THE

TECHNICAL REPOSITORY.

VOL. V.

THE

TECHNICAL REPOSITORY,

CONTAINING

Practical Information

ON SUBJECTS CONNECTED WITH

DISCOVERIES AND IMPROVEMENTS

IN THE

USEFUL ARTS.

ILLUSTRATED BY NUMEROUS ENGRAVINGS.

BY THOMAS GILL,

A CHAIRMAN OF THE COMMITTEE OF MECHANICS
IN THE SOCIETY FOR THE ENCOURAGEMENT OF ARTS, MANUFACTURES, AND COMMERCE, ADELPHI.

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THE TECHNICAL REPOSITORY.

I.—*Specification of the Patent granted to* Richard Badnall, *of Leek, in the County of Stafford, Silk Manufacturer; for certain Improvements in Dyeing.—Dated June 3, 1823.*

I, the said Richard Badnall, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the following specification thereof;—that is to say:

My improvements in dyeing consist, First, in the application of Prussian blue to the purposes of dyeing silk, cotton, wool, or any other article; and, Secondly, in the application of pressure to dyeing in general. The following is my method of dyeing by means of Prussian blue.

The Prussian blue, being previously ground as fine as possible, is to be put into any convenient vessel of glass or earthenware. Strong muriatic acid is to be poured upon it, a little at a time; and the mass is to be kept constantly stirred, with a rod of white wood, a piece of tobacco-pipe, or any other material not liable to be acted on by the acid. The stirring must be continued, till the mixture has become a smooth homogeneous mass of a semi-gelatinous consistence. The proportion of acid requisite for this purpose depends, in some degree, on the quality of the Prussian blue, and therefore cannot be precisely set forth in words; but, by proceeding carefully, as above described, it is impossible to fall into error; as the mixture, if made too thin from excess of acid, may be rectified by the subsequent addition of more Prussian blue.

This mixture, which I call Prepared Prussian blue, may be used as soon as made; but it is better after three or four days; and I have not found that its qualities are altered by age.

In dyeing silk with the Prussian blue, prepared as above, I proceed in the following manner.

The gum having been discharged from the silk by any of the usual means, I steep the silk, for three or four hours, in a cold solution of alum in water, of the common strength employed by silk-dyers: I then rince it well in cold water.

The dye-vat is composed by diluting the prepared Prussian blue with cold water, till its colour is of the required depth, according to the particular tint intended to be given to the silk. The silk, prepared as above, is then to be put on sticks, and immersed in the bath; taking care that it be constantly turned, that the colour may be perfectly level, and that it remain in the bath till it has acquired the proper tint or shade. It is then to be well washed in running water, till the water ceases to be dicoloured by it. Lastly, the silk is to be dried, either in the shade, or in a stove heated to not more than a summer temperature.

From Prussian blue, prepared as above, various greens and purples may be obtained; either by combining it with the ingredients usually employed for such colours, and dipping the silk in this compound bath; or, by using the bath of prepared Prussian blue, either before or after the application of the other ingredients, according to circumstances, and to the nature of such ingredients. These, however, it is not necessary to recite; the object of this part of my patent being merely my new mode of preparing Prussian blue, so as to dye silk, cotton, wool, or any other article, by means of it, either alone, or mixed and combined with other dyeing materials.

The Second invention I claim, is, the application of pressure to dyeing in general, whether it be that of thick cloths, hats, woods for veneering, or any other purpose; or any other or more delicate materials, such as linen, cotton, or silk goods, lace, &c.—For this purpose, the materials to be dyed are to be placed, with the dyeing-liquor, in any suitable vessel of wood, copper, iron, or other material; the aperture of which vessel can be secured water-tight, by a lid fitted to it by any suitable and well-known means.—To this vessel is to be fitted a hydrostatic pressure-pump, or any other machinery, employed for the purpose of inducing high pressure; such as a column of water or mercury of sufficient height, &c.—All things being thus adjusted, the lid is to be fitted securely on; and the pump worked, until the necessary pressure is obtained; when it is evident, that if the goods are put in dry, or well wrung, the pressure thus produced will greatly facilitate the introduction of the dyeing liquor within the internal pores, particularly in heavy cloth goods, hats, woods, hard-twisted silk, or lace; and, if necessary, suitable mechanical means may be employed to agitate and wring the goods, while under pressure: but I do not claim this exclusively, but only the application of pressure to the forcing of the dyeing liquor into the pores of the cloths, hats, silk, woods, &c. &c.; or the joint application of pressure, with suitable means for producing agitation, &c. &c.

II.—*On an Improved Method of fixing small Particles of Minerals, &c. on a Splinter of Sappare, Platina Wire, &c. for Examination by the Blow-pipe. By* JAMES SMITHSON, *Esq. F. R. S.**

SIR, *Oct.* 24, 1823.

WHEN the species of minerals are ascertained by their physical qualities, they mostly undergo no injury, or but a very slight one; such as, the determination of their hardness, the colour of their powder, their taste, &c. This is certainly an advantage; and I would highly recommend this method, were it constantly adequate to its purpose.

* From No. XXXVI. of the Annals of Philosophy, New Series. In a Letter to the Editor of that Work.

That it is not so, however, we have a proof, in the great errors into which those have fallen who were best skilled in it. Mr. Werner, its principal and most-distinguished professor, was unable, by its means, to discover the identity of the jargon and the hyacinth; of the corundum and the sapphire; of his apatite and spargelstein: and, while he thus parted beings, as it were, from themselves; he forced others together, which had nothing in common.

The chemical method justly boasts its certainty; but it carries destruction with it; and often bestows the knowledge of an object only at the expense of its existence. The sole remedy which can be opposed to this defect is, to reduce the scale of operating; and thus render the sacrifice, which must be made, as small as possible.

M. de Saussure's * ingenious contrivance for subjecting the most minute portions of matters to the action of fire, by fixing them upon a splinter of sappare, appeared to fulfil all that could be desired. It has, however, been scarcely at all employed; owing, partly, to the excessive difficulty, in general, of making the particles adhere to it; and, in consequence, of the almost unpossessed degree of patience required, and of the time consumed by nearly interminable failures.

That such should be the case, could not but be a subject of much regret; for, besides the economy of time and labour, and the great beauty of deriving knowledge from so diminutive a source,—and thus attaining important results with such feeble agents,—reduction of volume became, in this instance, productive of an increase of power; and, thence, of an extension of the series of qualities, by which substances are characterized.

A slight alteration, which I have made in M. de Saussure's process, has removed the objection to it. For water, saliva, and gum-water, which he employed,—and the last of which is not sensibly superior to the first,—I have substituted a mixture of water and refractory clay.

* *Journal de Physique, par Rozier; tome* xlv.

Small triangles, or slender slips of baked clay*, may be used in lieu of sappare, which is not at all times to be procured: or a little of the moist clay may be taken up on the end of a platina or other wire; and the object to be tried, be touched with it. This way may even be applied to pieces of the ordinary size, and supersede the use of the platina tongs.

But a proceeding which I have only recently adopted, appears to deserve the preference. Almost the smallest quantity of clay and water is put upon *the very end* of a platina wire, filed flat there. With this, the particle of mineral, lying on the table, can be touched, in any part chosen: in a moment or two, it is dry; and may be taken up, and put into the flame, without the clay exploding; as not unfrequently happens, when more of it is used. Particles, of the least visible minuteness, may thus be submitted to trial, with the utmost facility. The contact of the particle with the wire may, in general, be so managed, as to be extremely slight; as the slenderest point is sufficient to support it. However, when the utmost heat possible is desired, a fragment of a less-conducting matter may be interposed.

There may be cases, in which the presence of the clay is objectionable. I conceived, that some of the body itself, to be tried, would, on these occasions, supply its place. Flint was the least promising of any, in this respect: it was selected for the experiment. With a paste, of its powder and water, pieces of flint were successfully cemented to flint; and some of this paste, taken up on the end of a wire, served, if not quite as well as clay, yet very sufficiently. After being several times ignited, and quenched in cold water, the reduction of very hard matters (such as flint, for instance) to subtile powder is attended with no difficulty.

Earth of alum would, perhaps, be preferable to pipe-clay, for making the triangles in strips, and for agglutinating

* For Mr. Smithson's ingenious method of forming these useful slips and plates of baked clay, see Vol. III. p. 386, of this Work.—EDITOR.

objects to them: it would even have an advantage over sappare, in being a simple substance. Some, from the Paris shops, acquired but little solidity in the fire; but I afterwards learned that it had been obtained from alum, by fire.

Since I have been in possession of this means of so effectually confining the subjects of examination, as to be able to continue, during pleasure, to act upon them, I have directed but little attention to the fusibility of matters. Quartz, whose fusion has been called in question by M. Berzelius*, has seemed to be quite refractory. On some few occasions, however, when it has proved otherwise, the phænomena have neither corresponded with M. de Saussure's account, nor been always the same; which certainly admits of the fusion being attributed to an accidental cause.

But I have found, with much surprise, that flint can be melted without difficulty, and even when of a considerable bulk. Where the heat is most intense, a degree of frothing takes place: where it is less intense, there is a swelling of parts of the surface. The effects were the same, both with French and English flint; with black, and with horn-coloured. Does flint, like pitchstone, contain bitumen; which, at a certain heat, tends to tumefy it? This might explain the smell, arising from its collision; and the oil which Neumann obtained by its distillation; and to which no credit has ever been given. No doubt can, I conceive, be entertained, of flint being a volcanic production. On this point, I may speak again, at a future opportunity.

In using mere water, diamond, anthracite, and plumbago, were particularly difficult of trial; as any adhesion, which they had contracted with the sappare, was quickly destroyed, by the combustion of their surface: while, as the intention, in their case, is not to subject them to great heat, they may be so secured in the clay, as, at least, very much to retard their escape. Here, acting on very minute particles is essential; as, when large pieces are employed, the effect is too slow to be perceptible.

* *De l'Emploi du Chalumeau,* p. 108.

A pleasing way of demonstrating the combustion of plumbago, and of even exhibiting the iron in it, is to rub a little from the wetted point of a pencil, on one of the clay plates, mentioned formerly.

In trying the diamond, it was imagined that its glow continued, for an unusual time, after its removal from the fire. The present method afforded the means of making a comparison. A fragment of diamond, and another of quartz, chosen purposely, of rather a larger size, were fixed near each other in the clay; and it was observed, that the diamond was more luminous than the quartz, while under the action of the flame; and continued longer so, after its removal from it. The diamond, being a very slow conductor of heat, may occasion, in part, the latter quality.

In the same way, the fusibility of any two substances may, probably, on some occasions, be ascertained; and serve, from deficiency of a better, as a means of distinction between them.

I am, Sir, yours &c.

J. SMITHSON.

III.—*On the Preparation of Madder Lake. By the late Sir* H. C. ENGLEFIELD, *Bart.* F.R.S.*

SIR, *Tilney Street, May Fair, Dec.* 15, 1803.

AFTER many experiments on the red pigment to be prepared from madder, I have obtained from it a colour far superior to any which I have ever seen produced from it. I have received from many of our most-distinguished artists very satisfactory reports of its excellence. I mean to make my process public: and if it should be consistent with the views of the Society of Arts, &c. to publish it, and they should think the improvement I have made worthy of a premium, I shall be much flattered by their approbation.

* From Vol. XXII. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.—The Society voted its Gold Medal to Sir H. C. Englefield, for this valuable process.

I shall be much obliged to you by a line in answer; and am, Sir, your obedient servant,

To CHARLES TAYLOR, *Esq. Sec.* H. C. ENGLEFIELD.

The want of a durable red colour, which should possess something of the depth and transparency of the lakes made from cochineal, first induced me to try whether the madder-root, which is well known to furnish a dye less subject to change, by exposure to air, than any other vegetable colour, except indigo, might not produce something of the colour I wanted.

Several of the most-eminent painters of this country have, for some time, been in the habit of using madder-lakes in oil-pictures: but the colours they possessed under this name were either a yellowish red, nearly of the hue of brick-dust, or a pale-pink opaque, without clearness or depth of tint, and quite unfit to be used in water-coloured drawing, which was the principal object of my search.

My first attempts were, to repeat the process given by Margraf, in the Memoirs of the Academy of Berlin; but the colour produced by this mode was of a pale red, and very opaque; although the eminent author of the process states the colour he produced to be that of "*le sang enflammé*," which probably means a deep-blood colour.

It may, however, be observed, that colours prepared with a basis of alumine will appear much deeper when ground in oil than they do in the lump, the oil rendering the alumine nearly transparent. This advantage is, however, lost in water-colours. On examining the residuum of the madder-root after it had been treated in Margraf's method, it appeared tinged with so rich a red, that it was obvious that by far the greater part of the colour still remained in it, and *that* the most powerful and beautiful part. To extract this, several ineffectual trials were made, which it would be useless to enter into; but, on attentively examining the appearances which took place on infusing the madder in water, I began to suspect that the red-colouring-matter was very little, if at all, soluble in water;

and that it was only mechanically mixed with the water, when poured on the root, and suspended in it by the mucilage, with which the root abounds.

A very small quantity, therefore, can be obtained by any infusion or decoction; as the greater part sinks down on the root, or remains with it on the sieve, or in the bag, through which the infusion or decoction is passed to render it clear. I therefore was induced to try, whether, by some merely mechanical means, I could not separate the colouring matter from the fibrous part of the root. In this attempt my success was fully equal to my hopes; and, after several trials, I consider the process I am now about to describe, as the most perfect I have been able to discover.

Process 1.—Enclose two ounces, troy weight, of the finest Dutch madder, known in commerce by the name of *crop-madder*, in a bag, capable of containing three or four times that quantity, and made of strong and fine calico. Put it into a large marble or porcelain mortar, and pour on it about a pint of cold soft water. The Thames water, when filtered, is as good as can be used; it being very nearly as pure as distilled water, at least when taken up a very little way above London. With a marble or porcelain pestle, press the bag strongly in every direction, and, as it were, rub and pound it as much as can be done without endangering the bag. The water will very soon be loaded with the colouring-matter, so as to be quite opaque and muddy. Pour off the water; and add another pint of fresh water to the root, agitating and triturating it in the manner before described; and repeat the operation, till the water comes off the root very slightly tinged. About five pints of water, if well agitated and rubbed, will extract from the root nearly the whole of its colour; and if the residual root be taken out of the bag and dried, it will be found to weigh not more than five drachms, apothecaries' weight: its colour will be a kind of light nankeen, or cinnamon; and it will have entirely lost the peculiar odour of the root, and only retain a faint woody smell.

The water loaded with the colouring-matter must be put into an earthen or well-tinned copper, or, what is still better, a silver vessel, (for the use of iron must be carefully avoided through the whole,) and heated till it just boils. It must then be poured into a large earthen or porcelain basin; and an ounce troy weight of alum, dissolved in about a pint of boiling soft water, must be poured into it, and stirred until it is thoroughly mixed. About an ounce and a half of a saturated solution of mild vegetable alkali should be gently poured in, stirring the whole well all the time. A considerable effervescence will take place, and an immediate precipitation of the colour. The whole should be suffered to stand, till cold; and the clear yellow liquor may then be poured off from the red precipitate. A quart of boiling soft water should again be poured on it, and well stirred. When cool, the colour may be separated from the liquor, by filtration through paper, in the usual way; and boiling water should be poured on it in the filter, till it passes through of a light straw-colour, and quite free from any alkaline taste. The colour may now be gently dried; and when quite dry, it will be found to weigh half an ounce; just a fourth part of the weight of the madder employed.

By analysis, this colour possesses rather more than 40 per cent. of alumine. If less than an ounce of alum be employed with two ounces of madder, the colour will be rather deeper; but if less than three-quarters of an ounce be used, the whole of the colouring-matter will not be combined with alumine. On the whole, I consider the proportion of an ounce of alum to two ounces of madder as the best.

Process 2.—If, when the solution of alum is added to the water loaded with the colouring-matter of the root, the whole be suffered to stand, without the addition of the alkali, a considerable precipitation will take place, which will be of a dark, dull red. The remaining liquor, if again heated, will, by the addition of the alkali, produce a rose-coloured precipitate of a beautiful tint; but wanting in force and depth of tone.

This is the process recommended by Mr. Watt, in his Essay on Madder, in the *Annales de Chimie, tome* vii.; and this latter colour is what may, perhaps, with propriety, be called *madder-lake*. But although the lighter red may be excellent for many purposes, yet I consider the colour produced by the union of the two colouring-matters, as given in the first process, as far preferable for general use; being of a very beautiful hue when used thin; and possessing unrivalled depth and richness, either in oil or water, when laid on in greater body.

If but half an ounce of alum be added to the two ounces of the root, the first precipitate will be nearly similar to that when an ounce is employed; but the second, or lake precipitate, will be less in quantity, and of a deeper and richer tint. In this case, the whole of the colouring-matter, as before observed, is certainly not combined with the alumine; for, on adding more alum to the remaining liquor, a precipitate is obtained, of a light purplish-red. In this process, when two ounces of madder and an ounce of alum are used, the first precipitate has about 20 per cent. of alumine, and the second, or lake precipitate, about 53 per cent.; but these proportions will vary a little in repetitions of the process.

Process 3.—If the madder, instead of being washed and triturated with cold water, as directed in the foregoing process, be treated in exactly the same manner with boiling water, the colour obtained will be rather darker, but scarcely of so good a tint; and the residuum of the root, however carefully pressed and washed, will retain a strong purplish hue;—a full proof that some valuable colour is retained in it; probably fixed in the woody fibre by the action of heat.

Mr. Watt, in his excellent treatise on madder above mentioned, observes, that cold water extracts the colour better than hot water; and I have reason to suspect, that a portion of that colouring matter, which produces the bright red pigment, distinguished before by the name of madder-lake, remains attached to the root, when acted on by boiling water.

Process 4.—If to two ounces of madder a pint of cold water be added, and the whole be suffered to stand for a few days (three or four days), in a wide-mouthed bottle lightly corked, in a temperature of between 50° and 60°, and often shaken, a slight fermentation will take place, the infusion will acquire a vinous smell, and the mucilaginous part of the root will be in a great degree destroyed, and its yellow colour much lessened. If the whole be then poured into a calico bag, and the liquor be suffered to drain away without pressure, and then the root remaining in the bag be treated with cold water, &c., exactly as directed in the first process, the red colouring-matter will quit the root with much greater ease than before fermentation. It will also be equal in quantity to that afforded by the first process, but of a much lighter red. This difference of tint appears to be owing to a destruction of a part of the lake by the fermentation of the root; for if the colours from the fermented root be obtained separate, as in Process 2, the first precipitate will not sensibly differ from that obtained from the unfermented madder; but the second, or lake, will be of a very light pink. This process, then, is not to be recommended.

SPANISH AND SMYRNA MADDERS.

Spanish madder affords a colour of rather a deeper tone than the Dutch madder, but it does not appear to be of so pure a red as the Zealand crop-madder.

The Smyrna madder is a very valuable root. The colour produced from it, by Process 1, is of a deeper and richer tint than any I have obtained from the Dutch madder. The quantity produced from two ounces is only three drachms, twenty-four grains: but this is not to be wondered at; for as this madder is imported in the entire root in a dry state, and the crop-madder of Zealand consists principally of the bark, in which probably the greatest part of the colouring substance resides, there is every reason to think that the Smyrna madder really contains a greater proportion of colour than the Zealand, in equal weights of the entire root.

The products of Process 2 prove, that the *lake* of the Smyrna madder is more abundant in quantity, and of a richer tone, than that of the Dutch root; for from two ounces of Dutch madder, the first precipitate was two drachms, and the lake was two drachms and forty-eight grains; whereas, from two ounces of the Smyrna root, the first precipitate was one drachm and twenty-four grains. The proportion of the lake to the colour is, therefore, much higher in the Smyrna than in the Dutch root.

FRESH MADDER.

The colour may be prepared from the recent root; and it will be of a quality equal, if not superior, to any other. The difficulty of procuring the fresh root has prevented me from making as many experiments on it as I could have wished. I procured, however, a small quantity of the best roots, packed in moss from Holland; and the following process answered perfectly well.

Eight ounces of the root having been first well washed, and cleaned from dirt of all kinds, were broken into small pieces, and pounded in a bell-metal mortar, with a wooden pestle, till reduced into an uniform paste. This paste, being enclosed in a calico-bag, was washed, and triturated, as described in the first process, with cold water. About five pints seemed to have extracted nearly the whole of the colour. To the water thus loaded with colour, and boiled as before, one ounce of alum, dissolved in a pint of boiling water, was added; and the alkali poured on the whole, till the taste of the mixture was just perceptibly alkaline. The colour thus obtained, when dry, was of a very beautiful quality.

The success of this experiment, which was twice repeated with the same result, has led me to hope that it is not impossible that the mode of obtaining the colour from the fresh root here described, may be productive of advantages for more extensive use than I had in view, when first I attempted to obtain a pigment from madder. Many tracts of land in this country are as well adapted to the growth of this valuable article, as the soil of Holland can be; and the cultivation of it, which has more than once been attempted to a considerable extent, has been laid aside, principally from the expense attendant on the erection of drying-houses and mills, and the great expense and nicety requisite for conducting the process of drying. But should the colour, prepared in the mode just described, be found to answer the purposes of the dyers and calico-printers, the process is so easy, and the apparatus required for it so little expensive, that it might be in the power of any grower of the root to extract the colour: besides which, another great advantage would be obtained; the colour thus separated from the root may be kept any length of time without danger of spoiling, and its carriage would be only one-fourth of that of the root. I am, moreover, thoroughly inclined to believe, that, in the present mode of using the root, a very considerable part of the colour is left in it by the dyers: and should this prove to be the case, an advantage, much greater than any hitherto adverted to, may arise from the process here recommended.

Should it be attempted to obtain the colour from the fresh root on an extensive scale, I should recommend that the root be first reduced to as uniform a pulp as possible, by grinding or pounding. For this purpose, it is probable that the cider-mill would answer perfectly well; and its extreme simplicity is a great recommendation. For the purpose of trituration, bags of woollen, such as are used in the oil-mills, would probably answer as well as calico, and they would be much cheaper and more durable.

A large vat, with stampers, would be easily constructed, by those who are conversant in mechanics, for the holding them, and pressing them in water: and when the colour was boiled and precipitated, the flues of the boilers might easily be formed into convenient drying-tables, without any additional expense of fuel. The part of the process which I consider as of the greatest importance, and as being the essential advantage of my methods over all those which have come to my knowledge, is, the trituration or pressing of the root in water; and I believe that the colouring-matter of the root has not been hitherto considered as so nearly insoluble in water as I have reason to think it is.

It were much to be wished, that, in the present advanced state of chemistry, some skilful analyser would investigate the properties of this very useful root; in which, perhaps, it will be found that there are three, if not four, different colouring substances. Such are the processes and views which I have thought it not improper to submit to the consideration of the Society of Arts, &c.

I have only now to describe the specimens which accompany this Paper; assuring the Society, that they have been all prepared by my own hands entirely; and that I am therefore responsible for their having been produced by the processes stated, without the addition of any foreign matter whatever; excepting the cake ground up with gum, and the bladder of oil-colour, which were prepared, from the colour which I gave him, by Mr. Newman, of Soho-square, whose skill and fidelity are too well known to need any testimony in their favour.

It may be proper to add, that all the colours produced from the Dutch madder were prepared from the same parcel of crop-madder, in order that the differences in them might proceed from the processes, and not from a variation in the qualities of the root, which, in different specimens, will produce different shades of colour, under the same mode of treatment.

1. Dutch madder, treated by Process 1.
2. Ditto . . . . Process 2.
3. Ditto . . . . Process 3.
4. Ditto . . . . Process 4.
5. Dutch madder, two ounces; alum, one ounce; treated by Process 2.
6. Dutch madder, two ounces; alum, one ounce; fermented two days, and then treated by Process 2.
7. Produce of Process 1, ground in gum by Mr. Newman.
8. Produce of Process 1, ground in oil by Mr. Newman.

S. 1. Smyrna madder, by Process 1.
S. 2. Ditto . . . . Process 2.
S. 3. Ditto . . . . Process 3.
S. 4. Ditto . . . . Process 4.

Certificates accompanied the foregoing description, from Mr. Cotman and Mr. Munn, testifying the merits of Sir H. C. Englefield's madder-lakes as water-colours; and also from Messrs. West, Trumbull, Opie, Turner, Daniel, and Hoppner, speaking greatly in its favour, where it had been tried in oil-colours.

IV.—*On various Preparations of Carmine.*

CHINESE CARMINE.

TWENTY ounces of very finely-powdered cochineal are boiled with a pailful of river water, contained in a proper vessel; to which sixty grains of Roman alum are added. After seven minutes' ebullition, the boiler is removed from the fire, and the liquor put into another vessel, by means of a siphon: it may also be passed through fine linen. This liquor is to be preserved for use. A solution of tin is previously prepared, in the following manner. Ten ounces and a half of common salt (muriate of soda) are dissolved in a pound of aqua-fortis (nitric acid): to this solution, when cold, four ounces of Malacca-tin filings are added, by degrees:—a fresh quantity of tin must not be put in till the former is dissolved. This solution is added, drop by drop, to the heated cochineal liquid; and the carmine precipitates. When the carmine is deposited, the liquid is decanted; and the carmine allowed to dry in the shade, in china or Delft-ware vessels.

THE GERMAN METHOD OF PREPARING CARMINE.

Six pints of river water are boiled in a copper vessel: two ounces of powdered cochineal are then thrown into it, and well stirred. After six minutes' boiling, sixty grains of powdered alum are thrown in, and the whole suffered to boil for three minutes. The vessel is then removed from the fire; and the liquor drawn off with a siphon, and filtered through a lawn sieve. The liquor is then placed in many china or Delft-ware vessels, and allowed to remain at rest for three days; when it is decanted, and the deposits dried in the shade. After three more days, the liquor is again to be decanted; when it will have formed carmine of an inferior quality.

ALYON'S PROCESS.

Two pailsful and a half of river water being boiled in a copper vessel, a pound of ground cochineal is put into it by degrees, and the liquor is well stirred with a brush. After having boiled about half an hour, a weak alkaline ley is added, prepared with five drachms of soda, dissolved in a pint of water: this is poured into the decoction of cochineal; and, after half an hour's boiling, the vessel is removed from the fire, and set, in an inclined position, upon a table. Six drachms of alum are then added, and well stirred into it; and the whole is afterwards left at rest for twenty-five minutes. The liquor, which is then become of a very fine scarlet colour, is to be decanted into another vessel; and the whites of two eggs, previously beaten up with half a pound of water, are added: the whole is then stirred up with the brush; and the vessel replaced upon the fire, and made to boil. The whites of eggs coagulate, and precipitate with the colouring substance, which forms the carmine. The boiler is then removed from the fire, and left at rest for twenty-five or thirty minutes, in order that the carmine may entirely deposit itself. The liquor is decanted; and the deposit placed upon fine linen, that it may drain. The carmine is afterwards removed with silver or ivory spoons, and dried upon plates which are covered with white paper. A pound of cochineal, by this process, affords an ounce of carmine.

It is essential that *soft water only* be employed.

