PRESCRIBED BY THE ACT, BUT WHICH WAS NOT PRODUCED FOR CERTIFICATION UNTIL THE DAY HEREUNDER PREFIXED.

[*From Gazette, March 16th*, 1860.]

March 14th.

597. T. H. Jennens.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, March 16th*, 1860.]

March 13th.

646. J. Maudslay.

[*From Gazette, March 20th*, 1860.]

March 15th.

657. J. Livesey.

March 16th.

660. G. Johnson.
739. S. Fox.