We see, by two of these recipes, that alum is not, as many authors have advanced, an indispensable material, in the preparation of carmine: in one instance, it is replaced by the acid oxalate of potash; in another, by the hydrochlorate of tin: and the experiments of MM. Pelletier and Caventou prove that these salts, as well as the alum, serve, both to heighten the colour, and to assist in its precipitation, by the action of their excess of acid on the animal matter contained in the cochineal.

Carmine is very much used in miniature-painting: and a great quantity of it is also employed in the manufacture of artificial flowers. The confectioners and apothecaries make use of it, to colour various preparations: and it gives a beautiful tint, when mixed with any substances which they wish to colour. When it is used as a liquid colour, it is dissolved in the volatile alkali: the excess of alkali is dissipated by spontaneous evaporation; and, when the solution is become inodorous, it is fit for use.

MM. Pelletier and Caventou have given the name of Carmine to the pure colouring-matter contained in the cochineal, which is the basis of the carmine. These chemists have succeeded in separating it, by first macerating the cochineal in ether, in order to free it from a greasy substance which it contains, and then repeatedly treating the cochineal with boiling alcohol. At each decoction, it deposits, on cooling, a granulated matter, of a beautiful red colour; and, on leaving the solutions to a spontaneous evaporation, the deposit continues to form, and then assumes a crystalline appearance. In this state, the colouring-matter of the cochineal is nearly pure; nevertheless, it still retains a little of the greasy substance; to divest it of which, entirely, MM. Pelletier and Caventou direct it to be re-dissolved in alcohol at 40°, and then to add to it an equal part of ether. This mixture is at first very thick, but afterwards becomes clear; and, in a few days, the sides of the vessel are found to be covered with an incrustation of a brilliant reddish-purple colour, which is *pure carmine.* This has been characterized by the following properties: its colour is a vivid purple; it has a crystallized appearance; is perfectly unalterable in the air; heat easily decomposes it, and without producing any azote; it is very soluble in water; and neither crystallizes by evaporation nor cooling; it is insoluble in ether; soluble in boiling alcohol; &c.

V.—*On the Culture and Uses of Carrots.* By William Wallis Mason, *Esq.**

WITH FIGURES.

Sir, *Goodrest Lodge, near Warwick, Jan.* 31, 1805.

The purport of this communication is, to explain, with a degree of accuracy, the general, and, as far as possible, the best method of cultivating carrots. I shall, therefore, endeavour to remove those prejudices, which frequently occur in every branch of agriculture; while I give a brief statement of particulars, which experience, assisted by numerous comparisons, has induced me to consider as best adapted for rearing the plants; as well as the most judicious, in the application of the vegetables, when cultivated.

In Suffolk, the culture of this highly-valuable root has been carried on for ages: but, of late years, it has very much increased, and furnishes the best criterion of its worth. Various have been the attempts to extend the benefit more generally throughout the kingdom, but with

* From Vol. XXIII. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.—The Society voted its Silver Medal to Mr. Mason for this useful Communication.

little success; imaginary difficulties arising in the minds of cultivators, which I hope to obviate, by a more minute detail; and the observance of which will enable any farmer, on a proper soil, to raise a crop, which will, at once, be productive of great private advantage, and public utility.

On most farms, it will be found, that a considerable proportion of the produce from the best land (the meadow, and upland pasture) is consumed by the working cattle, and the lean and rearing stock, during the winter months.

The carrot system may be carried on, on inferior arable lands; and the produce, by judicious application, will be found to excel, far beyond general expectation, that of the grazing land; and which will, in consequence, be appropriated to general national advantage, in furnishing an additional supply of animal food, of wool, and the produce of the dairy.

A red loamy sand is at all times to be preferred, as free from stones as possible; but very large crops may be grown on any land which is not of a too tenacious or binding quality, and with a sufficient depth of soil.

In order to increase the growth of the root, it is necessary to remove the soil to the depth of 14 inches: this is easily accomplished, by first ploughing the furrow seven inches deep, in the usual manner; and then following with the plough, in the same furrow; which, with the assistance of an additional horse, brings up the soil from the depth required. The first plough continues to turn the fresh furrow, to the bottom of the double furrow; and, being followed by the double furrow, as in the first instance, the soil becomes completely mixed, and ready for the reception of the seed.

The first furrow is seven inches deep, and is removed into . . . .
The second furrow, of fourteen inches deep: this, in rotation, becomes the first stratum.

The lands, or stitches, cannot be too wide; say, from 18 to 25 yards.

It is necessary to observe, that the land, on which this crop is intended to be produced, should, at all times, be in a perfectly clean state; such as, for instance, a barley stubble, which has succeeded a fallow; &c. Yet few crops turn out more productive than those cultivated on clover, or leys of artificial grasses; ploughing the same as on a barley stubble.

A rule, which in most instances holds good, must not here be neglected; viz. that of getting in the seed directly after the ploughings. A neglect of this would be attended with the worst consequences. On stale land, the weeds would, in a short time, completely get the better of the young plants; and thereby occasion a great deficiency in the crop.

Five pounds of seed is commonly sown per acre; but as its value is very trifling, when put into competition with the advantages of having good plants, I never recommend less than six pounds per acre. In a dry season, there is great benefit in steeping the seed for twenty-four hours. To prepare it for the drill, or for sowing, it should be well rubbed, with the palm of the hand, against the side of the tub, to destroy the small fibres, and prevent their adhesion: and some fine sifted marl, and saw-dust, should be mixed with it; in the proportion of two-fourths of marl, one-fourth of saw-dust, and one-fourth of seed.

Drilling is, indubitably, the best way to get in the seed; the drills being from six to nine inches asunder: the advantages are obvious; the carrots stand the winter much better, from the tops of the vegetables being nearly buried in the soil, the green heads only being visible to the eye; and, indeed, it is very rare to see the smallest part of the red carrot above the surface: and the great facility it furnishes, in weeding and hoeing, in a district not hitherto acquainted with this useful branch of agriculture, must render it, in a two-fold degree, desirable.

Carrots, in their early state, are very tender plants, and very slow of growth. I have frequently noticed a field, where they were scarcely visible to the eye for three weeks or a month after sowing, which has yet turned out a most abundant product. It is frequently six weeks before they are fit to hoe; but to prescribe any rule for this is impossible, since the vegetation of every description of plants depends so much on the season. I shall only observe, that the most proper time to commence weeding or hoeing, is soon after the plants gain the parsley-leaf, or are about half an inch out of the ground. Every vegetable, intended to be thinned or separated by the hoe, cannot have this process performed upon it too early; since, from general observation, it is clearly ascertained, that the smaller the plants are, the greater should be the numbers left: and, as a second hoeing is absolutely necessary (if it is only to promote vegetation, by loosening the surface), the plants may then be distributed, as requisite. In hoeing of every description, it is always necessary to stir every part of the soil possible: in this instance, it must, on no account, be neglected.

The season for sowing is, from the middle of March to the 12th of April. In dry weather, it is best to have the seed rolled down. The land should always be harrowed after drilling or sowing; as, from the nature of the plant, a pulverization of the soil is requisite. It is, however, useless to detail particulars of this sort; which must, in so material a degree, depend on the state of the season; in which the judgment of the practical farmer cannot easily fail him. Suffice it to say, that the lighter, the finer, and the less binding the soil, the better vegetation must flourish.

With respect to the best method of cleaning the young crop, I have only to observe, that, nine times out of ten, it answers better to weed by hand, than to hoe, the first time; that is, supposing that the crop is much encumbered by weeds: but should it be perfectly clean (which, however, is rarely the case), the hoe will answer every requisite purpose. There is great care to be taken in the first hoeing; and, particularly, in leaving the plants sufficiently thick, and in not burying them in the process; for, should that be done, the fairest prospects would at once vanish. The women and children employed to weed, should not be suffered to pull up a single carrot: the hoe effects the purpose of setting out in a superior manner; and should, within two or three days, follow the weeders. I have frequently seen the land so much covered with weeds, that the number of the carrots was extremely doubtful: after hand-weeding, however, a very good sowing was often seen, which would have been destroyed, in a great measure, had the hoe been previously used. One weeding, and two hoeings, are generally sufficient: by the time they are accomplished, the carrot-tops are generally of a sufficient growth to shade the land. The proper hoe to be made use of, should have a blade four inches long, and one inch and half broad; of the form shewn in Plate I. fig. 1.; and be always kept very sharp.

Carrots, like turnips and other vegetables intended to be housed for winter, should not be taken up before they are full grown: they never answer better than when used from one to four weeks after they are taken out of the ground. They are little liable to injury in winter. The latest time for taking them up is just before the fibrous root begins to shoot in the spring; at which period the vegetable becomes less nutritive, and is, at the same time, injurious to the land.

By these attentions, I have invariably found the cultivation of carrots extremely beneficial to the land; and, not unfrequently, the value of the crop equal to the fee-simple of it. The greatest produce I ever remember, was eighteen loads per acre, forty heaped bushels to the load; yet I have heard of much larger crops.

Worn-out, ploughed lands are renewed by the intermixture of the fresh soil occasioned by the deep ploughing; and the proof is visible, in many succeeding crops, of corn, grasses, &c.

The same land will produce very good crops of carrots for years in succession; but, in this instance, manure becomes necessary.

The carrots are taken up with a narrow spade, which the labourer strikes into the ground with one hand; and at the same time, pressing it sideways, he draws out the root with the other hand; throwing the carrot to the heap, where his wife and children sit to cut off the tops. The tops are left, and spread, as manure to the land.

Expenses of Labour.

	s.	d.
Weeding varies from 5s. to 10s. per acre: . . average	7	6
First hoeing	7	0
Second ditto	5	6
Taking up, per load, and topping	1	2

In addition to these prices, it is necessary to remark, that the labourers, in dear seasons, have an allowance for flour; viz.

To every single man, one stone of flour per week; the master paying the additional price, above two shillings per stone.

To a man and his wife, one stone and a half per week; and half a stone per week to every additional child under twelve years old; at which time they are deemed capable of earning their own bread.

By the introduction of this judicious plan, the labourer shares the benefit of that grain which his own industry had helped to cultivate; and feels, but in a small degree, the oppression of the times: the interests of the master and of the servant become reciprocal; for the price of labour continues nearly at the same standard: had it been otherwise, the farmer must have suffered, when his commodities became of less value.

The annual rent of those lands, on which carrots are generally grown, is, from 5s. to 20s. per acre; but I have invariably found the profit by far the greatest when the best soil has been made use of.

A good crop, on land worth 5*s*. per acre	. . .	7 loads.
—————— 10*s*. ditto	. . . .	9 ditto.
—————— 15*s*. ditto	. . . .	11 ditto.
On the best land, as I before remarked	. . .	18 ditto.

The advantage in preferring good land is obvious; the chief expenses being nearly the same as on poor soil. The additional labour consists, chiefly, in taking up the crop.

Carrots are sometimes sown when the land has received but a single furrow;—a sure mark of indolence! The annexed Drawing (see Plate I. figs. 2 & 3) proves the necessity of deep ploughing by means of the double furrow.

Fig. 2, is the shape, and comparative size, of a carrot grown on a single furrow. The earth, below where the soil was stirred, acting as a repellent, checks the growth of the root, and causes it to shoot laterally.

Fig. 3, is the comparative growth and shape of a carrot grown on the double furrow.

On all soils which are adapted to this branch of husbandry, the first ploughing may be done by a pair of horses abreast; *the lower, or double furrow, by three horses, also abreast.* The nearer the cattle are to the work, the greater is the purchase; and they labour also with greater spirit, in sociable company, than when in a string at length. Fig. 4, will explain the manner of yoking *three* horses abreast, to a single purchase*: they will be found to be, on a fair trial, equal in power to *four* horses, drawing at full length.

ON RAISING CARROT-SEED.

It is a common practice, with the cultivators of carrots, to raise their own seed: it requires but little attention, and the crop is seldom known to fail. For this purpose, they choose such carrots as are in no respect injured by frost, are the handsomest, and of a middle size: they thin the green tops, leaving, however, about an inch in length of

* This excellent arrangement is well worth following, in many other similar cases.—EDITOR.

them; and cut two inches off the extremities of the roots. They then plant them in double rows, a foot apart, and six inches between the plants, in each row; the intervals between the double rows being three feet: these distances are requisite, as all the seed does not ripen at the same time. The paths, or intervals, serve to gather the seed; which must be done daily, as the seed arrives at maturity. It is frequently three weeks before the entire crop is cleared. The heads of seed must be spread to dry, on a floor; or, in dry weather, on the ground. The seed is afterwards separated from the stalks, with a comb. The season to plant carrots for seed, is the latter end of February, or the beginning of March, when the severe frosts are over.

ON THE USES OF CARROTS.

Having explained, in as concise a manner as possible, what is necessary to be observed, to enable the practical farmer to cultivate this highly-valuable root, in districts hitherto deprived of the great benefit it affords to the community, and of the great profit to the cultivator; and perfectly free from all theoretical and speculative opinions; I now proceed to a short detail of the uses and applications of carrots.

On their utility, for family consumption, it will not be necessary to dwell. I have therefore only to remark, that, since vegetables are found to be more or less nutritive, in proportion to the saccharine matter they contain, but few vegetables will be found to excel them. I have known large crops of carrots sold, for the London market, at forty shillings per load, delivered at a port four miles distant from the land which produced them; a price for which a ready sale will be found, in any populous town, during the winter season: but, for this purpose, they should be assorted, and all the overgrown and crooked ones be reserved for home consumption, for which they will answer as well as the others; and, when topped, half an inch of the green crowns should be left on: for this purpose, they are not usually washed.

For home consumption, I have invariably found them to answer best for the use of cart-horses: when designed for the food of other cattle, of any description, the green tops must be entirely cut off, and the carrots be washed perfectly free from dirt and sand. It is necessary to house them three or four days, at least, before horses are fed with them:—a neglect of this, is sure to be attended with dangerous consequences. It is generally known, that the cucumber, when left a short time in water, absorbs a proportion of it: the carrot does the same in a less degree, yet sufficiently to produce a considerable degree of fermentation, from the heat of the animal's stomach; and griping is occasioned thereby. To render them salutary, the time mentioned is sufficient for evaporation.

The washing of them is easily and expeditiously done, by filling a mash-tub three parts full of carrots; then, pouring cold water upon them, stir them well, and throw them out with four-pronged dung-forks; after this process, they may be laid, under cover, in large heaps, as much as six or eight loads in a heap. Secured from frost and rain, they will keep two or three months. It is, however, not right to suffer them to remain so long; as they would shrivel to two thirds in their measure: and, although they become more nutritious, from the loss of their aqueous parts, yet that is not sufficient to compensate the deficiency in their bulk.

Carrots are extremely valuable, when applied as food for cart-horses: when properly fed with them, they are in the greatest health and vigour; and their coats are as fine as the best-groomed coach-horses, even in the depth of winter, and when exposed to the inclemency of the season, in a straw-yard. For home consumption, I have invariably found them to pay more, by one-third, when given to horses, than when employed in feeding cattle.

After a variety of experiments, I have found the following manner of employing them to be the best;—To each cart-horse, one heaped bushel per day, with as much cut provender as he can eat: the latter should also be of the first quality. I recommend that it be composed of two-thirds of good wheat or oat-straw, and one third of clover. Wheat-straw is the best, and oat-straw next: barley-straw is, indeed, frequently given; but is never to be preferred, from its griping tendency. Horses cannot eat too much of cut food: when returned from their work, they should always be baited with it; or drink their water before carrots are given to them, and plenty of dry food be given with the carrots; as the dry nature of the one corrects the cold quality of the other.

There is not, however, any occasion to cut the carrots, but merely to mix them with the cut food, and feed with them in the manger. Horses used to carrots will prefer them to oats, when given together. If the straw and clover are not, however, of the first quality, oats should be given in proportion. By this method of feeding, there is a saving of at least two-thirds of the hay usually consumed; corn is entirely dispensed with; and the horses will be in better condition, than when fed with hay and corn only; that is, supposing that each horse is allowed, with his hay, half a peck of oats per day.

Great care must be taken never to give carrots, when horses come to the stable heated by work.

Carrots are not proper food for riding-horses; nimble exercise causes them to be laxative; and, as they sometimes will produce griping, I shall here insert a prescription, which has been proved effectual, by long experience, together with the treatment, to be pursued in such cases.

Oil of turpentine	. .	1 oz.
Castile soap	. . . .	1 oz.
Flour of mustard	. .	½ oz.

On the first symptoms, this mixture should be given, and it will not fail to remove the complaint.

The Castile soap is to be cut small, and be dissolved in a quart of boiling water: the mustard is then to be added; and the oil of turpentine mixed with it, the last thing. It should be given more than milk-warm: if the animal suffers much pain, add to it half an ounce of liquid laudanum.

On the first appearance of the disease, the horse should be well clothed, constantly rubbed with hard-twisted wisps of straw, and be kept as warm as possible. Should the disease increase, and the body swell much, a gallon of blood should be taken away, to check the inflammation, and afford time for the medicine to operate. If the symptoms still increase, repeat the dose, omitting the liquid laudanum. Clysters, and raking, afford much relief, when the symptoms first appear; and frequently remove the complaint.

Feeding-cattle improve more upon carrots than when fed upon potatoes or turnips: they are exellent food for ewes, at lambing-time: they should, however, be previously cut, or they are subject to break their mouths.

Store-pigs may be fattened on carrots only; and large hogs feed remarkably well, when fed with one-half corn and one-half carrots.

Heifers in calf, which require good keep, and calve early, thrive better on carrots and good oat-straw than on hay only;—one bushel of carrots per day. Care, however, must be taken, not to give them too early, or too many; in which case, the calves are liable to overgrow themselves. Weaned calves thrive well on this food;—a peck per day, is quite sufficient for each: more would increase their bodies too much.

Milking-cows give more milk when fed on carrots and straw than on hay only. In all these instances, their superiority over turnips is more, comparatively speaking, than the difference of a carrot-crop (rated at one guinea per load of forty bushels) is to the value of turnips on the same soil; rating them as a produce for home consumption.

One heaped bushel of carrots, therefore, is equal to 18 lb. of hay. Now, admitting each cart-horse to consume this quantity of hay in 120 days, it amounts to 2,160 lb.; the average produce of one acre of good pasture land.

The same animal, if fed on carrots, with the addition of the cut-straw provender, which is a substitute for corn, and adds solidity to the carrots, will require only 120 *bushels of carrots; or three loads;—not half the produce of an acre of arable land, worth only five shillings per acre.*

To this must be added, the great superiority, in point of condition, which the cattle evince. The latter method, of feeding with carrots and cut provender, is fully equal to 18 lb. of hay, and half-a-peck of oats, to each horse.

My object, in presenting these remarks for the consideration of the Society for the Encouragement of Arts &c. is the hope of extending a most valuable branch of agriculture (which has long stood the test of experience) more generally throughout the kingdom: and they are respectfully submitted, by their obedient servant,

William Wallis Mason.

To Charles Taylor, *Esq. Sec.*

VI.—*On a New Method of Cultivating the Mushroom. By Mr.* William Hogan, *Gardener to* James Warre, *Esq.* F. H. S.*

Sir, *Randall's Park, near Leatherhead, Jan. 5,* 1823.

Having devised a method of *growing Mushrooms* under shelter, which I have practised this season, with much success, I am instructed by my Master to transmit you an account of it. I have a peculiar pleasure in complying with his directions; for it will always be very agreeable to me to communicate to the Horticultural Society of London any matter in the way of my profession, tending to promote the objects of that Institution.

* From Vol. V. Part III, of the Transactions of the London Horticultural Society. In a Letter to the Secretary.

The exterior form of my bed resembles the old ones, as built against a wall; but, instead of building it solid, it is hollow. Strong stakes are inclined against the wall, at an angle of about sixty-five degrees, on which are placed hurdles, to support the bed. By this means, a cavity is formed under the stakes, for the purpose of receiving dung; which being readily changed, an opportunity is thus afforded of keeping up a permanent moist bottom heat in the bed; the absence of which, together with an insufficient depth of mould, for the spawn to run in, is the great defect of all other modes of raising mushrooms, with which I am acquainted.

Upon a structure thus contrived, I built two beds, eighteen inches thick; the uppermost four inches of which is mould of a loamy nature, with an admixture of one quarter of road sand. The substratum was formed of dung, which had lain in the stable-yard a considerable time: this was well shaken, and laid in ridges for about a week, giving it a few turnings in the interim, by which time it became moderately dry. I then added to it one-third of mould, collected under a group of common Horse-chesnut trees, where different cattle indiscriminately retreat, during the heat of summer: this lay in heaps, a few weeks previous to use. A layer of straw, or long litter, was first placed on the hurdle, to prevent the mould and short part of the dung from passing through them. In laying on this compost, I beat it with a spade, till it became solid; and then left it for a week, before it was spawned and moulded. When the mould was put on, I bestowed no other labour on that than beating it with the spade.

I did not use a covering of straw or hay; nor do I think it necessary, provided the places where the beds are built are sufficiently closed; but in an open shed such a protection must be provided*. With respect to watering, it would be difficult to lay down fixed rules: that must depend

* Where a covering is not used, the whole crop, fit for use, may be observed at once, which is very advantageous.

on the judgment of the gardener: however, from the depth of mould which is used on this plan, I can confidently state, that there is no necessity of being so sparing of water as is usually recommended by writers on the subject.

The beds which I made, as above described, were spawned on the 24th of August last: they came into bearing on the 21st of the following month; and would have continued bearing up to the present time, without ceasing, and for several weeks longer, if an unfortunate accident had not occurred on the night of the 28th of last month (December), by a fracture in the ceiling of the room, which admitted the frost.

Notwithstanding this accident, however, I propose, after giving the bed a few weeks' rest, to renew the linings: and I have the most sanguine hopes that my labour will be successful; for, upon a close examination, I find the whole mass of dung and mould is completely full of spawn.

The place in which the beds stand is a dark room, about ten feet square, exposed to the north, and with a floor of earth. They are each about eight feet six inches long; and measure seven feet over their surfaces, from the floor to the wall.

To the produce of these beds, my Master, and many Gentlemen in the neighbourhood, as well as their gardeners, can bear ample testimony. The appearance of the mushrooms was singularly beautiful. In their growth, they formed an apparently powdery substance, resembling the *Aphis Lanigera*, in its young state; and this progressively altered, till it became more crustaceous and solid, ultimately forming large clusters, of *one hundred to two hundred mushrooms*. One of these clusters, taken as a fair sample, was exhibited to you, by my Master, some time back; and from it, you may have formed a judgment of the general size and quality of the produce of the whole bed.

I have the honour to be, Sir,

Your most obedient humble servant,

WILLIAM HOGAN.

Note by the Secretary.

The cluster of mushrooms alluded to was brought to the Society's House, in Regent Street, on the 6th of November last: they were unusually fine in appearance; and some, when dressed, proved excellent. The abundance of the produce, so clustered together, was certainly very unusual.

Mr. Warre, in a Letter communicated after Mr. Hogan's Paper was sent to the Society, observed that the frost had not been so injurious to the bed as had been apprehended; for that it continued to produce mushrooms, though not in such quantities as before the accident: but this diminution of produce Mr. Warre attributed, in part, to the dung not having been changed, so that the bed was not sufficiently heated.

Mr. Warre further mentioned, that the produce altogether had been very great; for though dressed in every way possible, besides furnishing a frequent supply to neighbours, the beds, more than once, had yielded a gathering of a bushel of mushrooms for catsup. The mushrooms were thick-fleshed, firm, and high-flavoured: on their upper surface, they varied in colour, from a fine brown, to white; but were, invariably, of a light peach-bloom colour underneath. The clusters consisted, chiefly, of great numbers; and when they did not grow in clusters, single round mushrooms were produced.

Mr. Samuel Sawyer, gardener to Isaac Lyon Goldsmid, esq. of Camberwell, having seen the mushroom-beds formed by Mr. Hogan, and described above, has, in a communication made to the Secretary of the Society, and read at the meeting on the 18th of March 1823, suggested, that, instead of forming the bed upon stakes and hurdles, a sort of frame-work might be used; which, he proposes, should be constructed with bent iron rods, one inch and a half in circumference, and placed six inches apart; each end being let into bars, one to be fixed on the floor, the other against the wall; the whole forming a half-arch, the radius of which might be from two to three feet, according to the space required underneath the bed: the bed to be made over the whole surface of the iron-work, and the dung to be put in under it. The bars might be covered with woven iron lattice-work; the meshes of which should be so small, as to prevent the substances, used in making the bed, from falling into the cavity underneath, and mixing with the dung.

VII.—*On an Improved Colour-Mill; and on a superior Mode of Preserving Oil-Colours in Bladders. Invented by* Mr. James Rawlinson, *Artist.**

WITH FIGURES.

Sir, *Derby, Jan.* 10, 1804.

I have herewith sent a model of a machine for grinding colours; believing, that if the Society for the Encouragement of Arts &c. should be of opinion that it has sufficient merit to recommend it to the public, it cannot fail of receiving that attention, from the sanction of their approbation, which my recommendation could not procure for it.

The hitherto very unmechanical, inconvenient, and highly-injurious method of grinding poisonous and noxious colours led me first to imagine that a better might easily be contrived for that purpose. It must be obvious to every person, that the method hitherto adopted, of grinding colours on a horizontal marble slab with a small pebble muller, requires the body of the person, who grinds, to bend over that slab, and consequently his head; which causes him to inhale the noxious and poisonous volatile parts of the paint, which is not unfrequently ground with oil saturated with litharge of lead: and, if we may judge from the very unhealthy appearance of those men accustomed much to colour grinding, it should seem that the ill effects of this employment require a speedy remedy.

* From Vol. XXII. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.—The Society voted its Silver Medal, and the Sum of Ten Guineas, to Mr. Rawlinson, for this useful Invention.

The machine, of which I now send the Society a model, has not only the advantage of being an effectual remedy for this extensive evil, to recommend it; but it grinds the colours much easier, much finer, and much quicker, than any method hitherto adopted.

Having occasion for a considerable quantity of ground colours, in the profession in which I am engaged, and those in the finest state possible; and having made use of the machine for several years, and being more than ever convinced of its utility; I thought it my duty to present it to the Society of Arts &c.; hoping that it might not be found altogether unworthy of their attention. The cylinder of the machine that I use is sixteen inches and a half in diameter, and four inches and a half in breadth. The concave substitute for a muller, that it works against, covers one-third of the circumference of the cylinder: it is therefore evident, that, with this machine, I have seventy-two square inches of the concave marble muller in constant action upon the paint; and that I can bring the paint much oftener under this muller, in a given time, than I could by the usual method, with the flat pebble muller, which is seldom more than four inches in diameter, and, consequently, has sixteen square inches at work on the paint; whilst my concave muller has seventy-two. I do not mean to state, that a cylinder, the size of that which I now use, is the largest which might be employed: for I believe that a cylinder of two feet in diameter, with a concave muller in proportion, would not be hard work for a man; and then the advantage to the public would be still further increased.

This machine will be found equally useful, for the colours which are ground in water, as for those ground in oil; and I doubt not but that the great importance of this machine will be very soon generally experienced, in all manufactories where colours are used.†

† It has also been employed, with great success, in grinding Printing-ink; and, for many purposes, the cylinder and concave muller may be very advantageously made of cast-iron.—Editor.

The labour necessary, with this machine, in grinding colours exceedingly fine, is very trifling. It is, however, unnecessary to enter into any minute description of it here; as a mere inspection of the machine must sufficiently explain it.

To the colour-men it would evidently cause an essential saving in labour, and consequently in expense; which will probably have some weight in recommending it to their notice: and the advantages to the colour-grinder have been already stated.

I am, Sir, your very obedient servant,

JAMES RAWLINSON.

To CHARLES TAYLOR, *Esq. Sec.*

SIR, *Derby, Feb.* 6, 1804.

I was duly favoured with your Letter of the 3d instant: and, in reply to the questions which the Committee have proposed, I have made a sketch of my machine, with letters of reference to it; in order that I may the better explain the process of grinding with it.

In Plate I, fig. 5, A, is the cylinder, made of any kind of marble; but black marble is esteemed the best, because it is the hardest, and takes the best polish. B, is the concave muller, covering one-third of the circumference of the cylinder, and made of the same kind of marble with it: this is fixed in a wooden frame, *b*, which is hung to the frame E, at *i*, *i*. C, is a piece of iron, about an inch broad, to keep the muller steady; and is affixed to the frame, by a joint, at *f*. The small binding-screw (with its nut) which passes through the centre of the iron plate, at *c*, is for the purpose of laying more pressure on the muller, when required, as well as to keep it steady. D, is a taker-off, made of a piece of clock-spring, about half an inch broad; and is fixed, similarly to a frame-saw, in an iron frame, *k*, in an inclined position to the cylinder; and the frame turns on pivots, at *d*, *d*. G, is a sliding-board, made to draw out occasionally, in order to clean it, should any particles of paint fall upon it from the cylinder: it also forms a support for the dish H, to catch the colour, as it drops from the taker-off, D. F, is a drawer, for the purpose of containing curriers'-shavings, which are the best things for cleaning paint-mills. E, is the mill-frame.

Previous to the colour being applied upon the mill, I should recommend it to be finely pulverized in a mortar, covered over in the manner of the chemists, when they levigate poisonous drugs*. (This previous process of dry-grinding the colours is also equally necessary with the marble slab now in use.) After this, they should be mixed with oil or water, and, with a spatula or pallet-knife, be put upon the cylinder, near to the top of the concave muller: the cylinder is then to be turned round, towards the muller; which draws the colours beneath the muller, without any difficulty; and a very few turns of the cylinder spread it equally over its surface. When it is found to be ground sufficiently fine, for the purpose required, it is very readily removed, by means of the taker-off, before described; which must be held against the cylinder, and the cylinder be turned the reverse way, which cleans it very quickly and completely: and the muller will only require to be cleaned when the operation is nearly completed, and previous to changing the colour. For this purpose, it is to be turned back, being, as before said, hung upon pivots, affixed to the frame, at *i, i*; and may then be very conveniently cleaned, with a pallet-knife or a spatula. Afterwards, a handful of the curriers'-shavings being held upon the cylinder, by two or three revolutions it is cleaned effectually; and there is much less waste of colour with this machine than with any marble slab.

As to the quantity of colour to be ground at once upon

* Or rather, in an improved mill, used at Manchester, in the calico-printing business, by Mr. Charles Taylor, for grinding indigo, &c. in a dry state: of which mill I annex a drawing, and a reference to it, in order to render the whole business of colour-grinding complete.

this mill, that must be regulated by the state of fineness to which it is required to be brought. If it is wanted very fine, a smaller quantity must be put upon the cylinder at a time: and as to the time required for grinding a given quantity of colour, that will also depend upon the state of fineness to which it is to be brought. I have observed, that my colour-grinder has ground as much in three hours, with this machine, as used to take him a day in the old method; and, as he says, with great ease. The colour, also, was ground much more to my satisfaction, than in the former way; and it was attended with less waste.

I have mentioned the pulverizing of the colours in a covered mortar, which would prevent waste, as well as hinder the dust and finer parts of noxious colours from being injurious to the workman. In some manufactories, where large quantities of colours, prepared from lead, copper, and arsenic, are used, this precaution is particularly necessary. I do not mean to say that my machine is intended to supersede the colour-mills now in use, for the coarse inferior colours: it is intended for no such purpose; but only to supersede the use of the very awkward and unmechanical marble slab, on which all the colours for china-manufacturers, coach-painters, japanners, artists, &c. are now ground.

Several of the colour-manufacturers have frequently mentioned to me their great want of such a machine. As I had, however, no desire of troubling the public by describing a machine which would not answer its purpose, so I used it for several years before I presumed to recommend it to their attention: being, however, now completely convinced of its utility, and hoping that it may rescue a number of my fellow-creatures from a dangerous employment, I have ventured to submit it to the Society of Arts &c.; hoping, through its means, to witness its ultimate success. And further, to give the Society the most complete assurance in my power, I have annexed the opinion of a very ingenious and mechanical friend, who has frequently seen it at work.

If any other questions should occur to the Committee, which may be in my power to explain, I shall gladly do so.

I am, Sir, your most obedient servant,

To C. TAYLOR, *Esq. Sec.* JAMES RAWLINSON.

An Improved Mode of Securing Oil-Colours in Bladders. *By Mr.* JAMES RAWLINSON.

When the colour is ground, I recommend the following mode of tying it up in bladders, in preference to the usual method.

Instead of drawing the neck of the wetted bladder close, (in the act of tying it up, as usual,) I previously insert a slender cylindrical stick, and bind the bladder close around it. This, when dry, will form a tube or pipe; through which, when the stick is withdrawn, the colour may be squeezed, as wanted; and the neck be again closed, by replacing the stick. This is not only a neater and much more cleanly mode, than the usual one, of perforating the bladder, and stopping the hole with a nail; or, more commonly, leaving it open, to the prejudice of the colour; but the bladder, being uninjured, may be used repeatedly, for fresh quantities of colour.

The barrel of a small quill may be tied, in place of the stick, into the neck of the bladder, with its closed end outward; which will keep the colour secure, in travelling; and when wanted to be used, the end of the quill being cut off, it may afterwards be closed by a stick.

A Certificate from Mr. Thomas Swanwick, of Derby and another from Mr. John Middleton, Colour-manufacturer, of St. Martin's Lane, London; confirming the above statements, accompanied these papers.

Reference to the Engraving of Mr. CHARLES TAYLOR'S *Improved Mill, for grinding Indigo, and other Colours, in a dry state.*—Plate I. figs. 6, 7.

L, represents a mortar, made of marble, or other hard stone. One made in the usual form will answer.

M, a muller, or grinder, made nearly in the form of a pear; in the upper part of which, an iron axis is firmly fixed; which axis, at the parts marked N, N, turns in grooves or slits, made in two pieces of oak, projecting horizontally from a wall, &c.; and when the axis is at work, it is secured in the grooves, by the iron pins O, O.

P, the handle, which forms a part of the axis; and by turning which, the grinder is worked.

Q, the wall, &c. in which the oak-pieces, N, N, are fixed.

R, a weight, which may occasionally be added, if more power is wanted.

Fig. 5, shews the muller, or grinder, with its axis, separate from the other machinery: its bottom should be made to fit the mortar.

S, a groove, cut through the stone muller.

In grinding indigo, or such substances, in a dry state, in this mill; the muller, being placed in the mortar, and secured in the oak pieces by means of the pins, the indigo &c. to be ground is thrown into the mortar, above the muller: on turning the handle, the indigo, in lumps, falls into the groove cut through the muller; and is, from thence, drawn in, under the action of the muller, and again propelled to its outer edge, within the mortar; from whence the coarser particles again fall into the groove of the muller, and are again ground underneath it: this operation is continued, until the whole of the indigo &c. is ground to an impalpable powder: the muller is then readily removed, and the colour taken out.

A wooden cover, made in two-halves, with a hole in it for the axis to pass through, is usually placed upon the mortar, during the operation of grinding; to prevent any loss of colour, or ill effect to the operator.

VIII.—*On a Bisecting Gauge, for the use of Carpenters, Joiners, &c. Invented by* HENRY ROBINSON PALMER, *Esq. Civil Engineer.**

WITH FIGURES.

SIR, *Mare Street, Hackney, March* 3, 1813.

HEREWITH you will receive a gauge, which I have invented for the purpose of marking a line along the centre of any parallel or tapering solid; and which I beg to introduce to the notice of the Society of Arts &c. &c.

It has been much approved of by several workmen, to whom I have shewn it; as it will mark a centre-line with great accuracy: and it is well known, that it is more easy for a workman to measure from a centre-line thus formed.

It will also assist greatly in making mortices; besides answering all the purposes of the carpenter's ordinary gauge. It will cost about four shillings.

I am, Sir, your humble servant,

H. R. PALMER.

To C. TAYLOR, *M. D. Sec.*

References to the Engravings of Mr. Palmer's Bisecting Gauge, for marking a Line along the Centre of any Parallel or Inclined Solid.

Fig. 1. of Plate II, is a plan, and fig. 2. a perspective view of the gauge; the same letters referring to both figures; and the first being drawn at exactly one-half the real dimensions of it. A A, is a square bar of hard wood,

* Now of No. 13, Abingdon Street, Westminster, and Patentee of Improved Carriages and Rail-ways.—From Vol. XXXI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.—The Society voted its Silver Medal to Mr. Palmer, for this Invention.

planed straight, and having the two sliding cheeks of hard wood, B, D, fitted tight upon it. The cheek B is fixed fast on the end of the bar; whilst the other slides upon it, but may be made fast at any required place, by the thumb-screw, C. At the end, *b*, a common scribing-point is fixed in the bar; and with this, and the sliding-piece D, it forms the common gauge, used for drawing parallel lines from the edge of any piece of wood-work.

The addition made by Mr. Palmer consists of two brass arms, E and F, of equal length; which are centred in the two sliding cheeks, at *a a*: the other ends are jointed together, by the screw, G; which is formed into a sharp conical point beneath, to mark the work with.

In using this gauge, its two cheeks, B D, must be set to the width of the piece of wood intended to be scribed: and it must be evident, that the point of the screw, G, will always keep in the centre between the two cheeks, B D; because the two arms, E F, are of equal length, and a line joining their centres, *a a*, is perpendicular to the cheeks. This bisecting gauge will prove much more expeditious in use, than the common gauge used by carpenters for finding the centre of any piece of wood: to do which, they set it, as near as can be guessed, to the centre of the piece; and then, making a mark, they turn it to the opposite side of the piece: they then make another mark; and between these two marks the centre will be found.

If the piece of work is not parallel in its width, then the screw, C, must be loosened, and the two cheeks, B D, be kept pressed towards each other, with sufficient force to keep them in close contact with the two sides of the work; when the point, G, will traverse along the centre of the piece, as correctly as if it was parallel; because, in all situations, it preserves an equal distance between the two cheeks B D. These two cheeks have grooves made in them, to receive the brass arms E and F, when the cheeks are brought into contact.

IX.—*Process of Painting in Milk**.

THIS process, which is advantageously used in place of distemper or oil painting, is performed by means of a composition made with two pints of skimmed milk, eight ounces of slaked lime, six ounces of linseed or nut oil, five pounds of Spanish-white, and two ounces of Burgundy-pitch. The pitch is to be slowly melted in the oil, by a gentle heat: then add to it the mixture of milk and lime, being careful that it be previously heated, so as to prevent the too sudden cooling of the pitch.

A substitute for the above resinous milk may be made by mixing 144 parts of very dry powdered skimmed-milk cheese, 7 parts of slaked lime, 240 parts of Spanish white, and 2 parts of finely-powdered charcoal, with 80 parts, by weight, of water.

X.—*On Expanding and Contracting Centre-bits; for Boring different-sized Circular Holes, through Wood-Boards, without wasting the pieces which are cut out, or employing more labour than is necessary. Invented by Mr.* JAMES STONE, *Mechanist.*†

WITH FIGURES.

SIR, *No.* 79, *Great Titchfield Street, London, March* 3, 1823.

HAVING invented an Expanding Centre-bit, for boring holes in wood, from about one inch to nine inches in diameter; and being advised, by many persons who have seen it, to lay it before the Society of Arts &c.; I request the favour of you to submit it to their consideration; as it will, in many cases, accelerate the business of carpenters and other workmen.

I am, Sir, your most obedient, humble servant,

To C. TAYLOR, *M.D. Sec.* JAMES STONE.

* From the *Encyclopédie Domestique.*

† From Vol. XXXI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce. And an additional Communication, from Mr. Stone to the Editor.

References to the Figures of Mr. Stone's Expanding and Contracting Centre-bits.

Figs. 3 & 4, of Plate II, explain two methods of constructing these centre-bits: that shewn by fig. 3 being intended to form very large holes, even as much as nine or ten inches in diameter; whilst that shewn in fig. 4, is for smaller holes; but the principal convenience of both is, that they can be set to any required size, within their limits.

The large instrument, fig. 3, consists of a straight bar of iron, AA, with a shank, B, projecting perpendicularly from its centre; and which is formed into a square, at its top, to be received into a stock or brace, in the manner of a common centre-bit. C, and D, are two cutters, which slide upon the bar AA; and may be fixed, at any distance from the centre-pin, F, by the screws EE, so as to regulate the diameter of the hole intended to be cut. The centre-pin, F, is screwed into the under side of the bar; and its square and sharp point projects some distance below the edges of the two cutters, C and D. The cutter C is also made rather longer than the other, D; and is formed into two sharp cutting edges, to prevent the wood from splitting up, and making an irregular hole; it cutting two parallel lines around the circle which the other cutter, D, follows in; and takes out the wood, between the lines.

The forms of these cutting edges are shewn, on a larger scale, in figs. 5 & 6; the latter shewing the two sharp scribing edges, made to cut the sides of the circular groove; and the other, the sharp, inclined, and hooked edge, which cuts up the wood between the sides of the groove, in the manner of a chisel.

Fig. 4, shews the construction recommended for smaller centre-bits; in which the shank, A, is swelled out, at its lower part, into a square piece D, large enough to have a mortise made through it, for the reception of two arms; which are bent down, at right angles, at their outer ends, and formed into two cutters, B and C; these arms lie beside each other in the mortise, and can be removed to and from the centre, to the size of the hole intended to be cut; both being at once bound fast in the mortise, by the screw D. The forms of the centre-pin E, and of the two cutters, are exactly like those already described.

Additional Particulars, of Improvements, since made by Mr. STONE, *in his Centre-bits.*

SIR, 18, *Warwick Street, Golden Square, Dec.* 13, 1823.

Understanding that you are about to publish an account of my Expanding Centre-bits in your Repository, and having made some alterations in their construction since they were described in the Transactions of the Society of Arts &c., I beg leave to submit them to your consideration.

They are as follow:—Instead of making the cross-bar, AA, square, I now give it a triangular form, with one of its angles turned downwards: and I find, that the cutters are kept much more firm by the binding screws acting upon the flat top of the bar, and drawing the two lower sides of the sockets into contact with the corresponding faces of the bar, than they were when fixed upon a square bar. In place of making the centre-pins tapering off to a square point, so as to make their own way through the wood to be cut, I now make them round, and nearly cylindrical; and previously bore small holes in the wood, to fit them: by which means, the larger holes are now bored with much greater precision than formerly, and particularly in wood that is knotty, or of an irregular grain. And, in lieu of making the cutters and sliding-sockets all in one piece, I now make them separate; and the sliding-pieces have square mortise-holes made through them, at right angles with those which slide on the cross-bar: and I can now, very conveniently, form the cutters out of small square steel rods, or bars, of a proper size; which are bound fast, in the upright mortise-holes, by means of screws. I can thus easily replace a cutter, when broken or injured, without having any occasion to make a new socket to it, as formerly; and with this additional advantage, that the cutters can be raised or lowered, according to the greater or lesser thickness of the wood to be bored; and, besides, both ends of the steel rods may now be formed into cutters.

In this improved construction, however, it becomes necessary that the centre-pin should be placed in the same line with the cutters on the side of the cross-bar.

I am, Sir, your most obedient servant,

T. GILL. *Esq.* JAMES STONE.

XI.—*On the Manufacture of Carbonate of Potash, Salt of Tartar, or Cendres Gravellées, in France.**

THIS salt, properly prepared, is made by burning dried wine-lees in an oven: but the same names are given to a product obtained from the calcination of the husks of grapes, after the making of wine, the scrapings of wine-casks, &c. Not contented, however, with employing such inferior substances for this purpose, they also generally add various others, to increase the weight, and deceive the consumer. Sand, or even brickdust, are frequently used for this purpose; and the fraud is now become so common, that *cendres gravellées* of a good quality are very rarely procured. It is still more to be regretted, that the greater number of persons who make use of it, from not understanding its nature, frequently fail in their operations, without suspecting the cause. In order to remove this evil, we must trace it to its source. Now, it is not the actual manufacturers of the *cendres gravellées* who are so much to blame, as those who furnish them with the original materials, and particularly the scrapings of tartar. To speak truly, however, this is chiefly owing to the cheap market they go to: and, in this point of view, the consumer is frequently the most to be blamed; although, in the end, he is the greatest sufferer. Nevertheless, M. Poutet, of Marseilles, has proposed a method of ascertaining—not the quality of the *cendres gravellées*, for this was furnished long since by Descroizilles—but the quality of the tartar, whatever may be its appearance. This process is

* From the *Dictionnaire Technologique*.

founded on the nature of this salt; which, as we know, contains an excess of acid. M. Poutet begins by determining how great a quantity of pure tartar may be saturated in a ley of pure soda at 6°: he then takes a sample of the tartar which he would assay, of the same weight; and saturates it in the same manner; then compares the proportions of the alkaline solutions employed; and thus establishes a comparison between the qualities of the two specimens. We may see that this process is an imitation of Descroizilles' method; and, perhaps, it would be more simple to calcine the specimen of tartar which we would test, and to treat the residuum in the manner of testing potash; that is, to measure the quantity of alkali it contains, by means of the alkalimetre. Whichever method be adopted, we are certain that either would tend to prevent fraud; as it may, by this means, be easily detected.

Most vegetable matters, when burnt, leave a residuum, termed *cendres* (ashes): this is usually composed of various substances, but principally of alkali, partly saturated by the carbonic acid; of different salts; and of various oxides. These ashes are extremely variable: sometimes the alkali predominates, at other times the salts; depending entirely upon the nature of the vegetable product which furnishes them. Amongst the substances whose ashes are the most rich in alkali, wine-lees hold the highest rank: these are almost entirely composed of tartar, which is deposited in the wine, in proportion as the alcohol is formed. Now, tartar, like all other salts whose acid is of a vegetable nature, may be decomposed by heat: its base, that is to say, the potash, which is fixed, remains combined only with the carbonic acid, which is one of the products of the decomposition of the acid; so that the ashes of pure tartar contain nothing but the sub-carbonate of potash, excepting, however, a very small portion of sub-carbonate of lime. This, in fact, is the means employed in pharmacy, and in laboratories, to obtain this salt in a state of purity. It is to this product that the name of the *alkali of tartar* is given. If the manufacturers of potash would content themselves by using lees of wine only for that purpose, it would always be of a good quality; because those substances which, with the tartar, form part of the lees, are nearly all destroyed by the heat: but it is far otherwise, when to the lees are added, as is commonly the case, the stalks, stones, and refuse of the grapes, as well as the tartar scrapings from the casks; and, of course, it is much worse when sand or brick-dust are mixed with it. When the *cendres gravellées* are manufactured in this way, they are far from answering the purpose intended; namely, to furnish a pure alkali, which shall constantly produce the same effects; instead of which, this is actually the worst of all: nevertheless, it is still continued, because recommended in the old recipes; and, also, because most of the persons who use it are ignorant that a good potash can be substituted for it.—The following is the method of manufacturing the *cendres gravellées*.

When wine-lees are employed, they should have been previously dried; which is easily effected, either by submitting them to a high pressure, when inclosed in bags; or, simply, by exposing them to the strong solar rays. In the first case, a vinous liquor runs from them, which serves to make vinegar; and, if distilled, affords a small quantity of brandy. The lees are known to be perfectly dry, when they break clean, and with a kind of snap: and in this state they are burnt, either in round temporary furnaces; or in a fixed furnace, the draught of which is from a door at the bottom: in fact, in some manufactories they use only common ovens; but, in all cases, the operation is begun by kindling fagots of vine-branches, so as to afford a very strong flame. The heat having been sufficiently raised, masses of well-dried lees are added, and allowed to burn, without being removed: but from time to time they throw on new masses; and continue to do so, till the oven or furnace is sufficiently filled, to complete the combustion. The residuum forms a porous light mass, which breaks easily; and, on cooling, which it is allowed to do in the furnace, assumes a greenish colour, mixed with blue, owing to the presence of a little manganese.

The *cendres gravellées*, when well prepared, should be almost entirely soluble; and only afford, according to Chaptal, a residuum of about a sixteenth part; three parts of which will be composed of earthy carbonates; and one part, nearly, of sulphate of potash. Assayed by the alkalimetre of Descroizilles, it marks from 70° to 75°. When the solution is saturated by an acid, it ought not to afford any precipitate. In fact, the nitrates of silver and barytes scarcely produce in it any sensible effect.

In order that the *cendres gravellées* may be fit for the principal uses for which they are intended, and more particularly for dyeing, it is also requisite that the solution in water should be colourless; as, otherwise, its own colouring matters would combine with that intended to be obtained, and, necessarily, change its shade. This inconvenience takes place, especially, when the ashes have not been sufficiently burnt; that is, when they still contain any vegetable matters which have not been completely destroyed by the heat; and then they exhibit black spots, on being broken.

Thus, as I have before stated, it is of importance that the *cendres gravellées* used in the Arts should always be of the best quality. In general, when they are dissolved in water, they afford a considerable residuum: and if the solution is saturated by an acid, a very thick *magma* is formed, owing to the silex contained in the sand added to it before calcination. In fact, so far from possessing its proper qualities, it frequently produces results entirely opposite to those intended.

XII.—*On the Culture of the Cameline* (*Myagrum sativum*, Linn. *Gold of pleasure*).

The Cameline is a plant of the order Cruciferæ, cultivated largely in France, on account of its seed, from which an oil is extracted, not unlike rape-oil. This is sometimes used in painting, but more frequently in the manufacture of black soap, and for lamp-oil.

Land of an inferior quality suits the Cameline: it only requires moisture in the early part of its growth, and attains to complete maturity in three months after sowing; which circumstances render the cultivation of this article of much importance. The seed of the Cameline only retains its germinating faculty for one year: it is so small, that sand is mixed with it, for the purpose of spreading it on the land: a kilogramme of seed is sufficient to sow an acre of ground. The earth is turned up twice, and harrowed, to prepare it for the reception of the seed. When the plants spring up in too thick tufts, they must be thinned, so as to leave about six inches' space round each tuft. The seed is collected, for expressing oil from it, when the plant becomes yellow: that intended, however, to be preserved for seed, is left to ripen perfectly. The seed is beaten out of the husks with a staff or flail, and kept dry for a month, when it is put into a pressing-mill, in order to extract the oil in the usual manner. This oil is known, in commerce, by the improper name of *Oil of Camomile*, or *German Essence.* The stalk is only fit for fuel.

XIII.—*On securing the Scion to the Stock, in Grafting. By* David Powell, *Esq. In a Letter to* Charles Holford, *Esq. F.H.S.**

My dear Sir, *Loughton, Essex, Jan.* 13, 1822.

Having, for the last three seasons, found great convenience in a method of *securing the scion* in grafting, which, I believe, has not hitherto been much practised; and knowing the interest you take in any thing that relates to the garden; I beg the favour of you (if, on perusal, you think it worthy of attention) to communicate this account of it to the Horticultural Society.

* From Vol. V. Part III. of the Transactions of the London Horticultural Society.

It is simply this:—Grafting-wax, properly prepared when in a melted state, is spread evenly on sheets of moderately thin brown paper; which, when cold, is cut into slips, about three quarters of an inch wide.

When one of these slips is to be used, warm it with the breath, and bind it round the stock and scion; when it will be found to adhere so closely, as totally to exclude both air and moisture. No further trouble is necessary; though it may be as well to look over the grafts occasionally, pressing the paper close with the hand, where it may have before been missed; but after a few days' exposure to the warmth of the sun, it will generally be found adhering so closely, as to want no further attention. I have usually secured the whole by a small band of bass; but, in several instances, have found the strength of the paper sufficient to sustain the scion in its place. With the advantage of avoiding any unequal pressure upon the bark, the neatness and convenience of this method will, I doubt not, recommend it to the practice of amateurs; and I have equal confidence that its cheapness and utility will secure it a favourable reception with practical gardeners.

I shall be much gratified to find my communication thought useful; and be indebted to you for the chance of rendering it more known.

I remain, Dear Sir, yours truly,

DAVID POWELL.

POSTSCRIPT.

The grafting-wax recommended by Miller, and also in the several *Cyclopœdias*, under the head of Grafting, is composed of the following materials, with trifling variations as to proportion. I have used the following; viz.

Pitch	1lb.
Rosin	1lb.
Bee's-wax	½lb.
Hog's-lard	¼lb.
Turpentine	¼lb.

Melted, and well mixed together.

By placing the composition in an earthen pan, over boiling water, it may be kept in such a state of fluidity, as to be easily spread on the paper, with a brush: heated in this manner, the wax appears to retain its pliability much better than when exposed more immediately to the action of fire.

I have the pleasure to hear, from a practical gardener who tried the above method last season, that he found it answer completely; except in an instance where he had been over-sparing in material:—a hint, that the wax should be spread evenly on the paper, and not too thinly.

XIV.—*Remarks on Zinc Furnaces. By a* CORRESPONDENT. *With the* EDITOR'S *Observations thereon.*

SIR, *Falmouth, Dec.* 15, 1823.

IN the 23d Number of your useful Repository, you have spoken favourably of a new Chemical Work, which has been lately published at Glasgow. I have seen nothing of the book, but the extracts which you have given; and cannot, therefore, judge of the value of the whole: but I wish to make an observation on one of the processes, which may be useful to the young chemist, who may be induced to follow the directions of the author, in trying the experiment, and may find himself disappointed in the result: and as the object of your work is to instruct, and not to mislead your readers, you will, perhaps, have the goodness to insert it in your next Number.

The experiment to which I allude, is, "To obtain metallic zinc from its ore."—If zinc could be so easily reduced to its metallic state as the author supposes, spelter-makers would not erect such expensive works, to procure this metal from its ore by distillation in close vessels; but would smelt it in a common reverberatory furnace. The author did not recollect, that zinc is a *volatile metal;* and that the heat, which is necessary to reduce it from its ore, is sufficient to volatilize the whole of it. The fact is, that not a particle of that metal will be found in the vessel in which the author directs the experiment to be made. But if the mixture there mentioned (omitting the lime, which is useless) be put into a small earthenware retort, and exposed to an intense heat, the greatest part of the zinc, which was contained in the ore, will be condensed in the neck of the retort.*

As I have entered on this subject, I will make a few observations on the late Mr. Sheffield's "Improved apparatus for extracting zinc, or spelter, from its ores," described in your 2d Number.

The spelter-pots, for which Mr. S. took out a patent, look very well in a theoretical point of view, but will not answer in practice, for the following reasons. In the first place, the tubes in the inside of them occupy so much room, particularly Fig. 3*; and will consequently diminish the capacity of the pot so much, that the produce of the charge cannot possibly pay the expense. Secondly, the tube will render it impossible to remove the refuse of the charge, a part of which occasionally adheres very firmly to the pot: indeed, if the tube were not there, the charge could not be taken out through the hole in the top. In the spelter-works, the old charge is removed through the hole in the bottom of the pot, as they find it impossible to get rid of it in any other way. Thirdly, I object to them, because they will not facilitate the working-off of the charge, which was the object that Mr. S. had in view. I speak this from experience, having tried some pots very similar to Mr. S.'s, about twenty-six years ago, in a large spelter-furnace. My object being, then, to procure zinc from the *blende* of this county, in the least expensive way, I tried many experiments; but I found no pots answer the purpose so well as those which are commonly used by the spelter-makers. These pots are 3 feet 6 inches high, 3 feet in diameter at the top, and 2 feet 2 inches at the bottom; the charging-hole at the top being 9 inches, and the hole in

* The nose of which should be immersed in water.—EDITOR.

the bottom 6 inches in diameter. A furnace contains six of these pots; and the charge for them is 18 cwt. of ore, which is worked off twice a week. The produce of a charge, if the pots have been carefully attended to, ought to be from 6 cwt. to 6½ cwt. of zinc.

The furnaces described in Mr. Sheffield's specification are, in my opinion, still more objectionable than his pots. In making spelter, the pots must be frequently, and carefully, examined; for a very small crack will occasion a great deficiency in the produce; and the furnaces are so constructed, that every part of the pots may be seen, and consequently the cracks in them may be easily discovered, and mended: but in Mr. Sheffield's furnaces, it will be impossible to find the cracks, or to mend them: in their construction, as may be easily seen from the engravings, there is no provision made to remedy any defects which may occur during the process: if they crack, which often happens on the first application of heat, they cannot be made sufficiently impervious to zinc, when it is intensely heated, so as to yield a good produce; indeed, I am doubtful, if they were to remain sound, whether a sufficient degree of heat could be raised in them, to answer the purpose for which they were intended; for the heat necessary to work off a charge, is equal to the greatest that can be raised in a glass-house furnace.

I hope soon to have leisure to complete, and send you, the account of the method of smelting zinc, with drawings of the furnace and apparatus, which I promised you; and which will illustrate the subject I have ventured to discuss.

I am, Sir, your obedient servant,

T. Gill, *Esq.* R. E.

P.S. When are you going to give us some instructions on the interesting and fashionable art of *turning*?

Observations by the Editor.

We are always obliged by the *candid* remarks of any of our Correspondents, upon any actual or seeming defect in the information we are enabled to lay before our Readers; and, particularly, for those of our esteemed Correspondent R. E., to whom we are before indebted, for his excellent article "*On enabling artists to make and rectify their own nitrous acid,*" published in our Third volume p. 300; and, accordingly, thank him for the observation on the necessity of extracting zinc from its ores in closed, vessels.

We are sorry, however, that we cannot agree with him in his remarks upon the late Mr. Sheffield's vessels and furnaces for the same purpose; and the rather, as we are in possession of part of a large ingot of pure zinc, which was actually produced from a pot similar to that shewn in Fig. 3. Plate VII. of our First volume, under the management of Mr. Charles Sheffield, his son; and who, notwithstanding that, a crack did take place in the vessel (which he found the means of speedily stopping), conducted the operation to a successful close, at Mr. Sheffield's smelt-mill, near Cromford, in Derbyshire. And we have every confidence, that, had it pleased the Almighty to have extended Mr. Sheffield's life to a longer period, he would have proved the excellence of his patent compound-furnaces also.

Mr. Charles Sheffield is now engaged, as a mineralogist, under the Pasha of Egypt, in exploring the mineral treasures of that little-known country; and we have no doubt, that, on his return home, he will be perfectly able to satisfy us, and our Readers, of the entire fitness of his late father's zinc-furnaces (the results of his long acquaintance with the science of metallurgy, as practised in Germany as well as in this country) to effect their intended purposes.

We need not add, that we shall be much gratified in receiving our Correspondent's promised communication on smelting zinc; which, judging from his former article, cannot fail to be highly valuable.

XV.—*On the Manufacture of Ceruse, Krems-White, or White-Lead; and, particularly, of the celebrated Ceruse of France.**

Ceruse, or *White-lead*, is the *sub-carbonate of lead* of the Chemists †. This preparation is chiefly used in painting wood, or other articles, white. As it easily mixes with oil, and preserves its colour well, it is spread with facility by the brush, and affords a good body of colour, on whatever substance it is applied. It is either employed alone, as a colouring matter, or mixed with other colours, as well to brighten them, as to give them body. Ceruse is manufactured in various ways, in different countries. England and Holland, for a long time furnished commerce with this article; but establishments for the manufacture of it have been singularly multiplied within a few years; and there now exist a great number of them, in Germany, in the Netherlands, and in France. Marcel de Serres has given us an exact description of the process followed in Germany; and we cannot do better, than to copy it literally, for the information of our Readers. We shall afterwards point out the different modifications of the process, as used in other countries, particularly the new process adopted in France; and terminate the article by giving some general observations on Ceruse.

Krems-white has been so named, from the place where the first preparations of this colour were made: but, for some years past, the manufactories, which formerly existed there, have ceased working; and the finest manufactory of this article is situated at Klagenfurt, in Carinthia. This manufactory belongs to Baron Herbert: it ismuch more considerable than that at Feldmuhl, which belongs to Baron Leykam; or even than that at Vienna.

The town of *Krems* being much less known to the che-

* From the *Dictionnaire Technologique*.

† The common *ceruse* is frequently adulterated by the admixture of foreign matters; such as, lime, sulphate of barytes, &c.; but *pure ceruse* will not admit of any of these mixtures, without detection.

mists and mineralogists than *Kremnitz* in Lower Hungary, they have often, by mistake, termed this preparation *Kremnitz-white*, although it has never been manufactured at all in the latter place.

In order to give an exact idea of the method used by the Germans in preparing *Krems-white*, we will describe the various operations used in their processes.

FIRST OPERATION.

The lead used in all the manufactories of *Krems-white* is brought from Bleiberg, near Willach, in Carinthia. This lead is very pure, and does not appear to contain any oxide of iron,—a quality most essential to the beauty of the white. It is easy to judge of the advantages which the manufacture of Klagenfurt possesses over all the others, in having this pure lead so near at hand. The lead is melted in the common melting-pots; and then formed into leaves of various thicknesses, according to the manufactories. In order to make these leaves, the fused lead is poured upon a plate of cast-iron, with raised edges, placed above the pot; and as soon as the surface of the metal begins to consolidate, the iron plate is a little inclined: the lead which remains fluid then falls back into the melting-pot; and that which has set, or becomes solid, remains, and is raised up like a sheet of paper. The workmen, being careful to cool the plate, from time to time, with water, may easily cast many quintals of lead in a day. The leaves of lead vary both in size and thickness. In some manufactories, they are half-a-line * thick; and in others, scarcely a quarter. In certain manufactories, one of these leaves will entirely fill the box used in the succeeding process; whilst, in others, four will be required for that purpose. It is essential that the surfaces of the leaves should not be smooth; for it is evident, that a rough surface is easily attacked by acid vapours, whilst an even one presents fewer points of contact.

* A line is the twelfth part of a French inch, and rather exceeds the tenth part of an English inch; eleven English tenths of inches being nearly equal to the French inch.

SECOND OPERATION.

The formation of the leaves being thus accomplished they must then be so disposed, as to be easily attacked by the acids: for this purpose, they bend the leaves, and suspend them over pieces of square wood, the width of the boxes in which they are to be placed: these leaves, thus suspended by the middle, resemble the leaves of a book; and are placed, with the pieces of wood supporting them, in wooden boxes. The size of these boxes is nearly the same in all the manufactories: their length is about four-and-a-half or five feet; their width from a foot to a foot and two inches; and their depth from nine to eleven inches. These boxes are made very strong: they are always careful to secure them by mortises; and to observe that the nails, with which they are fastened, do not project through the sides of the wood. They never totally close these boxes, with the leaves of lead in them; but cover their bottoms with a coating of pitch about an inch thick. These boxes are, however, luted with paper, in those manufactories where the stoves are heated by smoke; for we well know how hurtful the vapours of sulphuretted and phosphuretted hydrogen gas are to white colours, and how quickly they attack the oxides of lead. In Carinthia, they formerly used, as well as in Holland, to form the leaves of lead into coils, and place them, thus coiled up, in the boxes: but this method does not appear to be advantageous; because it is evident that these coils present less surface to the action of the acid vapours, and they often fall into the liquid at the bottom of the boxes; which ought to be carefully avoided, because the carbonate of lead then formed is never white. The leaves, thus bent, and suspended on the pieces of wood, are placed in the boxes, so as to be at the distance of about two-and-a-half inches from the bottom. They are very careful that the leaves of lead do not touch each other, nor the wood of the boxes; for if they were to touch, the vapours could not so easily corrode them; and if they touched the wood, the carbonate of lead would be discoloured, and its whiteness injured. Previous to placing the leaves of lead in the boxes, they put in a mixture; which is not, however, the same in all the various manufactories: the proportions of this mixture being, in some, equal parts of vinegar and the lees of wine; whilst, in others, they use a mixture of twenty pounds of lees of wine, eight pounds and a half of vinegar, and one pound of carbonate of potash. It is evident, that, in those manufactories where carbonate of potash is not used, nor smoke employed to heat the boxes, it is not requisite to lute them; and that in those, on the contrary, where carbonate of potash and smoke are used, there is the greatest necessity for so doing: so that, in different manufactories, things which are the most opposite are recommended, and for very obvious reasons.

THIRD OPERATION.

The mixture being poured into the boxes, and the leaves of lead deposited in them, they place the boxes in a particular kind of stove; in which, by the means of heat, the vapour of the mixture which was put into the boxes, in rising, corrodes the leaves of lead, and forms a carbonate. The stove is usually heated by two furnaces; seldom contains more than ninety boxes; and has only one opening, which is used as a door. Although it is not very important to give the exact size of these stoves, nevertheless, as faithful narrators, we should mention, that the one measured was nine feet high, four toises wide*, and five toises long.

The heat must never be raised above thirty degrees†, and is generally continued about a fortnight; at the end of which time the operation is terminated. If the heat be too strong, and the vapours too thick, a great part of the carbonic acid escapes: and the lead being less attacked by these vapours, the produce of carbonate of lead is much less considerable.

When the operation has been well conducted, an equal

* The toise is equal to 76,734 English inches.
† Or 86° of Fahrenheit.

quantity of carbonate of lead, by weight, will be obtained, as of the lead which had been employed: thus, if three hundred pounds of lead be put into the boxes, the same quantity of carbonate of lead will be formed; as, when the crust of carbonate of lead is completely collected, a small quantity of lead will be found, which must be fused afresh, to form new leaves. The mixture, which is put into the boxes to form the carbonate of lead, will only serve once: and when, as in many manufactories, potash enters into the mixture, the residuum is sold to the hatters.

FOURTH OPERATION.

When it is presumed that the preceding operation is terminated, and that the leaves of lead have been properly corroded, they are removed from the boxes: they will then have become a quarter of an inch in thickness, or even more; whereas, in the first instance, they did not exceed the thickness of a quarter of a line. Rather large-sized crystals of acetate of lead are frequently observed on the edges of these leaves.

When the leaves of lead are removed from the boxes, they must be well beaten, in order that the crust of carbonate of lead, which is formed on their surfaces, may be removed. The carbonate of lead, thus obtained, is then put into large vats; where it is purified, by means of washing-over. Whenever it happens that there are any small pieces of lead found remaining in the boxes, they are washed in water, in order to dissolve and separate the acetate of lead which may adhere to them.

The manner of washing-over the carbonate of lead is very simple, and resembles a great number of other prosesses of this kind. For washing-over the carbonate of lead, they use a large wooden vat, generally of a square form, and divided into seven or nine compartments, which are all equal in size; but the partitions between them vary in height; so that, when the first or highest compartment is full, the water flows into the seoond, and so on. The water which flows into the first compartment passes successively into the others; and the workmen being careful to keep it always in motion, it successively deposits the ceruse which it carries along with it; the precipitates of white lead, which are found in the furthest compartments, being, successively, the finest and lightest. When the white lead has been thus washed over, it is deposited in other large vats; where it receives a second washing, and in which it is kept constantly under water. It is necessary to observe, that when the carbonate of lead is washed with water, a white scum always rises, and floats on the surface: this appears to be a kind of acetate of lead. In order to precipitate the small quantity of carbonate of lead found in solution, a little potash is added, and the carbonate instantly precipitates. This phænomenon, however, merits a more accurate observation. The carbonate of lead, purified by the washings to which it has been subjected, and remaining in the vats, would always preserve the consistence of a liquid paste: but, for convenience in commerce, it is always removed from the vats with wooden spatulas, and placed upon the drying-stages. When it comes into contact with the air, it very soon acquires the consistency of a soft paste; in which state it is put into moulds, in order that it may assume the form in which it is generally found in commerce.

All the carbonates of lead sold in commerce are nearly of the same quality; provided that no other substances are added to them; and, more particularly, if those which appear of the finest white, and are the most pure, be not separated from them. The varieties of carbonates of lead, bearing different names, are thus regulated.

First quality.—The carbonate of lead found in the last, or lowest department, is the finest. When carefully prepared, this is designated, in Germany, by the name of *Kremserweiss*, or *Krems-white*: it is likewise known by the name of *silver-white*. It is used by the apothecaries, and artists, for the most delicate purposes. Sometimes, however, a carbonate of lead, which remains floating a considerable time, is still whiter. This *Krems-white*, of the first quality, is entirely pure; and it is never mixed with sulphate of barytes, like those of inferior qualities; so that it may be regarded as a pure carbonate of lead.

Second quality.—This second sort is formed by mixing equal parts of sulphate of barytes with carbonate of lead: it is known, in Germany, by the name of *Venerianerweiss, Venice-white.*

The sulphate of barytes used in Germany, in the manufactories of carbonate of lead, is generally brought from the Tyrol; because, perhaps, it does not contain oxide of iron; but sometimes they obtain it from Styria. The ferruginous oxide, which may be contained in sulphate of barytes, is very prejudicial to the beauty of the white-colour, so much desired; and especially when the sulphate is calcined, which is done for the purpose of pulverizing it the more readily: and the calcination particularly discolours that from Styria, on account of the oxide of iron which it contains; whilst that from the Tyrol still remains white. In some manufactories, however, where they have perceived this inconvenience, they now cease to calcine the sulphate of barytes.

Third quality.—This third sort is formed by mixing two parts of sulphate of barytes with one of carbonate of lead: it is known in Germany by the name of *Hollanderweiss, Dutch-white.*

These various kinds of white are generally made according to the proportions we have described: however, for the manufacture of a very cheap article, they mix seven parts of sulphate of barytes with one of carbonate of lead: this white, nevertheless, always bears the name of *Dutch-white*, but is rejected for delicate painting. It is convenient that white lead should sometimes be mixed with sulphate of barytes; and for this simple reason, that it gives it more opacity; a convenience, however, which can only exist in the painting of the less-delicate pictures; as in the most-delicate paintings, its transparency is rather an advantage than otherwise.

[*To be continued.*]

XVI.—*On the Comparative Advantages of employing Band-wheels, Spur-wheels, and Bevel-wheels, in Machinery. By Mr.* JOSEPH BACKWELL, *Engineer.*

SIR, *London, Dec. 20, 1823.*

I BELIEVE that the difference in the friction between band-wheels, spur-wheels, and bevel-wheels, has never been ascertained from actual experiment; at least, I am not acquainted with any publication on this interesting subject. The following results, which I obtained from an experiment made on purpose, will contribute, in some degree, to point out the very great advantages, and disadvantages, attending the employment of these different methods of actuating machinery. Two band-wheels of equal diameter, and mounted upon horizontal shafts 15 feet asunder, were driven by a leather band or strap, one inch broad; and I found, that, by suspending a weight of four pounds to a line passing over a pulley, I could overcome the friction, and put them into motion. Two equal-sized spur-wheels, of cast-iron, with their teeth pitched, and dressed or trimmed, in the usual manner, and working into each other, at the same velocity as the two band-wheels, required five pounds weight to keep them in motion. On fitting two bevel-wheels, of cast-iron, also of equal diameters, upon two other shafts, they required a weight of seven pounds to give them a similar velocity with the others: and thus, the spur-wheels required one pound more to put them into motion than the strap- or band-wheels did; and the bevel-wheels, three pounds more.

I connected other and similar machinery to these shafts; and found the same proportional weights requisite to overcome the friction, and to put them into motion, as when they ran empty.

Of course, with other proportions, or differences in the diameters of the two wheels, the results would vary: still, the above may serve to shew the comparative advantages of employing band-wheels, in preference to spur-geer; and spur-geer in preference to bevel-geer, where we have it in our power to make an election: and, in fact, *wherever bevel-geer can be dispensed with, they ought never to be employed.*

Being now engaged to go abroad as a Civil Engineer, I have it not in my power to extend these experiments in this country: but should any opportunities, in my professional employments abroad, occur, of enlarging my experience therein, I shall not fail to communicate the results to you. In the mean time, I hope that some others, and more competent persons, will pursue this subject,—which is of so much importance, in this as well as in all other countries, where machinery is extensively employed,—and publish the results for the benefit of the community.

I am, Sir, your obedient servant,

T. GILL, *Esq.* JOSEPH BACKWELL.

XVII.—*Queries on Smethurst and Paul's Lamps;—On the Manufacture of Oil-Gas;—and on making Soda-Water. By Mr.* WILLIAM SAUNDERS.—*With Remarks by the* EDITOR.

SIR, *Jersey, Nov.* 20, 1823.

YOU would greatly oblige me, by inserting, in the succeeding Number of your Repository, the address of the Manufacturers of Smethurst and Paul's Lamps;—with information on the manufacture of Oil-gas, or a description of the necessary apparatus for that purpose, where a very few lights are necessary;—also, an easy method of obtaining good Soda-water.

The above are desiderata with a small circle of your Readers here. Perhaps the common fountain of the shops would answer the latter purpose, if its construction were made known.

I am, Sir, your obedient servant,

T. GILL, *Esq.* WILLIAM SAUNDERS.

Remarks by the EDITOR.

In reply to the first of the above Queries, we believe, that, although the principles of Mr. Paul's Lamps and

Reflectors are now pretty generally adopted, yet that the articles themselves are no where to be met with.

A good apparatus for the economical manufacture of Oil-gas, *on a small scale*, is yet, we believe, a desideratum: it is highly deserving of attention; and we shall be happy in being able to obtain, from any of our Readers, a good description of such an invention.

We are in possession of some valuable information on the subject of *making Soda-water on a large scale*, which we intend hereafter to lay before our Readers. In the mean time, we shall be glad to be favoured with any particulars relating to the construction of the soda-fountains of the shops.

XVIII.—*Queries on Sowing the Seeds of the Sugar-Beet; and on ascertaining that variety of it known in France by the name* Disette. *By* J. W. FORSYTHE, *Esq.*

SIR, *Bromyard, Herefordshire, Nov. 28, 1823.*

IN Nos. XIX & XX of your valuable Technical Repository, you have given an account of the mode of cultivation and treatment of the *Beet-root* in France, for the purpose of extracting sugar, and for the feeding of cattle. In that account, it is stated that the seed is sometimes deposited by means of a *sowing-machine*, drawn by a horse.

Allow me to beg that you will give, in an early Number, the *plan* and *construction* of the Sowing-machine; which would be of inestimable benefit to the agriculturists of this kingdom; inasmuch as it also would enable them so to deposit the seeds of the *Mangel-wurzel*. This has hitherto, I believe, never been accomplished by any machine; and the want of such contrivance very much impedes the cultivation of that excellent root.* I sincerely hope that, by your means, this difficulty may be obviated.

* Possibly, mixing its minute seeds with saw-dust and marl (as recommended for sowing carrot-seed, in the excellent communication on the culture of carrots by W. W. Mason, esq. contained in our present Number) might be sufficient to render them capable of being sown by the common sowing-machine.—EDITOR.

Permit me also to inquire, whether the variety of Beet termed *Disette* be the same as our *Mangel-wurzel*.

I am, Sir, your obedient servant,

T. Gill, *Esq.* J. W. Forsythe.

We, in common with our worthy Correspondent, shall feel obliged to any of our Readers who, from a residence in the neighbourhood of Paris, may be able and willing to afford us the necessary information on these interesting points.

XIX.—*On the Hydraulic Engine, constructed at Augsburg, by the celebrated Mechanic* Reichenbach.

WITH A PLATE.

We have re-published this Engraving, from Dr. Dingler's Polytechnic Journal, published at Stuttgart. It consists of a Plan and Elevation of a Cast-iron Water-undershot-Wheel; which works four pumps by one crank only; and elevates water to a reservoir, placed sufficiently high for it to flow down, by its own natural tendency, for the supply of the city. We shall give additional Plates of this machine in our succeeding Numbers, with enlarged views of those parts which require it; which will display no small mechanical knowledge in their construction: and shall defer the necessary References thereto, until all the Plates shall have been given.

We learn that this celebrated mechanic and astronomical instrument-maker is now engaged by the Emperor of Austria to superintend the Imperial Arsenal at Vienna;—he having invented a new method of boring cannon.

(*To be continued.*)

XX.—*Improvements in using Magnifying-Glasses.* By B. Bevan, *Esq. Civil Engineer.*

Sir, *Leighton Buzzard, Dec.* 19, 1823.

Many persons find it necessary, occasionally, to make use of a *magnifying-glass*; in the use of which, it is desirable to find, without much loss of time or distress to the eye, the proper focal distance: and it often happens, that a partial use of the hand, required to support the lens, is wanted for other purposes.

I have, for many years, adopted a simple mode of supporting a common pocket-lens, which satisfactorily provides for both the said requisites: and, as you do not despise a useful instrument *because it is simple and cheap*, I shall offer it to your Readers.

In the first place, I take a common pocket-lens (to be procured at any optician's, for two or three shillings, according to the manner of mounting it), and drill a hole through the centre of each side of the horn or tortoiseshell case, about the tenth of an inch in diameter; into which I insert a slender spindle of wood, about the size of a small quill, cut to a proper length to suit the focus of the glass, and also a little tapering at the end. This very simple mode of mounting the glass, adjusts the focus at once to the object; allows a partial use of the hand that supports it, for other purposes; and leaves the other hand at full liberty, for any operations that may be required.

If the free use of both hands is required, this also is provided for, by the small and cheap addition of a pedestal; consisting of a piece of wood, of any kind, about two inches square, and half an inch thick; with a hole made through its centre, to receive the lower end of the said spindle of wood, which must also be made tapering.

In operations of the sliding-rule, this mode of supporting the lens is very convenient; as it allows the left-hand, which holds the spindle, also to keep steady the stock of the rule; whilst the right-hand is free, to move the slide; and the eye is kept upon the magnified divisions, during the time of adjusting the slide.

I have used lenses of two inches, or less, focal length; but

I find one of five or six inches more generally useful, on account of the larger field brought into view.

I am, Sir, yours truly,

T. GILL, *Esq.* B. BEVAN.

XXI.—TABLES OF CANDLE-LIGHT: for Mean Time.

By B. BEVAN, *Esq.**

DAY.	JANUARY.		FEBRUARY.		MARCH.	
	End Morning.	*Begin* Evening.	*End* Morning.	*Begin* Evening.	*End* Morning.	*Begin* Evening.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	7 .. 31	4 .. 38	7 .. 7	5 .. 21	6 .. 17	6 .. 9
2	7 .. 30	4 .. 38	7 .. 5	5 .. 23	6 .. 15	6 .. 11
3	7 .. 30	4 .. 40	7 .. 4	5 .. 24	6 .. 12	6 .. 12
4	7 .. 30	4 .. 41	7 .. 3	5 .. 25	6 .. 10	6 .. 14
5	7 .. 30	4 .. 42	7 .. 1	5 .. 27	6 .. 8	6 .. 16
6	7 .. 30	4 .. 43	6 .. 59	5 .. 29	6 .. 7	6 .. 17
7	7 .. 30	4 .. 43	6 .. 58	5 .. 32	6 .. 4	6 .. 18
8	7 .. 30	4 .. 44	6 .. 56	5 .. 34	6 .. 2	6 .. 20
9	7 .. 29	4 .. 45	6 .. 55	5 .. 35	6 .. 1	6 .. 22
10	7 .. 29	4 .. 47	6 .. 54	5 .. 36	5 .. 58	6 .. 24
11	7 .. 28	4 .. 48	6 .. 52	5 .. 38	5 .. 55	6 .. 25
12	7 .. 28	4 .. 50	6 .. 50	5 .. 40	5 .. 53	6 .. 27
13	7 .. 27	4 .. 51	6 .. 48	5 .. 42	5 .. 51	6 .. 29
14	7 .. 26	4 .. 52	6 .. 47	5 .. 44	5 .. 49	6 .. 31
15	7 .. 26	4 .. 54	6 .. 45	5 .. 45	5 .. 46	6 .. 33
16	7 .. 25	4 .. 55	6 .. 43	5 .. 46	5 .. 43	6 .. 35
17	7 .. 24	4 .. 56	6 .. 41	5 .. 47	5 .. 41	6 .. 37
18	7 .. 23	4 .. 58	6 .. 39	5 .. 49	5 .. 38	6 .. 38
19	7 .. 22	5 .. 0	6 .. 37	5 .. 51	5 .. 36	9 .. 40
20	7 .. 21	5 .. 1	6 .. 35	5 .. 53	5 .. 34	6 .. 42
21	7 .. 20	5 .. 3	6 .. 33	5 .. 55	5 .. 31	6 .. 43
22	7 .. 19	5 .. 5	6 .. 31	5 .. 57	5 .. 29	6 .. 45
23	7 .. 18	5 .. 6	6 .. 29	5 .. 59	5 .. 27	6 .. 47
24	7 .. 16	5 .. 8	6 .. 27	6 .. 1	5 .. 25	6 .. 49
25	7 .. 15	5 .. 10	6 .. 24	6 .. 2	5 .. 22	6 .. 50
26	7 .. 15	5 .. 11	6 .. 22	6 .. 4	5 .. 20	6 .. 52
27	7 .. 14	5 .. 12	6 .. 20	6 .. 6	5 .. 18	6 .. 54
28	7 .. 12	5 .. 14	6 .. 19	6 .. 7	5 .. 15	6 .. 55
29	7 .. 10	5 .. 16			5 .. 13	6 .. 57
30	7 .. 9	5 .. 18			5 .. 11	6 .. 59
31	7 .. 8	5 .. 20			5 .. 8	7 .. 0

* Continued from Vol. IV. p. 266.

XXII.—*Queries, On Tinning Looking-glasses; On Ebony; On Grinding, Polishing, and Colouring Fluor-spar, and Derbyshire Petrifactions; and On Raising Weights.* By A Correspondent.—*With Remarks thereon by the* Editor.

Sir, *Woburn, Bedfordshire, Dec.* 18, 1823.

Having been a purchaser of your valuable Publication, the Technical Repository, from its commencement; I should feel extremely obliged, in your next, or some early Number, by an answer to the following subjects.

1. The best method of tinning or silvering looking-glasses?

2. The promised article on Ebony, and its use in the Arts, from the *Dictionnaire Technologique.*—See p. 346, Vol. III.

3. The best methods of grinding, polishing, and colouring Fluor-spar, and the Derbyshire Petrifactions?

Lastly; The *most simple* method of raising weights, of one to ten tons, to moderate heights; say 50 or 100 feet?

Trusting that these Queries are not foreign to the plan laid down for your work; (as I have not, in the limited works that I have perused, seen any thing sufficiently near to the purpose, and knowing with what minuteness you describe the various interesting articles which you present to the public;) I am induced to make this application.

T. Gill, *Esq.* W. B.

Editor's *Remarks upon the following Queries.*

The art of tinning or foliating plane-mirrors or looking-glasses has been often well and sufficiently treated upon, in many works; leaving hardly any thing new to be said upon the subject. A curious effect has, however, been experienced, in those Establishments where the same square leaden weights have been long used; namely, that of the lead absorbing a very considerable quantity of mercury; whereby they have become greatly increased in weight, although at the same time somewhat brittle, and subject, occasionally, to have their corners broken off.

The promised article on Ebony shall be given, as soon as we receive it.

With respect to the best methods of grinding, polishing, and colouring Fuor-spar, and the Derbyshire Petrifactions, we shall bear them in mind, and treat upon them hereafter. In the mean time, we shall be glad to receive any practical information thereon, from such of our Readers as may be qualified to afford it.

The last query, On the *most simple* method of raising heavy bodies, 50 or 100 feet high? is one of considerable difficulty; and, to answer it fully, would require the talents of the greatest Mechanics of the present day. We invite communications upon this important subject.

XXIII.—LIST OF PATENTS FOR NEW INVENTIONS, *which have passed the Great Seal, since Nov.* 24, 1823.

To Joseph Bourne, of Denby, in the County of Derby, Stone-Bottle Manufacturer; for certain improvements in the burning of Stone-Ware and Brown-Ware in kilns or ovens, by carrying up the heat and flame from the furnace or fire below, to the middle and upper parts of the kiln or oven, either by means of flues or chimneys in the sides thereof, or by moveable pipes or conductors to be placed within such kilns or ovens; and also, by increasing the heat in kilns or ovens, by the construction of additional furnaces or fires, at the sides thereof, and to communicate with the centre or upper parts of such kilns or ovens; and also, by conveying the flame and heat of one kiln, or more, into another or others, by means of chimneys or flues, and thus permitting the draft and smoke of several kilns or ovens to escape through the chimneys of a central kiln or oven, of great elevation; whereby the degree of heat is increased in the several kilns or ovens, and the quantity of smoke diminished. Dated Nov. 24, 1823.—To be specified in two months.

To John Slater, of Saddleworth, in the County of York, Clothier; for certain improvements in the Machinery or

Apparatus to facilitate or improve the operation of cutting or grinding Wool, or Cotton, from off the surfaces of Woollen Cloths, Kerseymeres, Cotton Cloths, or Mixtures of the said substances; and for taking or removing Hair or Fur from Skins. Dated Nov. 22, 1823.—In two months.

To Thomas Todd, of Swansea, South Wales, Organ-Builder; for his improvement in producing tone upon Musical Instruments of various descriptions. Dated Nov. 22, 1823.—In six months.

To Samuel Brown, of Windmill Street, Lambeth, in the County of Surrey, Gentleman; for an Engine, or Instrument, for effecting a Vacuum; and thus producing Powers by which water may be raised, and Machinery put in motion. Dated Dec. 4. 1823.—In six months.

To Archibald Buchanan, of Catrine Cotton-Works, one of the partners of the house of James Finlay and Company, Merchants, in Glasgow; for an improvement in the Machinery heretofore employed in Spinning-Mills, in the Carding of Cotton and other Wool; whereby the top-cards are regularly stripped and kept clean, by the operation of the machinery, and without the agency of hand-labour. Dated Dec. 4, 1823.—In four months.

To Josiah Parkes, of Manchester, in the County Palatine of Lancaster, Civil Engineer; for a certain method of manufacturing Salt. Dated Dec. 4, 1823.—In six months.

To George Minshaw Glascott, of Great Garden Street, Whitechapel, in the county of Middlesex, Brass-founder; and Tobias Mitchell, of Upper Thames Street, in the city of London, Gent.; for certain improvements in the construction or form of Nails, to be used in or for the securing of Copper, and other Sheathing, on Ships, and for other purposes. Dated Dec. 9, 1823.—In six months.

To Thomas Horne, the younger, of Birmingham, in the county of Warwick, Brass-founder; for certain improvements in the manufacture of Rack-pulleys, in brass or other metals. Dated Dec. 9, 1823.—In six months.

To William Furnival, of Droitwich, Salt-manufacturer; and Alexander Smith, of Glasgow, Master-Mariner; for an Improved Boiler, for Steam-engines, and other purposes. Dated Dec. 9, 1823.—In six months.

To Sir Henry Heathcote, of No. 23, Surrey Street, Strand, in the county of Middlesex, Knight, and a Captain in our Royal Navy; for an improvement of the Stay-sails, generally in use, for the purpose of intercepting wind, between the square-sails of ships and other square-rigged vessels. Dated Dec. 13, 1823.—In six months.

To Jarvis Boot, of Nottingham, in the county of Nottingham, Lace-manufacturer; for an improved Apparatus to be used in the process of Singeing Lace, and other purposes. Dated Dec. 18, 1823.—In six months.

To Pierre Jean Baptiste Victor Gosset, of Queen Street, Haymarket, in the county of Middlesex, Merchant; who, in consequence of a communication made to him by a certain Foreigner residing abroad, is in possession of an invention, of a combination of Machinery, for producing various shapes, patterns, and sizes, from metals, or other materials, capable of receiving an oval, round, or other form. Dated Dec. 18, 1823.—In two months.

THE

TECHNICAL REPOSITORY.

XXIV.—*Specification of the Patent granted to* JOHN CHRISTIE, *of Mark Lane, in the City of London, Merchant; and* THOMAS HARPER, *of Tamworth, in the County of Stafford, Merchant; for their improved Method of combining and using Fuel in Stoves, Furnaces, Boilers, and Steam-Engines.—Dated Oct. 9, 1823.*

WE, the said John Christie, and Thomas Harper, do hereby declare, that the nature of our said invention, and the manner in which the same is to be performed, are particularly described and ascertained, in and by the following specification thereof; that is to say:

Our said invention consists in combining bituminous coal, of a caking quality, with culm; that is to say, the culm, or small of stone-coal or anthracite, and forming the same, for use as fuel, into coke, in ovens, by the usual modes. The culm may either be taken in the casual or usual form of such culm, or be made expressly for the purpose, by breaking the larger stone-coal, by common mechanical means, into the culm or small. We combine the bituminous coal and the culm, in various proportions, according to the qualities of each, which vary in different situations;—our rule of admixture being, to combine as much as possible of the culm, with as little of the bituminous or caking coal, as may be sufficient to form a good coherent coke; but we have, in general, found equal quantities, in weight, to be a suitable proportion.

The coke, thus formed, is applicable for use, either by itself, or in combination with other fuel, in stoves and furnaces, and for heating boilers and steam-engines, where coke is applicable; and, in particular, our said coke may be advantageously used in furnaces for the smelting and manufacture of iron.

XXV.—*On a new and advantageous Method of Catching or Taking Mackarel, and other Fish; invented in the United States of America, and lately introduced into this Country, by Admiral Sir* ISAAC COFFIN, *Bart.**

THIS method, which has been practised in North America about two years, with the greatest success, is well deserving of being adopted in this country. It consists, in allowing the fishing vessels to drive under their fore-sails, and in throwing overboard, continually, a quantity of bait, prepared in the manner to be described hereafter, in order to bring the shoal of mackarel or other fish around the vessels. One or two boys are employed in this business; and each man of the crew is provided with two lines, with hooks affixed to them; and, as soon as they get to work, whilst the second line thrown in is sinking, the other is pulled in; and, with a jerk, the fish caught is thrown from the hook on the deck, without being touched with the hand; *and, as the hook is not to be baited, a large number are taken in a very short time; for, as soon as the hook is under water, it is seized by the fish.* The line is small, and dyed of a dark-blue colour; it is about seven fathoms in length. The hook is inclosed in lead, which is to be scraped at times, to give it a bright appearance, the more to resemble the bait. The hook is called a *jigger*; and the piece of lead it is buried in, is about four inches long; the line being passed through a hole made in its upper part, and prevented from coming out by a knot tied on it.

Every vessel must have a mill, with a wooden cylinder full of knives, fixed in circles, at proper distances, for cutting the bait, and acting against or between two rows of other knives driven into a block of wood fastened at one

* We have been kindly permitted by Sir Isaac to copy this interesting article, from the specification of the patent which he has obtained for the introduction of this valuable discovery into this country; and to add other particulars, furnished by him.—EDITOR.

end of a wooden chest, which is about thirty inches and a half high at one end, and thirty at the other: it is one foot wide, and twenty-six inches long. The cylinder has necks or pivots at each end of it, turning in holes made in the sides of the chest, and has a winch or handle to turn it with. A wooden plank is placed on a level with the axis of the cylinder, having gaps made in the end of it, for the rings or circles of knives to pass up, and to clear the knives from any particles of bait which might adhere to them. The bait consists of fish, which are laid upon the wooden plank, and pushed against the knives upon the cylinder, whilst it is turned round in the direction towards the block containing the two rows of knives; and, when the bait is cut, it falls into the chest, from whence it may be taken out from time to time, by lifting up that end of the wooden plank which is farthest from the cylinder, it being made to turn upon centres for that purpose.

Any kind of fish will answer for the bait, such as cod, haddock, or the poorer kind of mackarel. Fresh bait is preferred, but that which has been salted a few days is often used.

The American fishing-line is made of cotton, of about the thickness of stout whip-cord; and is composed of three strands, each strand consisting of *five* others, and these, again, of two threads twisted together; so that *it is composed of thirty single threads.*

We have good reason for believing that this valuable discovery will very soon be adopted in our fisheries, under the persevering efforts of Sir Isaac Coffin.

XXVI.—*On a simple, cheap, and accurate Method of experimenting on small quantities of Gases, by means of Bent Tubes. By Mr.* WILLIAM KERR.*

WITH FIGURES.

Paisley, October, 1823.

THE greatest obstacles to experimental research, that have hitherto presented themselves to young chemists, and even

* From No. XIX. of the Edinburgh Philosophical Journal.

proficients in the science, are the expense of the requisite apparatus, and the want of room to contain them. This has especially been the case with respect to apparatus for experimenting on gases. These obstacles, it is hoped, the following contrivance will do much to remove.

A glass tube, from six to twelve inches in length, and from two to five lines wide, so as to be capable of holding from two to six drachms, is to be hermetically shut at one end, and bended a little below its middle, so as to form two branches, of which the shut branch will be somewhat shorter than the other, diverging from each other nearly at a right angle. The vertex of the tube should be widened on the concave side, and this done more toward the shut than the open branch, as is represented in Plate IV., fig. 1. The vertex A, of the convex side of the curvature, does not correspond with B, that of the concave side, but is beneath the shut branch.

The gas evolved from the mutual action of two bodies, of which, at least, one is a liquid, may be collected in the shut branch in the following manner.

Let the tube be held in the hand by the open end, so that this be the highest, and the short end the lowest part of the tube; then, the liquid is to be poured in, till it begins to ascend above the vertex. The shut extremity is now to be elevated as high as the open end, while the vertex is depressed, so as to be the lowest part of the tube. In this position, the shut branch will remain full; the liquid within it being supported by the pressure of the atmosphere on the small portion of the fluid that is above the vertex, in the open branch. If a solid body, of greater specific gravity than the liquid, be now introduced into the open end of the tube, it will fall down to the vertex; and any gas evolved from its surface will rise through the liquid, and be collected in the short branch, while the liquid will ascend in that which is open. Owing to the vertex side being beneath the shut branch, while that of the concave is nearer the open one, the whole, or almost the whole, of the gas evolved from any bit of solid matter, resting on the most depending part of the curvature, will ascend into the shut branch. In this manner, the gas is collected, unmixed with common air; and, if the experiment requires the application of heat, the bent part of the tube may be placed in a sand-bath; so that, by means of such tubes, experiments may be performed on small quantities of gases, not only more economically, but, it is hoped, more accurately than is commonly done on larger quantities, with a more costly apparatus.

A bent tube, of the form described, may be also used for discovering the quantity of gas absorbed by a liquid: for example, the quantity of oxygen absorbed from atmospheric air, by a solution of the protosulphate of iron. The air being confined in the sealed branch, by the solution contained in the open one, will be exposed to the pressure of the column of liquid; and, as the open end may be corked, the solution can absorb no other gas but that contained in the tube. The quantity absorbed may be known, by tying, at the commencement of the experiment, a waxed thread around the tube, at the boundary of the air and liquid.

Other gases may be absorbed by other liquids, in nearly the same manner; for instance, carbonic acid by milk of lime: only, when any other gas than atmospheric air is introduced into the tube, the whole tube must be previously filled with water. The water in the open branch, with the exception of a small quantity, sufficient to confine the gas, is then to be sucked out with a straw or small glass tube, and the milk of lime substituted for it.

A bent tube of a small size answers best for collecting gas; and one of a larger size, for the absorption of gases.

If the experiment to be performed requires any considerable time, the curvature of the tube may be passed through a slit, made in a thin board; the slit being of such length, that the branches of the tube may rest upon the extremities of the slit. Experiments may be going on, at the same time, in several tubes, placed in as many slits in the same board; and which may also be made to form part of a very convenient portable frame, for holding a number both of the bent tubes for gases, and test tubes for precipitations.

Fig. 2, is the plan of such a board; which may be made of mahogany, eight inches square, and one quarter of an inch thick: in it, there are eight slits for bent tubes; and, at one end, it is pierced with eight holes, for test tubes. This board forms the top of the frame: another board, of the same dimensions, parallel to the former, forms the sole; and these two boards are connected together, at the corners, by four small wooden pillars. The whole frame need not weigh more than eleven ounces. It may be placed on a table or shelf; and may be lifted from one place to another, loaded with all the tubes that it is intended to contain, without disturbing any of the processes going on in them.

The slits and holes should be numbered; and a register be kept of the processes going on in each of the tubes.

It is hoped that these bent tubes will be found useful to students at Universities; and to travellers, who cannot carry a large, brittle, and expensive apparatus along with them.

To those who have not the means of purchasing expensive chemical apparatus, the bent tubes will recommend themselves by their cheapness; each of them superseding, for small experiments, a retort, a pneumatic trough, and a receiver.

In the laboratory of the chemist they will also be useful, by enabling him to perform experiments in the small space of eight or nine inches square, which would otherwise have required eight or nine retorts, and as many receivers.

An addition may be made to these tubes; by which the quality of the gas, evolved at any period of the experiment, may be examined, without disturbing the process going on. An account of this improvement may form the subject of another communication.

XXVII.—*On an improved Stove, for the use of Tinmen, &c.* *Invented by Mr.* John Hobbins.

WITH A FIGURE.

Sir, *Walsall, Jan.* 13, 1824.

Having invented an improved stove, for heating the copper tools used for soldering, by tinmen, &c., as well as for ventilating their work-shops; and having experienced the great advantages of it in my own business; I am desirous of making it generally known, through the channel of the Technical Repository, to which I have been an early subscriber.

The body of the stove is made of sheet-iron, with grate-bars, as usual; but, instead of putting the soldering tools into the fire itself, and thus exposing them to the joint action of heat and oxygen, which renders it necessary to be continually filing them to remove the oxided parts and to renew the coat of solder upon their points or edges, I heat them in a *wrought-iron or cast-iron box*, and thus have no occasion to file them oftener than once in the course of a week. I am also thereby enabled to burn *coke* in the stove, instead of *charcoal* as usual, by which a very great saving indeed, in the cost of fuel, is effected.

I have also, as above mentioned, converted the tinman's stove into a ventilating stove. This I have effected by closing the ash-pit; and causing the air that supplies the fire to pass down a side pipe, which is elevated towards the ceiling of the workshop, and enters the ash-pit by an elbow. This alteration will, however, be better understood by a reference to the accompanying sketch (see Plate IV. fig. 3.); in which also is shewn a flat cover to the pipe, suspended by a line passing over two pulleys, with a counter-balancing weight; and by raising or lowering this cover, the supply of air to the fire is accurately adjusted; and it also brings with it whatever unwholesome vapours may have arisen to the upper part of the workshop. As, however, I have not found it sufficient to remove the heavy vapour of a smoking lamp, such as is used by tinmen; so

I intend to add a descending branch to the side pipe, to pass through the work-bench, and, by means of registers in the pipes, to draw the air either from above or below, at pleasure. D, is the door or slide through which the stove is supplied with fuel; and, by leaving it a little open, I can lessen the draught through the stove at any time; as, for instance, whilst the workmen are at meals; and, with a very little addition of fuel, the fire may be made to burn with a decreased draught, even to the barely keeping it alight.

B, is the cast- or wrought-iron box, into which the tools are put to be heated: it is closed behind; and rests upon an iron bar, which is passed through the sides of the stove.

AD, is the ash-pit door, for the purpose of removing the ashes from time to time; and the stove is erected upon three feet, to admit of placing a receiver underneath it, in which the ashes may be taken away.

I have drawn this sketch, on a scale of one-eighth the real size of the above.

I am, Sir, your obedient servant,

T. GILL, *Esq.* JOHN HOBBINS.

P.S. I shall shortly communicate to you some improvements which I have made in a foot-lathe, to lessen the friction, upon the principles laid down by you.

XXVIII.—*On an improved Mode of collecting English Opium; and an Analysis of Turkey and English Opium. By* J. W. JESTON, *Esq.**

WITH A FIGURE.

SIR; *Henley on Thames, Jan.* 30, 1823.

HAVING lately been informed that the Society for the Encouragement of Arts, Manufactures, and Commerce, had offered premiums for promoting and improving the

* From Vol. XLI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce; just published.—The Society voted its Large Silver Medal to Mr. Jeston, for this valuable Communication.

cultivation of the *papaver somniferum*, you will oblige me by submitting to the members of your Society the present communication; which, although it does not come within the conditions of the premium this year offered, on account of the small scale on which my experiments have been conducted, yet I am induced to offer to the Society the method I have adopted in collecting opium, with a view that it may prove useful to those persons who are cultivating this plant more extensively. The plan of collecting the poppy juice immediately that it exudes from the capsule, I have tried for three years, and find it expeditious and effectual. I have added a comparative analysis of English and Turkey opium. In the box, will be found two cakes of opium, collected this last season; the scarification-scoops, and bottles used in collecting; also some specimens of morphine, of narcotine, and of a very tenacious adhesive matter, &c. extracted from English opium. Allow me to add, that I have tried, and now use, the English opium medicinally in my profession, and find it rather stronger, and more certain in its operation, than the best Turkey opium. I remain, Sir, &c.

J. W. JESTON, *Surgeon, and H. P. 36th Reg. of Foot.*

To A. AIKIN, *Esq. Sec. &c. &c.*

In April 1816, I prepared a quarter of an acre of land in Warwickshire, by having it divided into beds, four feet and a half wide, with a foot and a half for path-ways; these I had planted with several varieties of the *papaver somniferum:* the seed was mixed with ashes, in the proportion of four ounces of seed to the bushel: each bed contained seven rows of plants, nine inches asunder. The plants blossomed the end of July, and the capsules were not fit for scarifying till the middle of August. The season being extremely wet, and having been disappointed in some former experiments in gathering the opium in the usual way by allowing the juice to be inspissated on the capsules, I now tried a new method of collecting the milky tears; for which purpose I employed for my scarificator an inch and six-eighths of an old watch-spring, sharpened at both extremities and on the four sides: this I thrust through a thick circular slice of a large wine-cork, letting the end project to the depth that I wished to have the heads scarified; and on one end becoming blunted, the other extremity, on being set to a proper depth, might be used: by this means I had the advantage of four scarificators. My collector consisted of a tin scoop, two inches and three-fourths in length, and half an inch in diameter, fixed, with a little tow and wax, into the mouth of a strong ounce-and-half or two-ounce phial*. Armed with this scarificator and collector, I found that I could collect from one to two ounces of the milky tears of opium in the hour. My plantation consisted principally of the semi-double purple and white, the red and double varieties producing very little juice. I employed one boy daily, from August to the end of September, during which time it rained more or less every day. The quantity of dried opium collected by the boy and myself was two pounds six ounces, and 120 pounds of seed. Having ascertained, by this experiment, that the white and semi-double purple were the only varieties worth cultivating, and that the sooner the seed was sown in the spring the greater the number of capsules, I repeated, in 1821, my experiments in Oxfordshire. I prepared a quarter of an acre of land, by dividing it into beds as before; the land being of a light gravelly soil, and poor. This year, I prepared my seed by mixing four ounces of nitre in fine powder, and the same quantity of seed, with a bushel of ashes; and had it planted in February, by women, with blunt dibbles, five rows to a bed. The seed vegetated well. I found the worms very destructive to the early plants; but having sown a superabundance of seed (two pounds to the quarter of an acre), I secured a good crop. I had them twice thinned out, and hoed to a foot

* See Plate IV, fig. 4.

distance between every plant. They came into blossom in June; the season being favourable, with occasional showers. I employed one or two boys from the middle of July to the 10th of August. The plants had most of them from three to six capsules, and some more. I found the following plan very expeditious in collecting the juice:— As soon as the capsules were half grown, two boys, each provided with a scarificator and scoop, taking a bed between them, scarified from ten to twenty heads, making a horizontal incision half round the upper part of the capsule: they then began to scoop off the juice, which flowed immediately, and which, if allowed to remain but a few minutes, would run off in large drops on the ground. The juice readily runs down the scoop into the bottle; which being filled, the scoop, after having the inside of the tube scraped out, is removed to a fresh bottle. By this mode, excepting during heavy rains, the boys can be employed collecting the whole of the day. The least adulteration of the juice is easily detected; the pure milky tears, on being emptied from the bottles, being of a white solid mass: if water or any other fluid is mixed with it, it is more or less brown, and the opium in the bottles remains liquid. I paid the boys 8*d.* per day, and gave them 1*d.* extra for every bottle of opium collected; and from this *encouragement-money*, I found the two boys did not require my constantly looking after them. The following table will shew the details of each day's collecting:—

			Bottles.		Ounces of Opium.
July	18,	One boy collected	4	containing	6
	19,	Two boys D°.	9	D°.	$13\frac{1}{2}$
	20,	D°.	10	D°.	15
	21,	Wet all day.			
	22,	Sunday.			
	23,	Two boys D°.	13	D°	$19\frac{1}{2}$
	24,	D°.	12	D°	18
	25,	D°.	11	D°	$16\frac{1}{2}$
	26,	D°.	10	D°.	15

		Bottles.		Ounces of Opium.
27,	A wet day.			
28,	One boy D°.	5	containing	7½
29,	Sunday.			
30,	A wet day.			
31,	One boy collected	5	D°.	7½
Aug. 1,	D°.	4	D°.	6
2,	D°.	4	D°.	6
3,	D°.	4	D°.	6
4,	D°.	3	D°.	4½
6,	D°.	3	D°.	4½
8,	D°.	3	D°.	4½
10,	D°.	2	D°.	3
16 days		102 bottles		153 ounces.

or 8 pounds 15 ounces of recent opium; which, when dried, afforded 5 pounds 9 ounces of very pure opium. Each head was scarified three or four times, or as long as they would bleed; and on going over the beds the second, third, and fourth times, there were many fresh capsules from the side shoots to scarify; also a quantity of dried opium was frequently collected, which had exuded after the former gatherings. Scarifying the heads too deep destroyed the seed, also the further supply of opium. I collected 170 pounds of seed in August, and extracted 30 pounds of extract from the dried capsules. I found two boys quite sufficient for the quarter of an acre. For the nitre I gave 6*d*. per pound, and used it at the rate of 8 pounds to the acre, besides ashes.

My experiment of last year did not succeed so well, owing to the dryness of the season and lightness of the soil. In February 1822, having prepared an acre of ground by dividing it into beds of five feet width with the plough, I had it sown broad-cast with 8 pounds of seed mixed with nitre and ashes, and raked in. The seed came up well, and very thick; but, owing to the great mildness of the preceding winter, the slugs and worms destroyed the greatest part of the crop. The beginning of April I had it sown a second time; and this also failing, owing to the great dryness of the season, I planted half the ground with potatoes, which produced a tolerable crop. The poppy plants which succeeded grew this season from two to three feet high, and had not more than two or three capsules; whereas some plants that had stood the winter had from six to ten capsules, growing from five to six feet high: they came into bloom in May, and afforded a very abundant supply of opium, clearly proving the advantage of the autumnal sowing. The following table will shew the quantity of opium that was collected from this acre, and the short time which it produced opium. The plants came into blossom the middle of June, and I began to collect the opium on the 28th.

1822,			Bottles.		Ounces of Opium.
June 28,	Three boys collected		15	containing	22½
29,	Four	D°	23	D°	34½
30,	Sunday.				
July 1,	Four boys collected		26	D°	39
2,	. . .	D°	15	D°	22½
3,	Two	D°	12	D°	18
4,	. . .	D°	11	D°	16½
5,	Wet.				
6,	Two boys part of a day		7	D°	10½
7,	Sunday.				
8,	Two boys collected		10	D°	15
9,	One boy	D°	5	D°	7½
10,	. . .	D°	5	D°	7½
11,	. . .	D°	4	D°	6
12,	. . .	D°	3	D°	4½
13,	. . .	D°	2	D°	3
13 days collecting			138 bottles		207 ounces,

or 12 pounds 15 ounces of recent opium; which, when dried, produced 8 pounds 5 ounces of fine opium, and cost 1*l.* 10*s.* 2*d.* in collecting. It will appear, from the above statement, that four boys were too many, after the first three or four days, for the half acre: the plants not being very numerous, they went over them in less than two days: I consequently discharged two of them. One of the boys collected, the first day he was employed, nine ounces, and the second day eleven ounces; and had there been a sufficiency of plants, the boys would every day have collected a larger quantity of opium, from becoming more expert at it. The boys received the same encouragement-money as before. Every evening, the bottles that were collected during the day were emptied into shallow tin pans, 14 inches by 10: these I placed in the garden, sheltered from the rain; and by stirring the opium once or twice a day, it soon dried, sufficiently to be formed into cakes of two pounds weight each. After the opium had been in the pans a few days, they were placed one over the other, cross-ways; by that means taking up very little space, and having a current of air between each pan. I found the leaves of the large palmated rhubarb a very clean and convenient covering for the cakes, which, by preventing them sticking together, allowed of their drying sooner. One pound of the poppy-juice I dried over a water-bath. Although the opium was quite thick before heat was applied, it soon became fluid and watery, and afterwards dried up into a very brittle mass. By attending in the field occasionally myself, I found that there was one variety of the white poppy, with high crowns and smooth capsules, growing from 4 to 12 heads, and producing a much larger quantity of milky tears than the common white poppy: the seed of some of these I have selected for my future experiments.

I am inclined to think that there is still much information to be gained, before the cultivation of this important plant can be brought to perfection in this country, in selecting the seed, the best time for sowing, and the preparation of the soil; but I hope that the encouragement that has been given by your very excellent Society will soon surmount all difficulties. The poppy has a tap-root, is a very hardy plant, flourishing best in a loamy soil. Last September I had two acres drilled with poppy seed, the rows rather more than a foot apart; and although the plants are small, yet the severe frost has not apparently injured them. I am now trying the effect of ashes, lime, nitre, and short stable-dung, as top-dressings to three different parts of the field. There is a double advantage in having an autumnal as well as a spring crop, by allowing a longer period for the collectors to gather the opium. The produce of the last crop, besides opium, was 320 pounds of seed; which, on being pressed, will give from 12 to 13 gallons of oil, and 180 pounds of oil-cake. I have found the poppy-stems useful in lighting fires; 1000 pounds of stems producing 95 pounds of ashes, and 7 pounds of potass mixed with sulphate of potass: the residuum consisted of 5 parts calcareous matter, and one of silex, carbon, and insoluble substances.

The following analysis was undertaken, to ascertain if any difference existed between the best Turkey and English opium, and in what that consisted. After many experiments for the last two years, which I feel much pleasure in laying before the members of the Society, I find that England need no longer be indebted to Turkey, or the East Indies, for this valuable drug; her own soil and clime being capable of producing poppies containing all the active ingredients of the very best Turkey opium.

In my analysis, I found English opium contained a larger quantity of morphine, or gummy extract, and of narcotine, or resinous extract, but a much less quantity of the inactive ingredients; viz. ceroma, or waxy principle (soluble in boiling spirits, and separating from it whilst cooling), and a very adhesive, tenacious matter, insoluble in spirits of wine, but readily so in æther and the essential oils, resembling, in many of its properties, caoutchouc. The insoluble remains of Turkey and English opium, consisting of gluten and earthy matter, are much the same.

The opium which I used for my experiments was thoroughly dried, and in powder; common opium losing from 40 to 60 grains in an ounce, whilst drying.

The insoluble matter was collected and weighed very exactly in these experiments; for I frequently found much difficulty in reducing the extracts to the same exact degree of dryness; and sometimes they would exceed the original weight of opium when added to the insoluble parts, owing to a small quantity of moisture being still very tenaciously retained, even when reduced to powder; which gave the result the appearance of being incorrect.

EXPERIMENT THE FIRST.	ENGLISH OPIUM.	TURKEY OPIUM.
	Grains.	*Grains.*
480 grains (one ounce) of Opium, in powder, was dissolved in two pints of cold water: after macerating for several days, it was strained, and the residue was repeatedly boiled in fresh water, till the fluid passed the filter colourless: on evaporating these different fluids, and drying the extract, I obtained	360	334
Whilst this watery infusion was evaporating, a quantity of resinous-looking matter separated, and subsided to the bottom of the pan, in the form of very minute crystals.	120	146
The residuum, insoluble in water, was boiled in three ounces of spirit of wine, and filtered: on cooling, it deposited several grains of ceroma, of a light-yellow colour, tasteless, and of the consistence of butter. This I separated, before the fluid was quite cold, to prevent its adhering to the crystals, which soon began to shoot from the sides of the bottle, and which continued to enlarge for several days. On more spirit being boiled with the residue, it still deposited ceroma, but the fluid did not afford any more crystals. The spirit dissolved of ceroma . .	5	4
Of resinous extract in crystals	7	Not any
Of resinous matter not easily crystallized	42	47
The insoluble residuum, on being dried, weighed . .	66	95
and possessed the singular property of becoming highly electrified, on being rubbed in a mortar; so much so, that it was with some difficulty collected together again: this property was destroyed by boiling it in oil of turpentine, which dissolved of a substance like caoutchouc	21	41
Leaving a light-brown, earthy, insoluble powder, weighing	46	54

A paper of this powder was folded together, and placed on a stove to dry: before the covering was much

	ENGLISH OPIUM. Grains.	TURKEY OPIUM. Grains.
scorched, it took fire, and burnt like pyrophorus made from alum and carbon, spreading an intolerable stench of burnt horn or animal matter.		
The extract of 360 grains, obtained by evaporating the watery solution, was mixed with three ounces of ether, one ounce being digested on it at a time: the two first quantities deposited crystals on the sides of the bottle; the third did not: the ether, on being evaporated, left a mass of narcotine . .	34 ...	20
which, on dissolving in spirit, produced fine crystals.		
The remaining gummy extract consisted of pure morphine, and weighed	326 ...	314

EXPERIMENT THE SECOND.

480 grains of Opium, in powder, was dissolved in one pint of rectified spirit of wine: after macerating several days, it was strained, and fresh spirit boiled with the residue, till the spirit passed the filter tasteless: it dissolved	384 ...	366
Leaving an undissolved residuum of	96 ...	114
This residuum, boiled in water, dissolved of gummy extract	23 ...	25
Leaving a residuum of	73 ...	89
The residuum of 73 grains was boiled in oil of turpentine; and the insoluble matter, after having been separated from the oil and dried, weighed . . .	32 ...	52

EXPERIMENT THE THIRD.

480 grains of Opium was digested in 13 ounces of proof spirit, and strained: fresh quantities of proof spirit were boiled with the residuum, as long as it appeared to take up any of the opium: it dissolved	388 ...	366
Leaving a residuum of	92 ...	114
On boiling the residuum in oil of turpentine, it dissolved	54 ...	74
Leaving a residue of insoluble matter	38 ...	40
And in one specimen of very fine Turkey Opium, proof spirit dissolved 360 grains, leaving a residue of 120 grains, of which oil of turpentine dissolved 90 grains of this caoutchouc substance, leaving only 30 grains of insoluble matter.		
In making the tincture with opium that had been dried over a water-bath, proof spirit dissolved . .	320	
Leaving a residue of insoluble matter	160	

This tincture was placed on a warm stove, whilst making; and on cooling, it deposited the specimen of impure narcotine crystals sent for examination.

EXPERIMENT THE FOURTH.

	ENGLISH OPIUM. Grains.	TURKEY OPIUM. Grains.
480 grains of Opium, in powder, was macerated in two pints of common distilled vinegar: fresh quantities of acetic acid were boiled with the residuum, till it passed the filter colourless: it dissolved	388	348
Leaving a residuum of	92	132
Oil of turpentine, being boiled on this residue, dissolved	46	88
Leaving a residue of gluten and insoluble matter, of .	46	44
The acetate of opium was saturated with water of pure ammonia, and produced a grey precipitate of narcotine, very slow in subsiding to the bottom of the bottle, weighing	104	64
On re-dissolving it in spirit of wine, very fine crystals were deposited from it whilst cooling.		
The fluid, after separating the narcotine, is not easily evaporated to dryness, but contains of morphine, or gummy extract	284	284

Five grains of narcotine may be obtained from every ounce of English tincture of opium, by mixing an equal quantity of water of ammonia with it. It may also be obtained by boiling spirit with the residuum after making the tincture of opium. It appears to contain powerful properties: the crystals are very light, and, on opening papers of them incautiously, I have found them occasion a peculiarly unpleasant sensation in the nose and throat.

Narcotine is sparingly soluble in boiling water, but readily so in ether, the essential oils, boiling acetic acid, and spirit of wine, which, on cooling, affords a portion of the resin in fine white crystals, which appears to be the resinous part of opium, quite pure, and unmixed either with the ceroma or caoutchouc; a small quantity of these substances, particularly the ceroma, converting the crystals into a resinous mass, not easily again crystallized. Its solution does not perceptibly affect turmeric-paper; but litmus-paper, that has been soaked in weak solution of potass, or lime-water, is slightly reddened, in the same manner as by the tincture of benzoin. Tolu, shell-lac, mastic, and some other resinous tinctures which I have tried, alter the colour of litmus-paper. I obtained the same results with ether and spirit; but I used the oil of turpentine in these experiments, to save the great expense attending the repeating them frequently with spirit. On evaporating the oil of turpentine, it left the caoutchouc substance of the appearance of a very tenacious bird-lime, entirely soluble in ether.

The morphine I have given medicinally, with the happiest results. Many persons, who, from some peculiarity of constitution, could not take laudanum, have derived much benefit from this preparation, without suffering the usual unpleasant effects from opium. I find one grain of morphine is equal to one and a half of common opium.

I have adopted the terms *morphine* and *narcotine,* from having met with them in a Paper in the Medical Records for June 1821; wherein Robiquet has called the gummy extract *morphine,* from supposing it contained the anodyne and composing principles; and the resinous, crystalline mass, *narcotine,* from possessing the stimulating and stupifying principle.

I have to apologize to the Society for having occupied so much of their valuable time; but I trust that the importance of the subject will be a sufficient excuse.

I am, &c. &c. J. Ward Jeston, Surgeon, and
H. P. 36th Regt. of Foot.

CERTIFICATE.

Dear Sir, *Henley on Thames, Jan. 28, 1823.*

I feel great pleasure in stating, I frequently visited your plantation of poppies during last summer, and that I saw and much admired your very simple but excellent plan of collecting the opium from the plants.

I am, Sir, &c. &c.

To J. W. Jeston, *Esq.* Paris Dick, M.D.

XXIX.—*On ornamenting Steel with Gold and Platina. By* Nicholas Mill, *Esq.*

Sir, *Bridge Cottage, Camberwell, Jan. 8th,* 1824.

In a Paper inserted in your Repository for November last, I suggested some inquiries respecting the various methods of gilding practised by artisans. Since that period, I have been prosecuting some experiments, with success, for ascertaining the proper mode of superficial gilding upon steel: and I transmit the result to you, for the benefit of that class of artists. It is necessary, perhaps, to premise, that the instructions given, in most elementary works upon chemistry, for gilding with the ethereal solution of gold, are either erroneous, or not sufficiently explicit; and to this cause may be traced the many failures which have occurred in practising this art.

The following is the process which I used; and which answers equally well, either for gold or platina.

Dissolve any quantity of gold or platina in nitro-muriatic acid (*aqua regia*), until no further effervescence is occasioned by the application of heat. Evaporate the solution of gold or platina, thus formed, to dryness, in a gentle heat; (it will then be freed from all excess of acid, which is essential); and re-dissolve the dry mass in as little water as possible: next take an instrument which is used by chemists for dropping liquids, known by the name of a separating-funnel, having a pear-shaped body, tapering to a fine point, and a neck capable of being stopped with the finger or a cork; which may contain a liquid ounce, or more: fill it with the liquid about one quarter part; and the other three parts, must be filled with the very best sulphuric ether. If this be rightly managed, the two liquids will not mix. Then, place the tube in a horizontal position, and gently turn it round with the finger and thumb. The ether will very soon be impregnated with the platina or gold, which may be known by its change of colour. Replace it in a perpendicular position, and let it rest for 24 hours; having first stopped the upper orifice with a small cork. The liquid will then be divided into two parts; the darkest-coloured being underneath. To separate them, take out the cork, and let the dark liquid flow out: when it has disappeared, stop the tube immediately with the cork; and what remains in the tube is fit for use, and may be called the gilding-liquid. Let it be put into a bottle, and tightly corked. When an article is to be gilded, a vessel of glass or unglazed ware must be provided, of just sufficient size to admit the article: it must then be filled with the gilding-liquid, nearly to the top. The steel must be *very highly polished*, and be entirely free from *rust* or *grease*. A basin, full of clean water, must be ready at hand: the article must be immersed into the gilding-liquid, and allowed to remain *as short a time as possible;* then be taken out, quickly plunged into the water, and well rinsed: it must next be dried with blotting-paper, and be placed in a temperature of 150° Fahr. till it be completely heated throughout; it may then be polished with rouge and a soft leather; or, which is better, be burnished.

It will be as well to observe, perhaps, that the muriate of gold or platina, formed by digesting these metals in nitro-muriatic acid, must be entirely free from all excess of acid; because it will otherwise act too forcibly on the steel, and cause the coating of gold to peel off. Pure gold must be employed. The ether must not be shaken with the muriate of gold, as is advised in chemical publications; for it will be sure, then, to contain acid: but, if the two liquids be continually brought into contact, by the motion I have described, the affinity existing between ether and gold is so strong, as to overcome the obstacle of gravity, and it will hold the gold in solution. The ethereal solution may also be concentrated by gentle evaporation. Care must be taken not to wipe the steel until the heat has been applied. This gilding is an effectual protection against rust; and is, at the same time, very ornamental.

I am, Sir, your obliged servant,

T. GILL, *Esq.* NICHOLAS MILL.

XXX. — *On preparing and engraving upon Steel-Plates. By the late* Charles Warren, *Esq.**

The death of Mr. Warren, in the interval between the adjudication of the medal and the day of annual distribution of the rewards, has prevented the Society from receiving a written communication on this interesting subject from the inventor himself. The following statement, therefore, is taken from the report of the Committee to the Society, and from details communicated by Mr. Warren's personal friends, especially by Mr. Joseph Phelps, who was pupil to Mr. Warren during the whole progress of his experiments and discoveries.

Some of the earliest specimens of engraving on steel were produced by Albert Durer. There are four plates etched by this artist, impressions of which exist in the British Museum, which, in all books of art, are recorded as having been executed in steel: of these, one has the date 1510 inscribed on it. Since that time, attempts have been made occasionally to employ steel instead of copper, as a material to engrave upon; but apparently with little success, on account, principally, of the great hardness of the material, which in a short time blunted and destroyed the tools which were made use of.

Steel exists in two states, the elastic and the brittle; the former being considerably softer than the latter. Of the elastic steel, a saw-blade may be considered as an example; and, in fact, pieces of saw-blade were the material upon which nearly all the first attempts have been made, of late years, to revive a practice which, if successful, offered so many advantages to the artist and to the public. Mr. Raimbach, a few years ago, executed an engraving on a block, or thick plate of steel; but met with so many difficulties in the execution, that his experiment remained insu-

* From Vol. XLI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.—The Society voted its large Gold Medal to Mr. Warren, for these important improvements.

lated, and produced no sensible effect on the art of engraving.

Mr. Warren, in his early youth, was much employed in engraving on metals for the use of calico-printers and gunsmiths; and the experience thus acquired induced him afterwards to turn his mind to the subject, with a view of applying it to fine art. It was suggested to him by Mr. Gill, one of the Chairmen of the Committee of Mechanics, that the method employed by the artists of Birmingham, in the manufacture of ornamented snuffers and other articles of cast-steel, is, to subject the steel, after having been rolled into sheets, to the process of decarbonization, by means of which it is converted to a very pure soft iron: being then made into the required instrument, or other article, the ornamental work is engraved, or impressed, on the soft metallic surface; after which, by cementation with the proper materials, it is again converted superficially to steel, and thus rendered capable of acquiring the highest degree of polish.

In the attempt, however, to apply this process to plates for the engraver's use, two opposite difficulties occurred. A plate of steel of the same thickness as that of common copper-plate, when thoroughly decarbonized and thus reduced to the state of very soft iron, yields readily to the graver and other tools, and, especially, is susceptible of the process of *knocking up:* this consists in scraping out the error, and afterwards striking the under-side of the plate with a punch and hammer, in order to raise the cavity to the general level, and thus allow the artist to take the error out, without occasioning any unevenness of the engraved surface: it was found, however, that plates of the thinness requisite for this operation, and of the usual superficial dimensions, were very liable to warp, in the last or re-carbonizing process, and were thus rendered incapable of giving perfect impressions. If, in order to avoid this disadvantage, blocks, *i.e.* plates of three or four times the ordinary thickness, were made use of, the warping, indeed, was prevented, but at the same time the process of knocking up became impracticable; and it was necessary, in order to remove an error or defective part, to grind out the surface, or to drill a hole from the under surface almost through the plate, and then, by forcing in a screw, to raise that part of the face which was immediately above it. This latter process, however, was so tedious and difficult, as exceedingly to detract from the advantage of substituting steel for copper.

In this state of things, it became a very interesting object of inquiry to ascertain how many impressions might be taken from a plate of soft or decarbonized steel; and it was found that such a plate, prepared according to Mr. Warren's process, is capable of affording several thousand copies, without undergoing any sensible wear. In proof of this, impressions were laid before the Committee by Mr. Warren, from two plates of decarbonized steel executed by him; the one, for an edition of Mackenzie's works, published by Cadell; the other, for an edition of Beattie and Collins, published by Rivington. These exhibit, both in the landscape and in the figures, the most elaborate and delicate work: five thousand impressions have been taken from one, and four thousand from the other; and yet, between one of the first and one of the last impressions it was impossible to detect any perceptible difference.

If Mr. Warren had carried on his experiments alone, working by himself till he had brought his plan to perfection, it is probable that, at the period of his death, the evidence of the great importance of his discovery would by no means have been so complete as it actually was; and the result of his exertions might have been lost, to the great detriment of the profession, and of the fair fame of this eminent artist: but selfishness and secresy, in any thing which related to the improvement of the art to which he was attached, formed no part of his character; and all his discoveries, both those relating to the preparations of the plates, as well as those which have reference to the engraving upon them, were unreservedly and gratuitously communicated. The consequence of this liberality was, that, besides the plates of Mr. Warren's own engraving produced before the Committee, impressions were shewn of portraits, engraved on decarbonized steel, for the Evangelical Magazine; demonstrating, that, after 25,000 copies have been taken, the plates still remain in a good state, and are not yet in want of repair. Mr. Mar stated, that having made an engraving on one of Mr. Warren's plates, he did not take his own proofs till after the 8000th impression; and, in another instance, the engraving being a portrait, Mr. La Hie, the printer, certified that the artist's own proofs were not taken off till after the 20,000th impression.

Mr. Warren's original process for decarbonizing the steel plates consists in procuring a box or case of iron, and covering the bottom of it with a mixture of iron-turnings and pounded oyster-shells: on this a steel plate is laid: another bed of the mixture is then added; and so on alternately, till the box is full; taking care that a bed of the composition shall form the upper as well as the lower layer. The box, so charged, is then to be placed in a furnace, and to be kept for several hours at the highest heat which it will bear, without melting; after which, being allowed to cool gradually, the plates are found to be reduced, for the most part, to the state of soft decarbonized steel.

Mr. Hughes, a copper-plate maker, having been instructed by Mr. Warren in his process, and finding that the steel did not always turn out sufficiently and uniformly soft (particularly for the purpose of engravers in mezzo-tinto), imagined that those occasional defects were owing to a deficiency of heat in the cementing process; accordingly, he substituted a case or oven of refractory clay for the cast-iron one, and then, applying a considerably higher heat than the cast-iron box would have endured without melting, was enabled to obtain plates so soft that they may be bent over the knee. Each plate requires two or more cementations; and, as the first cementation warps them more or less, Mr. Warren was in the habit of rectifying them by means of a hammer. Mr. Hughes finds that the places struck by the hammer are apt to be less softened by the cementation than the other parts, and, therefore, that plates so treated will often turn out unequal in hardness. His own practice is, to use a mallet, and as little force as possible, in detaching the cement from the surface, and in rectifying the plate.

The plate being cleaned and polished (but not too highly), is ready for the engraver. When it comes into his hands, the first operation is, to lay the etching ground; in doing which, the plate must be rather less heated than is usual with copper; otherwise the ground, as it cools, contracts, presenting a honey-combed surface, and leaving parts of the plate uncovered. The same defect is apt to occur if the plate be too highly polished. The ground should be laid rather thicker than on copper.

Various menstruums were made trial of by Mr. Warren, for biting-in with. Nitric acid, considerably more diluted than for copper, was made use of, and, on the whole, with good success. Nitrate of mercury was found to blunt or round the edges of the lines: acetic acid, with a small portion of nitrate of copper, produced the same effect: sulphate of copper bit light tints very beautifully, but its further action rendered the lines rough. The best menstruum, however, is half an ounce of crystallized nitrate of copper, dissolved in a pint and a half of distilled water, and a few drops of nitric acid added to the solution. This will be found to bite both deeper and clearer than dilute nitric acid.

It will be advisable for the artist, when first etching on steel-plate, to keep a register of the time which he finds necessary for the menstruum to act before the parts have attained their due degrees of strength, and this will serve as a guide to him in his subsequent operations. Mr. Warren generally found about two minutes sufficient for an outline, unless it was required to be very strong: the middle tint was produced in about ten minutes, and the darkest shadows in forty minutes. The menstruum should not be more than one-sixth of an inch deep on the plate; otherwise it will be difficult to see the work, and it becomes exhausted in about ten minutes, and then requires to be replaced. While the menstruum is acting, the work must be constantly swept with a camel-hair brush, in order to remove the precipitated copper, which, if allowed to remain in the lines, renders their edges rugged, and destroys their beauty: especial care must be taken to clear the ends of the lines, as these are most liable to bite foul. In stopping-out, the ground (Brunswick black) must be laid on very thin and even; and instead of terminating abruptly, must be smoothed off very gradually; for the smallest ridge or prominence will retain the copper, and then the ground will infallibly be penetrated, and the biting will become foul. By attending to these directions, an etching may be obtained on decarbonized steel, as deep, and quite as sharp, as it can be on copper.

Concerning the great superiority of steel-plate over copper-plate, for all works that require a considerable number of impressions to be taken, there can exist no doubt: for though the use of the graver and of the other tools requires more time on steel than on copper, and though the process of re-biting has not yet been carried to the degree of perfection in the former that it has been in the latter, yet the texture of steel is such as to admit of more delicate work than copper; and the finest and most elaborate exertions of the art, which on copper would soon wear, so as to reduce them to an indistinct smeary tint, appear to undergo scarcely any deterioration on steel; even the marks of the burnisher are still distinguishable after several thousand impressions.

Both the public and the artist are eminently benefitted by this discovery;—the public, by having a multitude of impressions as good as copper-plate proofs; and the artist, in greatly extending the range of his reputation, by the permanence thus given to the finest and most characteristic touches of his hand.

XXXI.—*On preventing the Ravages of the Book-Worm, the White Ant, &c. By Mr.* THOMAS ALLSOP.

WITH A FIGURE.

SIR, *Madras*, 30*th August*, 1823.

I WAS put in possession, a few days since, by Mr. J. R. Hogg, Proprietor of the Carnatic Library, of all the Numbers, which have reached this place, of the *Technical Repository:* and being exceedingly partial to all works of that description, I found peculiar satisfaction in the perusal of it. Being myself in possession of many useful receipts and compositions used by the natives here, as well as having a practical knowledge of some others experimented by me, I shall be happy in the opportunity of opening a correspondence with you; wherein I shall occasionally advert to subjects which, probably, may not be considered altogether useless, and which, perhaps, are not generally known. This being my first communication, I shall only advert to a simple remedy for "*securing books, &c. from the ravages of that destructive insect, the book-worm:*" which I happily effected, by putting the leaves of the *margosa*-tree (in Malabar, *vaypum yellay*) between those of the book, if bound; but if added, with a small portion of green vitriol to the paste, by the bookbinder, in preparing the pasteboard covers, the necessity of putting the leaves into such books is obviated. I am not aware that this tree grows in England; but the fact might be easily ascertained, upon inspection of the leaves now sent*.

The oil expressed from the nut of this tree (called, in Malabar, *vaypum thylum*), used in a certain proportion with rock-oil (in Malabar, *mhun thylum*), is also a preventive to the ravages of the *white ant* in buildings, particularly the timber parts; and, if smeared over any wood, will effectually prevent the depredation of every species of insect or vermin. The medicinal and other qualities of these oils I

* In Plate IV, fig. 5, we have given a correct outline of one of these leaves.—EDITOR.

shall reserve for a future occasion, should you deem them worthy of notice. In the mean time, I beg to remain, Sir,

Your most obedient servant,

T. GILL, *Esq.* THOMAS ALLSOP.

P. S. I have had books in my library, with the *margosa* leaves in them, for the last eight or ten years, totally free from worms: others, without the leaves, have been nearly destroyed. *Holding books infested with worms over the fumes of sulphur and camphor, has also entirely destroyed the insects, and prevented the recurrence of the evil.*

XXXII.—*On taking Plaster-Casts of Leaves and Foliage. By Mr.* WILLIAM DEEBLE, *Artist.**

SIR, 1, *Seymour-Place, Islington.*

I HAVE ventured to offer to the notice of the Society of Arts &c. a specimen seleeted from casts of leaves and other parts of plants, obtained by a process which, though very simple, is, for any thing I know to the contrary, new.

The object I proposed in making casts similar to the one now submitted, was to supply myself with fac-similes of the form and texture of those plants which, as an engraver, I might have to introduce in the fore-ground of landscapes. It is well known, that those who have attained eminence in landscape-engraving, have devoted a large portion of time to actual study in the fields. I need not allude to the difficulties which deny this practice to a man engaged in a profession demanding his own almost unassisted exertions, especially in a metropolis; nor mention how the inaptness of season or situation will prevent the obtaining of such plants as may be immediately wanted. These circumstances suggested to me the advantage, and a trial proved the practicability, of procuring, at an easy expense either of labour or money, accurate casts of the most common and conspicuous plants.

* From Vol. XLI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.—The Society voted its Silver Isis Medal to Mr. Deeble for this Communication.

After a few experiments, I perfected a process which I will describe, that succeeded to an extent of which the Society may form their own opinion from the specimen produced.

If the purpose I have named were the only one to which casts of this nature were applicable, or if I thought that my success was the limit of their perfection, I would not have troubled the Society with their consideration; but it has been imagined that practice in the operation of making the moulds would lead to a degree of improvement of which my attempt gives a very inadequate idea; and which would render the casts useful for completing botanical collections, or illustrating botanical distinctions: and further, that the exhibition of the varied forms and convolutions of flowers and leaves, in such a material as plaster of Paris, would suggest adaptations and combinations which might be made available to the decorative purposes of architecture; and prevent that perpetual recurrence to examples of antique ornament that stigmatizes the architectural talent of modern Europe.

I am not aware if these are objects that would be worthy of the promotion and patronage of the Society, supposing the probability of it even to be as great as I am flattered it is by the friends who have advised this communication. For myself, I have merely to say, I shall be happy to exhibit the means to the Society; and more so, if they can discover in them any prospect of permanent good.

I am, Sir, yours &c.

W. DEEBLE.

The following are the particulars of Mr. Deeble's process. The leaf, as soon as convenient after being gathered, is to be laid on fine-grained moist sand, in a perfectly natural position; having that surface uppermost which is to form the cast; and being banked up by sand, in order that it may be perfectly supported. It is then, by means of a broad camel-hair brush, to be covered over with a thin coating of wax and Burgundy-pitch, rendered fluid by heat. The leaf being now removed from the sand and dipped in cold water, the wax becomes hard, and at the same time sufficiently tough to allow the leaf to be ripped off without altering its form. This being done, the wax mould is placed on moist sand, and banked up as the leaf itself was; it is then covered with plaster of Paris made thin, care being taken that the plaster is accurately forced into all the interstices of the mould by means of a camel-hair brush. As soon as the plaster has set, the warmth thus produced softens the wax, which in consequence of the moisture of the plaster is prevented from adhering thereto; and with a little dexterity it may be rolled up, parting completely from the cast, without injuring it in the smallest degree.

Casts thus obtained are very perfect, have a high relief, and are excellent models, either for the draughtsman, or for the moulder of architectural ornaments.

XXXIII.—*On the Woburn Perennial Kale, a Variety of Brassica Oleracea Acephala Fimbriata. By Mr.* GEORGE SINCLAIR, *Gardener to the* DUKE *of* BEDFORD, *F.H.S. &c.**

IN the very interesting Paper of M. DE CANDOLLE on the Species, Races, and Varieties of the Genus *Brassica*, there is no mention made of a singular and but-little-known-sub-variety of the *Brassica oleracea acephala fimbriata*; which I have called the *Woburn Perennial Kale*; and now propose to give some account of, to the Horticultural Society.

The valuable properties of this plant, as a never-failing winter-green, deserve to be more generally known: for, excepting that some plants and cuttings have been distributed by the Duke of BEDFORD, in consequence of its having been cultivated in his Grace's gardens at Woburn Abbey, it certainly is almost unknown as an esculent vegetable. I have, however, lately learned, that plants of a similar character, and nearly resembling it, are, occa-

* From Vol. V. Part 3, of the Transactions of the London Horticultural Society.

sionally, though rarely, grown in gardens in the county of Norfolk.'

This variety of *Brassica oleracea* was first grown at Woburn Abbey in 1808; and, until 1814, it was cultivated as an ornamental plant. The foliage being very finely divided or fringed, and of a deep-purple colour, it was not considered unworthy of a place in the flower-garden. For seven years it refused to flower, though cultivated in different ways, in pots, in the open ground, and in the green-house. The original plant, in 1817, had attained the height of seven feet, when it flowered; but it did not then perfect any seed. Previous to this, it was found that every cutting or slip of the plant, when properly treated, struck root in the open ground, as freely, almost, as seedling-plants of the common varieties of Kale. On trial of its properties as an esculent, it proved to be equal to the best winter-greens.

In 1815, a space in the kitchen-garden, of one hundred and fifty square yards of ground, was planted with cuttings of the Perennial Kale. This plantation has ever since afforded an abundant crop, annually, of winter-greens, without the aid of manure or any other labour, save that of keeping the ground free from weeds.

The produce, on an average, is double that of the annual varieties of winter-greens; as the following comparative statement will shew:

Perennial Kale, on ten square yards, produced 144 lb. 10 oz.

Green Borecole, on ten square yards, produced 28 lb. 3 oz.

Purple Borecole, on ten square yards, produced 30lb. 1 oz.

It may be remarked, that the plants of the Perennial Kale, which afforded the above produce, were of eight years' standing in the soil, without manure. All the plants in the above trials were cut to within three inches of the ground; and the stems were included in the weight stated as being the complete produce of each variety in one season. These results being obtained under the same circumstances, as to soil, situation, and season, are therefore conclusive of the superiority of produce.

That the nutritive powers of these varieties are nearly alike, the following details of the results of several trials, made with much care, will afford proof:

		Nutritive Matter.	Woody Fibre.	Water.
1750 grs. of the	Perennial Kale afforded	109 grs. ..	233 grs. ..	1408 grs.
1750 grs. —	Green Borecole —	110 grs. ..	220 grs. ..	1420 grs.
1750 grs. —	Purple Borecole —	112 grs. ..	280 grs. ..	1358 grs.

The above trials were all made on the tops and sprouts of the plants used for the table; and, in all other respects, were under the same circumstances.

The following mode of cultivation of the Woburn Perennial Kale I have found perfectly successful:—About the beginning of April, or as soon as the crop of winter-greens is completely out of season, the stems are cut down near to the ground, within two buds of the roots; the soil is then pointed, or slightly forked over, and afterwards kept clear of weeds by the hoe: this is all that is required for a plantation already made. To form a new plantation, the stems cut off in the March or April dressing, reduced to lengths of six or seven inches, answer very well for cuttings to strike root; though the lateral shoots, or those with crowns, make the strongest plants: the first year after that, however, all distinction is lost. These cuttings may either be planted immediately in the places where they are to stand permanently, in rows from twenty to twenty-four inches apart, applying water when required, until they are firmly rooted; or, in a bed of rich light earth, from three to four inches apart, to be afterwards transplanted, when well rooted, to the situations where they are intended to remain. The cuttings should be inserted into the ground, three parts of their length. A soil intermediate, as to moisture or dryness, suits them best. Like most of the *Brassicæ*, this kale requires a rich soil, particularly for the first season: it thrives, however, on clays, as well as on sandy soils; but the weight of produce, on such, is proportionally less.

From defective structure in the essential parts of its blossoms, the Perennial Kale perfects little seed: but, as it propagates so freely by cuttings, the want of seed is scarcely felt in its culture; and, indeed, as it is subject to sport much, when raised from seed, it seems essential to the preservation of the particular variety, that it should be increased by cuttings.

Having obtained about two ounces of the seed, from plants grown in a situation remote from any other cabbage, and even from any cruciferous plant, it was sown. The plants raised from it have exhibited ten distinct varieties: they are now three years old: of these, there is only one that perfectly agrees, in all points, with the parent stock; the rest are different in the colour and form of the leaves. Specimens of the leaves of these have been prepared, and sent for the inspection of the Horticultural Society. The plant which is farthest removed from the original has the leaves smooth, fleshy, nearly entire, and in colour and substance precisely resembling the young leaves, or those emitted by the stems of the Early-York and Imperial Cabbages: from this, through nine others, the colour, form, incisions, and substance of the leaves regularly approximate, until all distinction is lost in the original plant.

The very superior annual produce of the Woburn Perennial Kale, the saving of manure as well as of labour in its culture, and its hardy nature (always ensuring a crop of excellent winter-greens), are properties which recommend it to a place in every kitchen-garden, more especially in those of farm-houses and cottages.

XXXIV.—*On improved Melting-Pots, for Brass-founders, Steel-melters, &c. Invented by Mr.* Henry Marshall, *of Newcastle-on-Tyne.**

Large earthenware crucibles (technically called melting-pots) are used in great quantities by brass-founders, steel-

* From Vol. XLI. of the Transactions of the Society of Arts, Manufactures, and Commerce.—The Society voted its large Silver Medal to Mr. Marshall, for this improvement.

melters, and other workers in metal. They are made in London, Birmingham, Sheffield, and other places; and their ingredients are tenacious refractory clay, together with fragments of earthenware, made of the same or similar clay, reduced to powder more or less coarse according to the experience of the manufacturer. It is not necessary that they should be possessed of the highest degree of refractoriness, since the heat to which they are exposed is not so great, nor are the fluxes employed by the founders so active, as are necessary for the reduction of metallic ores to their reguline state. But it is especially expedient that they should be capable of enduring considerable changes of temperature without cracking or becoming unsound, as otherwise each pot would not be capable of standing more than a single fusion. The common melting-pots being made entirely of earthy ingredients, are very apt to crack, either if allowed to cool gradually after the first fusion, or if a second charge of cold, or nearly cold, material is thrown in while the pot remains in a heated state. The German black-lead pots (or blue pots as they are called) contain a considerable quantity of plumbago in their composition, and hence will stand a greater number of fusions; but the cost of these is considerably greater than the common melting-pots, and in time of war they are not always to be had.

Mr. Marshall's pots are made of a mixture of Stourbridge clay, potsherds, and *pulverized coke*, well incorporated together by beating; and, instead of being *thrown* on the potter's wheel, the pot is made by *pressing* the above composition into a brass mould of the proper size and figure, by means of a core worked by a powerful screw-press. Thus the vessel acquires a great and equal degree of solidity throughout; while the intermixture of *coke* with the clay, by giving *a certain porosity of texture*, renders it much less liable to crack, on transition from heat to cold, than those melting-pots composed entirely of earthy ingredients.

The following certificates from founders of great respectability attest the goodness of the pots made by Mr. Marshall, and that the price of them is not greater than of those from other makers.

CERTIFICATES.

SIR, *Gateshead, near Newcastle, March* 9, 1822.

I have for some time past used the improved earthenware crucibles made by Mr. Henry Marshall, of this place, and find them much superior to those I have formerly had from Birmingham and other places. I have them frequently in use a second day, which I never before could accomplish; and consider them in many respects equal to the black-lead pots, and come equally as low as the pots I have used generally. I am, Sir, &c.

To A. AIKIN, *Esq. Sec. &c.* JOHN ABBOT.

SIR, *No.* 69, *Red-Lion Street, Clerkenwell, March* 21, 1822.

Observing the offer of a premium for improved earthenware crucibles, I beg to acquaint the Society, that those made by Mr. Henry Marshall, of Newcastle-upon-Tyne, are much superior to any I ever saw, or used, for bearing great heats and standing changes of temperature without cracking. I use them frequently a second day, which I could not accomplish by any other make: in short, I conceive them superior to black-lead pots.

I am, Sir, &c.

To A. AIKIN, *Esq. Sec. &c.* ROBERT BOWER, *Brass Founder.*

February 15, 1822.

I certify that the large crucibles, with "H. Marshall, Newcastle," pressed upon the edge, are the best clay crucibles I ever made use of.

H. VERNON, *Master of the Metal Mills, Portsmouth Yard.*

SIR, *Brownlow Street.*

I beg to acquaint you, for the information of the Society of Arts, that I am in daily use of Mr. Henry Marshall's crucibles, and find them of a very improved quality. I use them frequently two or three days: and from having made use of the black-lead pots in my business, I now find that Mr. Marshall's are equal, if not superior, to them, and not higher in price than the earthenware crucibles before in common use. I am, Sir, &c.

To A. AIKIN, *Esq. Sec.* &c. A. HARCOURT, *Brass Founder.*

46, 47, 48, & 49, *Shoe Lane, March* 23, 1822.

This is to certify, that we, the undersigned, can and do assert, from experience, that the melting-pots manufactured by Mr. H. Marshall, of Newcastle, are superior to any we ever used; and that we have tried various other manufacturers' pots, but give a decided preference to those manufactured by the above-named Henry Marshall.

W. PONTIFEX, SONS, & WOOD.

XXXV.—*On the Cultivation of Mesembryanthemums. By Mr.* WILLIAM MOWBRAY, *Gardener to the Earl of* MOUNT NORRIS, *F.H.S. &c.**

SIR, *Arley Hall, near Bewdley, Nov.* 30, 1822.

I SEND, as you desired, an account of my method of managing *Mesembryanthemums;* the different sorts of which, when planted out of pots, contiguous to each other, have a most beautiful effect, and are admired by every observer. The bed I used for this purpose was made in a pit which runs along the front wall of one of the hot-houses at Arley Hall; and is composed of good rich garden-mould, mixed with a fair proportion of fresh loam. In the spring of 1821, I planted out as many plants as filled three lights, putting nine or ten under each light, of different sorts; such as, *inclaudens, aurantium, perfoliatum, deltoïdes, barbatum,* and other species of different habits. The strong-growing kinds were put towards the back, and the dwarf ones in front. They soon grew very vigorously, and

* From Vol. V. Part 3. of the Transactions of the London Horticultural Society.—In a Letter to the Secretary.

flowered exceedingly well; having a very different appearance from that they exhibit when confined to small pots: many of them continued in blossom all winter, and until the spring, when I gave them a good thinning; for they were spreading over each other, and mixing together. At that time, I planted the remainder of the pit; which is forty feet long, and four feet wide, in the clear. I also covered the surface with stones of different sorts; which were laid irregularly, so as to resemble rock-work: the stones had the effect of keeping the branches from the soil, which might otherwise decay them. The whole have done well: many still continue flowering, and are likely to do so through the winter. Nothing can surpass the brilliancy of the blossoms, on a bright day in summer.

In winter, the whole must be covered with lights, and, occasionally, with mats, as pits in front of houses usually are: but these are not necessary in summer, as the plants must be fully exposed to the free air, the same as hardy green-house plants; and require little more, than thinning, and plenty of water. Pits in front of stoves must be preferred; as the warmth from the front-wall in winter will repel damps, and, with a little covering above the glass, will sufficiently keep out the severest frost.

I was induced to attempt the above mode, from observing that ice-plants grow to perfection on small hillocks of rich mould, supported by stones put together in imitation of rock-work, two or three feet high, with a base of about four feet in diameter: these banks look well, when the plants cover them entirely. I have cultivated ice-plants in this manner, with success, every year, since I have been at Arley Hall.

I am, Sir, your obedient servant,

WILLIAM MOWBRAY.

XXXVI.—*On the Hydraulic Engine constructed at Augsburg by the celebrated Mechanic* Reichenbach. (*Continued.*)

WITH A PLATE.

We now give, in Plate V. fig. 3, a cross-section of this machine; and, in fig. 4, a section of the water-wheel and its race. A third Plate, to be shortly added, will contain the details of the valve-boxes; the piston, with a novel application of the ball and socket to it; and other parts, on a larger scale: which will be accompanied with a description of the machine, and references to all the figures in the three plates. (*To be continued.*)

XXXVII.—*On the advantage of using the Colouring Matter of Red Cabbage as a Test for Acids, Alkalies, and Compound Salts.* By Mr. Thomas Griffiths.*

Sir, *9, Church Street, Kensington.*

I request you will lay before the Society of Arts &c. the inclosed specimen of test-paper, made from the infusion of red cabbage; which paper is a test of the presence both of acids and alkalies: the former changing its blue colour red, the latter changing it green.

The application of this paper to the purpose of the experimental chemist I believe will be found to possess a claim to originality. It is thus prepared:—Take one pound of the minced leaves of the red cabbage, and boil the same with a pint of distilled water, till all the blue colour is extracted. The liquor is then to be strained through a cloth or sieve; and the clear infusion, which is of a fine blue colour, is to be evaporated to half its bulk, and poured into a shallow dish: the paper may then be dipped into it, and hung on lines to dry. A sheet of the filtering paper, which is the paper used, absorbs two fluid ounces of the infusion.

Metallic and other salts, which, although they be neutral, give indications of alkali with turmeric paper, do not

* From Vol. XLI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

affect this paper as alkalies, but give indications of neutral or acid salts, as may be the case.

The paper is reddened by the following acids:—Acetic, arsenic, boracic, camphoric, carbonic, citric, malic, muriatic, nitric, oxalic, phosphoric, prussic, pyroligneous, sulphuric, sulphurous, tartaric, and all the acids that I have tried.

It is turned green by the following alkaline substances: —Potash, soda, lime, baryta, strontia, magnesia, ammonia, carb. ammonia, carb. potash, carb. soda, borax.

The following substances give alkaline indications with turmeric paper, not being so:—Permuriate of iron, protomuriate of iron, pernitrate of iron, protonitrate of iron, protosulphate of iron, persulphate of iron, sulphate of zinc, muriate of tin, muriate of zinc, boracic acid.

Corrosive sublimate reddens this paper, as also that from litmus.

Acetate of lead turns this paper green, as an alkali does; but there is no test-paper with which it does not give indications of alkali.

In alkalimetry, *two* test-papers are employed, litmus and turmeric; and two drops have to be taken repeatedly from the solution, in order to try if it is acid or alkaline; and by taking away so many drops, the result of the process is rendered fallacious.

With my test-paper, one drop of the solution only is required, as it is a test both for acid and alkali. In many other processes of analysis, a test for acid and alkali at one operation may probably be found advantageous.

THOMAS GRIFFITHS.

XXXVIII.—*On Native and Artificial Carbonates**.

CARBONATES are formed by the combination of oxides with the carbonic acid. These kinds of salts may be divided into

* From the *Dictionnaire Technologique*.

two species; neutral carbonates, and sub-carbonates: they differ in the proportion of acid they contain. In the neutral carbonates, the base forms a fourth part of the quantity of the oxygen contained in their acid; and in the sub-carbonates, the proportion is as one to two.

The generic character of carbonates is, to produce a brisk effervescence whenever they are thrown in powder into any acid. The result of this decomposition is, on the one part, the carbonic acid, which is disengaged in a gaseous form; on the other, a salt, formed by the union of the base of the carbonate with the carbonic acid employed. Another distinct character of the carbonates may be mentioned, which is, their ready decomposition by the action of heat; with the exception, however, of the sub-carbonates of potash, soda, barytes, and strontian, which do not possess this property.

The neutral carbonates are scarcely known, and consequently very little used. The sub-carbonates, on the contrary, are widely diffused, and constitute a great part of the mass of the globe: they are applied to a great number of purposes; and their history, either as respects science or the arts, is one of the most important that can be traced, and on every account merits an especial attention. We will therefore commence this article by describing them; and close it, by adding what is important respecting the neutral carbonates.

Sub-carbonates.—We shall here only treat of those kinds which are well known, and much employed in chemistry, in medicine, or in the arts.

Sub-carbonate of ammonia.—This salt is one of the constant products of the decomposition of all animal matters, when submitted to the action of a somewhat elevated temperature: but as it is then always accompanied by an extremely fetid oil, and as it cannot be purified in the same manner as other salts, on account of its great volatility, it is evident that we cannot have recourse to any direct means to produce this salt, when we would obtain it divested of all foreign matters. The white sub-carbonate of ammonia of commerce is always the product of the decomposition of another ammoniacal salt, by a sub-carbonate: the common sal-ammoniac is generally used for this manufacture; but care is taken to choose it perfectly white and dry. To eight parts of this salt, ten parts of pulverized whiting are added, well washed and dried; the whole being mixed together; and either put into a glazed earthen retort, *coated*; or into a cast-iron apparatus, according to the quantity to be made at once. To the first vessel a leaden or earthenware receiver may be adapted, perforated at the bottom: this recipient must be plunged into a tub, with a constant current of cold water passing through it. All the joints of this apparatus must be carefully luted together, and a loose or moveable plug be adapted to the opening at the bottom: the operation may then be commenced; being very careful to apply a very moderate heat, particularly if an earthen retort be used. The proper temperature to be preserved is that in which the vapours may be condensed as fast as they are emitted: and the fire must necessarily be slackened, whenever the vapour escapes, by raising the plug placed at the lower extremity of the apparatus. On the contrary, the operation is supposed to be going on properly, when the vapours are not driven out forcibly through this opening, and a thick cloud is seen in the interior of them, in which nothing is perceived but a slight movement. Another indication, which may serve as a guide to the operator, is the temperature of the recipient, which is always regulated by the greater or less quantity of vapour which is disengaged; and this consequently shews whether the fire should be augmented or slackened. As the decomposition advances, it becomes more difficult to produce the ammoniacal carbonate; and it is only by increasing the heat that it is obtained. We are apprised that the operation draws near to a close, when the vapours rush out in a forcible manner, and are no longer cloudy, but quite transparent: this appearance is caused by the great quantity of aqueous vapour which is produced at this time. Finally, the operation is known to be entirely terminated, when, notwithstanding that the heat be constantly kept up, the recipient becomes quite cold. It is advantageous, however, that the operation should not be continued to this juncture, but that it be stopped at the moment when the aqueous vapours are seen to be disengaged; because these vapours will dissolve a portion of the condensed product in the recipient; and especially as the small quantity of carbonate accompanying them is not worth the large quantity of fuel required at this period to produce it.

The operation being finished, the apparatus is allowed to cool, and is then unluted. If an earthen receiver has been used, and be broken, the upper part of it is found to be lined by a very beautiful dense carbonate, which is pellucid, white, and very dry: it is about two inches in thickness, if a sufficient quantity of materials have been acted upon. The salt condensed at the lower part is always somewhat damp and discoloured; and must be kept apart, to be rectified. M. Gessard, a manufacturing chemist, proposed (*Bulletin de Pharmacie*, tom. ii.) to submit all the products obtained, to a rectification. But this operation may be entirely avoided, by using none but the best articles in this manufacture: their greater value will be more than compensated, by the expense saved, and the loss avoided, which always attends rectification. Whatever precautions may have been taken, there is still a considerable quantity of the sub-carbonate of ammonia decomposed; and the emission of the ammoniacal gas is so rapid, that it becomes insupportable to the operator. M. Gessard has proposed, indeed, to make this gas pass through tubes, surrounded by water; but the carbonate accompanying it, stops them up so quickly, that they must be changed every instant, which is not possible. The sub-carbonate thus obtained is also less odorous, because it loses a great part of its base.

We see clearly that the product of this operation arises from a double decomposition of the respective bases and acids: but it would be wrong to attribute this result wholly to the influence of affinity; for we know that it is possible to regenerate the two primitive salts employed (that is, the sal-ammoniac and the carbonate of lime), by mixing the solutions of the two salts resulting from their reciprocal decomposition. This difference of effect evidently depends on the influence of the circumstances under which we act. In the one case, it is the caloric which produces the formation of an extremely volatile combination: in the other, it is the cohesion which determines the production of the most insoluble combination that can be obtained by the four given elements.

The sub-carbonate of ammonia possesses the odour of its base, which is owing to its excess: the ancients, who knew nothing of the carbonic acid, called it the concrete volatile alkali, in order to distinguish it from its base; to which they gave the name of *fluid volatile alkali,* on account of its liquidity. The sub-carbonate of ammonia, however volatile it may be at the temperature of boiling water, will nevertheless crystallize on cooling: for this, it is only requisite that it be dissolved to saturation in a BALNEUM MARIÆ, at a temperature from 60° to 80° of the centigrade thermometer. The solution is then to be filtered; and it deposits, on cooling, a great number of transparent granular crystals, without any well-defined form. It is in this state that it is sold, under the name of *sel volatil d'Angleterre.*

A great quantity of the sub-carbonate of ammonia is employed in the chemical laboratories: it is an excellent re-agent, to detect some substances; and is particularly valuable, for the property it possesses of dissolving certain oxides, and, owing to its great volatility, of being readily separated from them. A great quantity of this salt is consumed in giving pungency to snuff. It has been demonstrated, indeed, that ammonia is the natural vehicle to a great number of odours; and as such, is particularly useful in the manufacture of snuff. The energy of its aroma is regularly heightened by the presence of volatile alkali: it is the same with musk, and many other substances. The sub-carbonate of ammonia is also very frequently employed in scouring cloths, and particularly in the removing of spots caused by acids. It is the best material that can be employed in this case; because it is essential to make use of a body, which, whilst it entirely destroys the effect of the acid, does not produce any other, equally mischievous; which takes place when more active alkalies are used.

The sub-carbonate of ammonia results from the combination of two parts, in volume, of ammoniacal gas, and one of carbonic acid; or of an atom of acid, and another of its base;—or, in weight,

of 56,41 carbonic acid,
and 43,59 ammonia.

Such is its composition in its perfect state; but the sub-carbonate of ammonia of commerce always contains 10 or 12 parts, in the 100, of water; and it also varies in other respects, according to the temperature at which it has been obtained. The more it has been heated, the less ammonia it contains.

Sub-carbonate of barytes.—This salt exists in nature; and is found, rather plentifully, in veins. We owe to Doctor Withering the first discovery of it, at Anglezark, in Lancashire; and he has explained its composition. The celebrated Werner has given to this mineral the name of *Witherite.* It has since, however, been found in many other places. Witherite is generally found in the form of fibrous concreted or mammillary masses: it is pellucid, and of a yellowish colour, resembling that of horn. Its primitive form is an obtuse rhomboid. It approaches, in density, to sulphate of barytes; but differs greatly from it in its composition, its structure, its solubility in weak nitric acid, and its infusibility when submitted to the action of the blowpipe.

The native sub-carbonate of barytes is employed in England to destroy rats: it is used in the laboratories, to obtain various salts of barytes; for which purpose it is sufficient to dissolve it in any suitable acid; always, however, taking the precaution to dilute it; because, on the one hand, its strong cohesion forms a great obstacle; and, on the other, the solubility of the barytic salts is not sufficiently great to abstract the water naturally combined with the acid employed; and a further portion must consequently be added. We may nevertheless arrive at the same result, by taking care to calcine the sub-carbonate of barytes: by this means, it becomes more porous, its cohesion is partly destroyed, and then the acids attack, and dissolve it with much greater facility.

For some purposes, however, the artificial carbonate of barytes is made use of; that is, such as is obtained by the double decomposition of a soluble salt of barytes and an alkaline sub-carbonate: but, as it is requisite that it be in this case perfectly pure, it is evident that it cannot be thus obtained, but from salts already purified: it is, therefore, generally procured by employing the sub-carbonate of soda and the muriate of barytes, both in solution. The sub-carbonate, thus obtained, must be washed till the washing-water comes from it perfectly pure. Berzelius has recommended the employment of the sub-carbonate of barytes for the treatment of those minerals in which the presence of an alkali is suspected; but he advises, for the greater certainty, to prepare the sub-carbonate of barytes with the sub-carbonate of ammonia, which is removed more easily than the other, by washing and dessication.

The sub-carbonate of barytes is composed of $\left\{\begin{array}{l}22 \text{ acid.}\\ 78 \text{ base.}\end{array}\right.$

Sub-carbonate of lime.—There is not another, amongst the great number of salts known to exist, that excites so great an interest as this, in whatever way it may be considered; whether its excessively-varied forms, its formation, its origin, the divers periods of its creation, its situations, the enormous masses which constitute it, the multifarious uses to which it is applied; all these merit particular attention, and might become the subject of profound study: we could not, therefore, give a general history of it, without writing whole volumes; but shall here content ourselves with considering it in that point of view in which its utility in the arts is most conspicuous; and, consequently, confine ourselves to a description of those varieties so employed. Nevertheless, we shall give a slight glance at the classification which naturalists have endeavoured to establish among the numerous varieties of carbonate of lime; or, at least, we will point out the principal groupes of this large family; referring those of our readers, who desire a fuller detail, to the treatises of mineralogists.

We distinguish two distinct species of carbonate of lime —the octohedral, and rhomboïdal. The first was formerly known by the name of *arragonite:* it is generally found in the form of a prism, with four or six faces, or a dodecagon, composed of two acute pyramids, opposed base to base. The cleavage of these crystals leads to a primitive form, which is an octagon; whilst the natural joints of the lamina of the rhomboïdal carbonate of lime, whatever may be its secondary form, always inclines to an obtuse rhomboïd. Now, according to the crystallographers, one substance cannot assume two different primitive forms; and it must therefore be classed under two distinct species. These two species, however, have been analyzed comparatively, by a great number of chemists of the highest respectability, who have ascertained the identity of their composition. Stromeyer of Göttingen is the only one who has found carbonate of strontian in the arragonite, but in quantities very small and variable. MM. Bucholz and Meissner have since pointed out some varieties of arragonite which do not contain any portion of carbonate of strontian; thus the difficulty remains as before, and the crystallographic mineralogists continue to make two distinct species of the arragonite and the rhomboïdal spar: and in this they think themselves fully authorised; as there may exist, in these two species, other differences, which are independent of their form:—the arragonite, for instance, is harder and of greater specific gravity than the common carbonate of lime. They therefore pretend, that there must exist real differences in the composition of these two salts; and if they have hitherto been known, or considered, as identical, it must be owing to the insufficiency, and the imperfection, of our analytical methods. We, in fact, do not possess any given means, which can conduct us to the discovery of this difference: all that we know, is, that these three circumstances constantly accompany it, *in situ*, either together or separately:

1. The presence of gypsum, which is, however, the least frequent.

2. That of rocks; evidently of volcanic origin, or, at least, very probably so; such as basaltes.

3. That of oxide of iron: this is the most common accompaniment.

At present, we cannot infer much from these observations; but they may eventually prove of great importance.

We will no longer dwell on the comparison of these two species; nor shall we describe any of the varieties of the arragonite; because, with respect to the arts, they present no interest.

All the varieties of the rhomboïdal carbonate of lime have this general character, besides those appertaining to all the carbonates, that they afford, when strongly heated before the blow-pipe, a quick-lime, known by its sparing solubility in water, its acrid and urinous taste, &c.: all have also the property of readily dissolving in nitric acid, and of letting fall a precipitate of an insoluble salt, when the oxalic acid is added to this solution. When the rhomboïdal spar is transparent and homogeneous, it affords the phænomena of a double refraction; that is, when viewing an object through the two parallel faces of the primitive rhómboïd, we perceive two images. It is not the same with the crystals of arragonite.

(*To be continued.*)

XXXIX.—*On the Manufacture of Ceruse, Krems-White, or White-Lead; and, particularly, of the celebrated Ceruse of France.*

(Continued from p. 62.)

It now only remains for us to point out the methods employed for pulverizing the sulphate of barytes, and for triturating the mixture of it with the carbonate of lead. The mill for pulverizing the sulphate of barytes is frequently impelled by water: under the stampers or pestles of this mill, the barytes is placed, on iron plates perforated all over; so that the powdered sulphate of barytes, passing through the holes in the plates, falls into receivers, placed underneath them.

The triturating of the sulphate of barytes, and the mixture of it with the carbonate of lead, is performed in a colour-mill, nearly similar to that already described, as being used in the manufacture of blue verditer.—(See Vol. III. p. 354; and a representation of the mill in Plate 13, fig. 1.)

The workman employed in the trituration of the carbonate of lead turns the upper stone, whose diameter is from twenty-two to twenty-four inches, by means of a pole; which works in a ring, fixed either in the wall, or in the cieling over the centre of the stone, so that the pole be free, and not confined in its movements in the ring. The lower extremity of this pole, or handle, is furnished with an iron socket, terminating in a pin, which is placed in a hole made in the top of the stone near the periphery. It is evident that the mill-stone will move round its centre, when the workmen turns the pole in a circle.

The white lead, either mixed with barytes, or entirely pure, is poured into an opening made in the centre of the upper or moveable stone; and when it is sufficiently ground, it is passed down a spout, into a proper recipient. The lower stone is surrounded with a border of wood; to prevent the liquid colour from being scattered, and guide it slowly into the spout.

The upper stone is made to rise or fall, so as to grind the colour to the degree of fineness required.

In order to effect the complete mixture of the sulphate of barytes with the carbonate of lead, they reckon that half a day's work is required to finish 100lb.

General Observations.

According to the description which we have given of the routine of operations which the carbonate of lead requires, it appears very astonishing that the preparation known by the name of *Krems white* has been but very imperfectly imitated in other parts of Europe. That it has not been effected in a complete manner, cannot be caused by the quality of the acetic acid employed in Germany; since, in many manufactories, all kinds of vinegar are indiscriminately used: even in the establishment at Klagenfurt, the vinegar, or rather *verjuice*, made from wild apples, or crabs, is often used; and vinegar, possessing very little strength, is frequently made use of in Germany. Neither can it be accounted for by their mixing sulphate of barytes with it; since *Krems white*, of the finest quality, does not contain any; as the more sulphate of barytes is mixed with the carbonate of lead, its white colour is the less beautiful.

If we might judge of the causes of the ill success of this preparation in other parts of Europe, we might perhaps think, that the beauty of the *Krems white* may be attributed to the following causes—first, perhaps, partly, to the purity of the Villach lead, which does not contain the smallest quantity of silver; a thing very rare, and which may contribute to the beauty of the carbonate of lead. It is evident, that in these preparations in which the sulphate of barytes is mixed, the purity of this substance decides the beauty of the white.

2dly, to the manner of washing the carbonate of lead. It appears that it is especially in the manner of performing the washing that the dexterity of the workman principally consists; and he who best understands the manner of washing the lead, is regarded as the most able workman. It is on this process, simple as it appears, that the greater or lesser beauty of the white lead depends.

3dly, to the means of trituration; which although simple, are yet sufficient to give the greatest brilliancy to the white.

4thly, to the manner in which the lead is disposed in bent sheets, a form the most favourable to the action of the vapours; which not having to act upon a thick body, may the more easily corrode the surfaces submitted to their action. The lead, in this manner, is more decomposed; and, consequently, the carbonate must be more perfect.

And, Lastly, to the mode of evaporation. The slow evaporation, generally used in the manufactories of *Krems white*, is favourable to a successive developementof the acid vapours; so that they only attack the lead, submitted to their influence, by degrees; the result of which is, that there are very few vapours lost; and a great superiority, both in the weight and in the quality of the carbonate of lead, is obtained.

In 1809, M. Dall'armi, proprietor of a manufactory of ceruse at Rome, sent a memoir to the *Societé d'Encouragement*, in which the author laid before them many very important observations, which we think it our duty to introduce here. M. Dall'armi, after having related the various phenomena which the formation of ceruse presents, conceived that the vinegar was only an intermedium in this manufacture, and disposed the lead to unite itself to the oxygen and carbonic acid: he supposed that these three agents must be incessantly acting at once upon the lead; and that the fault of the manufacturers of the ceruse of commerce was, that they did not sufficiently attend to this necessary combination; and that, therefore, the products obtained by them, were always uncertain. He presumes, that it would be almost impossible to obtain, spontaneously, layers perfectly white throughout their mass. Nature only converts lead into ceruse in a slow and gradual manner; necessarily leaving that white imperfect, which immediately touches the metallic lead.

Agreeably to these observations, the author employed an arched vault, where the carbonic acid extricated might be contained, as in a reservoir; and into which the air could only penetrate by two small apertures made in the crown of the arch. He also deviated from the accustomed plan, of placing the pots one over the other; and formed but one layer of them, which he placed upon a bed of horse-dung, of one foot in thickness, and lightly pressed together: he then placed straw upon the pots, and over this, a second layer of horse-dung. He was certain that this disposition would prevent an excessive accumulation of heat, which should be constantly kept up to 40° or 55° of Réaumur's thermometer*; and that it would also facilitate the access of air to the interior of the pots. These vessels, which were in the form of a truncated cone glazed within and without, and a foot high, had each a cross of white wood, fixed about two inches from the bottom, on which a dozen leaves of cast lead were placed. Into each pot he poured two small glasses of vinegar, diluted with water, that it should not be too strong: he then covered them, which finished this part of the process. At the expiration of a fortnight, he visited the pots, in order to put more vinegar into those which he found to be empty. This operation was easily performed, and without displacing the lead, by raising the layer of dung, and sounding the pots with a little rod. In six weeks afterwards the whole was opened in order to collect the ceruse. The scales of it were then found dry, and not adhering very closely to the leaves of lead, on which they were formed: it was found sufficient to bend the latter, in order to remove the ceruse, without producing scarcely any dust: nevertheless, in order to preserve the health of the workmen, and that they might not be subjected to the inhaling of this dangerous powder, the author invented close cases, with three compartments, in each of which two workmen might be employed at once. The first compartment had a moveable cylinder in it, with two divisions, which received the leaves,

* 122° or 156° of Fahrenheit.

covered with ceruse, which a child threw in; after having separated them from the soiled and pasty ceruse, and from the thick residuum of vinegar, which is always found, in a greater or lesser quantity, at the bottoms of the pots. In the second compartment, he placed high and narrow boxes, of such a size, that a workman might readily remove them, when they were filled with the scales of ceruse. The workmen threw into them that ceruse which was intended to be passed through the mill; and weighed them, when they were full. Into the third compartment he introduced those leaves of lead which had already been once used; and which he weighed, before returning them into the pots, in order to form new ceruse. The workmen, who were stationed opposite to each other, placed their arms in two leather sleeves, which were nailed to two openings made in the case: they tied these sleeves round their wrists; and were thus prepared for working in the interior of the case, which was completely closed, the light only being admitted by a pane of glass. The author also recommended another precaution which appeared to him to be necessary; and which was, that the workmen, before commencing their labours, should rub their hands over with oil, suet, or soap; in order to close the pores of the skin, and render it less liable to absorb the ceruse. This method, though very simple, has, in his estimation, many advantages. First, it is very expeditious, and, at the same time, preserves the health of the workmen employed.—Secondly, the leaves of lead, which remain after the ceruse is detached from them, do not lose their form, and may be regularly replaced in the pots.—Thirdly, it allows, even at the moment of collecting it, an exact account to be taken of the quantity of the product.

The lead, by being converted into ceruse, increases in weight about 33 *per cent.* — that is, If they place 300 kilograms of lead in the pots, and afterwards extract 133 kilograms of ceruse, they will find about 200 kilograms of lead in its pure state, ready to be submitted to a renewal of the process. The mean product which M. Dall'armi obtained from each pot, was 4 kilograms and one-sixth of ceruse. That which remained at the bottoms of the vessels, after having been washed, worked, and reduced into loaves, had a dusky white appearance, but was nevertheless readily sold.

The abundance of the product depends, in a great measure, on the breadth of the leaves of lead which are introduced into the pots: the thinner they are, and the greater the surface presented to the action of the vinegar, the quicker they are converted into ceruse. The author, by way of experiment, affixed some of them to pieces of pumice-stone, made as lids to the vessels, and so disposed as to admit into the interior of them both atmospheric air and carbonic acid; but finding that this process was extremely expensive, in lead, fuel, and time, and besides, had many other inconveniences, he adopted small ingot moulds of cast-iron, in which he cast the leaves as thin as he wished; and these might be cooled at pleasure.

Cast-lead is generally preferred, as well for economical reasons, as because the surface of laminated lead obstinately resists the action of the vapours from the vinegar.

The kind of dung employed, is likewise of importance. To fresh dung, that which is already advanced in putrefaction must be added, and the mixture must be varied, according to existing circumstances; the end designed being, to produce and support an intense heat, but not to be so strong as to quickly volatilize all the vinegar in pure loss, and thereby to fail in the operation. The author tells us, that he has tried, with success, to replace the dung, with tan, recently taken from the pits.

If there is any preference in the scales of ceruse, it must be given to those that are the thickest; because, being fewer in number in any given weight of lead, they do not afford so much of that grey matter with which the leaden leaves are constantly covered. In order to break the scales, they are indiscriminately put either into a horizontal or a vertical mill, according as situation renders the one or the other most convenient. The scales are generally hard and compact; after having been crushed, they are ground with water, till they are reduced to a thin kind of pulp, or nearly a liquid state, and of an impalpable fineness. This operation requires many hours to complete it. Care must be taken not to put in too many scales at once, according to the power of the mill. The paste is afterwards washed in a great quantity of water, and passed through a very fine sieve, which retains every impurity; such as any small particles of lead which may have fallen amongst the scales, grains of ceruse, imperfectly triturated, &c. The water is decanted after the carbonate is precipitated. In this state the ceruse must be submitted to different preparations, according to the use for which it is designed.

The paste, still too liquid for use, is laid and spread upon a clean linen cloth, resting upon a flat absorbent surface, formed of wood-ashes, washed and powdered; of powdered bricks and plaster of Paris, all mixed together with water, and carefully dried, at a moderate heat, by means of brasiers placed under it. They thus quickly bring the paste to such a consistence, as to receive with facility any form desired, and without its being subject to injury, or becoming spongy and friable in its complete drying. They either fill small unglazed earthen vessels, of a truncated conical form, with it; or make it into the form of bricks, by compressing it in moulds. The loaves are left to dry in the cups; and the bricks are placed on the absorbent supporters, either in the air or on a stove; carefully guarding them from dust, smoke, or sulphurous vapours.

For painting in oil, the artists prefer, for their pictures, that ceruse which is of a beautiful clear white, and is of the greatest opacity; but when it is used to cover large surfaces, as in house-painting, it must be a colour which easily incorporates with the oil, and spreads well under the brush or pencil. It has been found that a mixture of chalk will give to the ceruse those qualities which the workmen desire. According to M. Dall'armi, this mixture may be extended to a twelfth part. The quality of the chalk has also, necessarily, an influence on the ceruse. He recommends that it be whitened by means of muriatic acid, for ceruse of the first quality; but for the second quality, he thinks this whitening superfluous.

Since he has not placed the pots one above the other, as usual, he has not found either the leaves of lead, nor the scales of ceruse to be covered with that black coating, which he had good reason to suppose was the effect of the sulphuretted hydrogen, developed by the fermentation of the animal matters, and retained in the midst of a great heap. Nevertheless, in spite of all the changes which he has made, whenever this gas is formed, the pots are slightly coloured by it.

The author, wishing to dissolve and form into white salts the oxydized atoms of the foreign metals which are often found in lead, and at the same time to disengage the sulphuretted hydrogen which might be found in the paste, tried for this purpose weak muriatic acid. He is certain of obtaining complete success, although his experiments have, as yet, only been made on a small scale.

[*To be continued.*]

XL.—*Additional Remarks on Zinc Furnaces &c.* By a Correspondent. *With the Editor's Observations thereon.*

Sir, *Falmouth, Jan.* 21, 1824.

Your observations on my remarks on the late Mr. Sheffield's zinc pots and furnaces* render it necessary for me to address you again on the subject, by way of explanation. You do not agree with me in my opinion, that these pots and furnaces will not answer the purpose for smelting zinc in the large way, because you know that an ingot of zinc was produced from one of these pots.

I have no doubt but that zinc can be produced from a

* See our last Number, p. 54.

charge in either of the pots described in the 2d Number of your Repository; and I have not given it as my opinion that it cannot be produced from them; I only said, that they could not be used to advantage, and gave my reasons for this opinion. The greatest objection to them is the utter impossibility of removing the remains of the charge, without breaking the tubes. Can you inform me how an iron ladle, or any other instrument, can be introduced through the charging-holes of these pots, so as to take out the refuse of the charge?

I really cannot see how it is to be accomplished: and if this cannot be done, a new pot must be used for every charge, which would be attended with an expense that could not be borne. Some of the zinc-pots, which are used in the large spelter-furnaces, the dimensions of which I have given you in my last communication, remain good for twelve or fifteen months. When the pots have been in the furnace for some time, the sides, which are immediately exposed to the fire, vitrify, and become thin: when this is perceived, they are moved round, and a fresh surface is opposed to the heat: by this means, they last much longer; but Mr. Sheffield's pot, fig. 3, owing to its having a neck, cannot be moved; it is therefore, for this reason, not suited to the purpose for which it is intended.

I feel much obliged to you for adding, in a note, what you considered as an omission in my description of the process of procuring zinc by distillation in a retort: but I did not direct the neck of the retort to be immersed in water, because I knew, from experience, that the pressure of a column of water would force the zinc through every pore of the retort, and render the produce very deficient.

If the neck of the retort be a foot long, the whole of the zinc will be condensed in it, if it be left open, and care be taken to rake it out, with a crooked wire, as it is collected, lest the neck be choked. In this way, I have procured nearly 1oz. of zinc, from 2 oz. of clean black blende, which had been thoroughly calcined, and mixed with charcoal

I have frequently used the same retort for three different assays of blende, and always found a greater produce from the second and third operations; because the retorts become so vitrified, externally, by the heat, that they are rendered impervious to the zinc. These retorts have been only made *of a particular composition*, under my direction: they may be put into the strongest fire, without any preparation, and it is impossible to fuse them in any furnace.

I cannot conclude, without assuring you, that although we do not exactly coincide in our opinions respecting the zinc apparatus, I entertain the highest opinion of the ability, which you have shewn, in many instances, in conducting your excellent work.

I am, Sir, your obedient servant,

T. Gill, *Esq.* R. E.

Observations by the Editor.

We are again induced to regret, that we cannot subscribe to the opinions of our esteemed Correspondent, R. E. on the apparent deficiency of the late Mr. Sheffield's zinc-apparatus, to answer its intended purpose: as we can hardly believe that a metallurgist of Mr. Sheffield's vast experience would attempt a thing not likely to succeed. As to the zinc-pots requiring to be changed at *every charge*, we do not see the necessity of it; as a sufficient space might be left around the bottoms of the tubes, to receive the refuse of *several charges*, by only leaving out some of the perforations at the bottoms of the tubes.

The ingot of pure zinc, of which we have a part in our possession, was two inches and five-eighths broad, one inch and five-eighths thick, and of a length proportionate; so that it may be considered as forming part *of a successful operation in the large way.* The beautiful appearance of the brilliant facets of the fractured parts is such as we have never seen in any other specimen.

XLI.—*On the advantages of planting Forest-Trees amongst Furze.* By CAPTAIN JOHN HAWKINS.*

SIR, *Quay House, near Kingsbridge, Devon, October* 1, 1822.

I BEG leave to detail some of the experiments made since my return from India, four years ago, in improving thirty acres of waste land on an estate of mine, called Flear, three miles from the town of Kingsbridge, in Devonshire, the greater part of the land not being worth half a crown an acre, and some of it not even sixpence an acre.

About two acres of this land, covered with immense heaps of rubble, thrown out from old slate quarries, being well situated for a cider orchard, and four acres and a half of rocky ground lying favourable for irrigation, I converted the last-mentioned portion, at a considerable expense, into a watered meadow, and the other portion I prepared and planted with apple-trees.

But although the meadow promises to yield a fair crop of hay during the next season, and the orchard has this year produced some bushels of apples, yet, as all that I mean to do to them will not be completed before the next Spring, I propose to defer the description of the method adopted in converting these two portions of useless ground to such valuable purposes; confining myself at present to the description of the remaining twenty-four acres and a half, which were planted with forest-trees.

Of this quantity, seventeen acres and a half was a brake of the common *dwarf* English furze, lying on the side of a steep rugged hill facing the West: being at first unwilling to plant the whole quantity, the furze was rooted out from six acres of the most even land, which was then ploughed, manured with lime, and sown to oats; but the crop failed, and I then determined to plant the whole, engaging Mr. John Pontey, nurseryman and planter, of Plymouth, for that purpose.

Mr. Pontey having viewed the land, advised me to pro-

* From Vol. XLI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

ceed in rooting out the furze with mattocks, and to clear all the land previous to planting the young trees, similar to the six acres already cleared and sown to oats the season before, and accordingly four acres more were cleared of the furze roots. But finding the rooting up of the furze tedious and expensive, I determined to plant the young trees in the remaining seven acres and a half, in pits dug among the furze roots, previously cutting off the growing furze close to the ground with a hook, and without any other preparation of the land whatever.

[*To be continued.*]

XLII.—MISCELLANEOUS.

On the unfair publication of garbled Extracts from our Work, without acknowledgment, and with misrepresented Wood-cuts of the Figures.

It has just come to our knowledge, that the proprietors of a minor weekly publication of very recent origin have been largely making *garbled* extracts from our work, particularly of the articles furnished by our Editor, as fast as they appeared; not only without quoting the work from whence they derived them (except in one instance), — and thus endeavouring to make them appear as actual contributions from the author of them to their work; but also making him accountable for the *misrepresentations* of them, contained in their own wood-cuts.

Our Readers will recollect, that, in Vol. IV. p. 235, published in October last, we gave an article "On an improved mode of actuating Snuff-Mills," with an engraved figure; to which we request they will refer. This improvement was self-evident, in our description and engraving of it; and the Editor congratulated himself on the great saving of friction it would occasion, on its adoption, over the old method of actuating snuff-mills.

How greatly then must he have been surprised, on finding, in the work alluded to, his invention so completely misrepresented in their wood-cut! which, instead of exhibiting an improvement in the mode of actuating snuff-mills, has transformed it into a worse mill than those usually constructed.

It represents a snuff-mill upon an upright axis, with a cylindrical neck above, but so *roughened* by the wood-cutter, as to appear more like a cylindrical *rasp,* or *file,* than a smooth polished neck, as in the original. But this is nothing, in comparison with what we shall next describe. Our engraving shews the lower end of the axis as being formed into a polished cylindrical pivot, with its end slightly convex, resting upon a flat polished steel plate, described as being quite hard; and the pivot as surrounded by a bell-metal collar, also resting upon the steel plate, and having four semicircular hollows made across its lower face, to allow of oil flowing into it from the box or chair in which it was placed, and thus to keep the acting parts constantly running in oil, exactly as described in Vol. I. p. 454, in our article "On reducing Friction in Machinery." It is evident, that, in this improved construction, the weight of the cast-iron snuff-mill, or mortar, is supported upon the end of the axis; and it would, consequently, turn with great ease, and very little loss of power from the friction upon the pivots. But, instead of this disposition, the wood-cutter has actually converted the lower pivot into *an angular conical boring or cutting tool,* used, seemingly, with an intent to perforate or bore a hole in the flat plate it rests upon: for, as no explanation whatever is given of the parts, this would appear to be its only office; and thus our Editor, in whose name this misrepresentation is given, is made answerable for a means of *producing friction,* instead of *lessening it,* as he hoped he had successfully done.

Nor is this all;—for, instead of the pivot being surrounded, as we have above stated, with a bell-metal socket, resting upon the bottom plate, we are presented with a *something* (but what, it is impossible to make out) surrounding *the conical end of the borer,* between two screws: as it does not come at all into contact with the bottom plate: and, in short, there is such an entire change in the construction of the parts as could never have arisen from *mere carelessness.*

Queries.—On an universal Chuck for Turning; On the want of a good Work on Turning; on a Turner's and Lapidary's Lathe in one; On a Lute for Pumice-stone Furnaces; On uniting pieces of Tortoise-shell; On rendering Silk, or Linen, Water-proof; and, On preserving Birds, and other subjects of Natural History. By a CORRESPONDENT.—*With Observations thereon, by the* EDITOR.

SIR, *Newark, Nottinghamshire, Nov.* 14, 1823.

REFERRING to the First Volume of your valuable Repository, Article 53, I find an Universal Chuck for Turning mentioned. I beg leave to inquire, if you can inform me where I can obtain one, and the price of it: or if you cannot do that, you perhaps may shortly be able to give a description of it, in an early number of your interesting work, together with an article or two on Turning:—for I perfectly agree with your former Correspondent, on the want of a work on Turning. In case you, or any of your valuable Correspondents, could give a description of a Lathe, uniting the Turner's and Lapidary's Lathe in one, it would, I doubt not, be very acceptable to a number of your Amateur Subscribers.

Can you inform me, what is the best lute, or cement, for fastening small pieces of pumice-stone, as a lining for a furnace of a larger size than the very excellent portable furnace of your invention.

Are you in possession of a method of joining tortoise-shell, without rivet or cement; or a way of softening and uniting small pieces of it together, after the manner of *papier-machée?* What is the best method of rendering silk or linen water-proof, without making them adhesive or liable to crack?

I think an article or two upon preserving birds, and other subjects of natural history, will be very acceptable to many of your Readers.

Requesting you will excuse my troubling you with so long a Letter, and wishing every success to your Repository, I beg leave to subscribe myself, Sir,

Your obedient servant,

A CONSTANT READER.

J. R. R.N.

Observations on the foregoing Queries, by the EDITOR.

In regard to the *Universal Chucks*, for Turning, they are of various forms, and suitable for different purposes, according to their construction. We are in possession of several, not generally known; and which may, hereafter, form subjects for this Repository. A good Work on Turning is yet a desideratum in the English language. The French and German Works are the best hitherto published upon this extensive and interesting subject. We fear that *a good Lathe*, uniting in itself the twofold qualities necessary to fit it for the Turner and Lapidary, is hardly to be expected. Messrs. Holtzapffel and Deyerlein have, indeed, lately fitted up several, with convenient horizontal laps of cast-iron, pewter, and brass, to be occasionally driven by the band-wheel, for the purpose of grinding and sharpening the turning-tools with accuracy, and for engine-turning; and, where it is indispensably necessary, the laps used in grinding and polishing stones, gems, &c. may be possibly actuated in a similar manner. There can be no difficulty in driving the sheet-iron circular plates used in slitting the stones, with emery and water, or diamond-dust and oil of bricks, in the ordinary lathe.

We do not recommend the employment of *pumice-stone, for lining large furnaces*; as, although it is a *tolerably refractory, natural slag*, yet we have experienced that, even on the small scale recommended, owing to its slow conducting power, the heat excited by the fuel contained within itself, not being able to escape, has actually vitrified it throughout. We, however, believe, that a lute might be made of the pumice-stone, in coarse powder, mixed with cut flax and any refractory clay, which would answer our Correspondent's purpose.

The common method of joining tortoiseshell together, is, by making the joint overlap a little; binding a wet linen cloth around it, and pressing the whole between the jaws of a pair of red-hot tongs. In this way, the effects of heat, moisture, and pressure, are combined in a very convenient manner; and the tortoiseshell is compelled, by their joint action, to become partially dissolved, and to unite firmly, Horn and tortoiseshell boxes are thus formed; these substances being placed in brass moulds, and subjected to the action of strong screw-presses, which are placed in boilers; and when heated, the screws being turned, compel these softened substances to unite firmly together, and to receive the forms given to them by the moulds. A glue, which may assist in their union, can also be made of the raspings of tortoiseshell; by exposing them in close vessels, with a little water, to the action of heat, under pressure, in the manner of a Papin's digester.

We shall request the information of any of our qualified Readers upon an improved mode of rendering silk and linen water-proof, so as to give them the qualities described by our Correspondent.

We have seen specimens of Natural History (such as the skins of birds, beasts, and snakes) preserved by Mr. Waterton, merely by wetting them with a solution of chloride of mercury (corrosive sublimate) in alcohol, and in a much superior manner to any we ever saw before. Should this query meet Mr. Waterton's eye, perhaps he would kindly favour us with some additional particulars hereon.

Association for the purpose of working the Mines in Mexico.

This Association was formed by some of the principal bankers and merchants, with a capital of one million sterling, to be applied for the purpose above stated; and was divided into 10,000 shares of 100*l.* each. It should appear, from the Prospectus, that those mines only have been chosen, which have been already worked; and those, too, of the first importance: there will therefore be no such risks attending this speculation as are usually associated with mining concerns. The parties have, of course, taken every precaution, in regard to the protection of the Government and the proprietorship. We refer to the Prospectus itself for particulars, and which may be had of any of the Directors.

It has been a source of the greatest regret to enlightened men, that the riches of the world should ever have been deposited in the hands of the Spaniards, whose national character has been imbued with so much lethargy and supineness, the great enemies to the advancement of mankind. The revolution, which will now take place in that hitherto inhospitable land, will be a fresh source of wealth to Europe, and a sure road to the improvement of the Mexicans themselves.

It is almost impossible to calculate on the advantages likely to be derived by this Company, from the arrangements they appear to have made; for what may not be expected from British capital, enterprize, and genius, in an almost *primitive* land, in which the precious metals are distributed with so lavish a hand. To convey an idea of the ignorant and slovenly manner, in which mining, as well as all other processes, have, in most instances, been conducted in Mexico, we shall afford our Readers a few anecdotes and observations, which almost border upon the ludicrous.

When the ore is dug, it is conveyed to the surface of the earth, either on the backs of men called (*Tenateros*), Beasts of Burthen, or in leather bags. The Tenateros may well be called beasts of burthen, for they frequently remain laden *with a weight of from 225 to 350lb. for the space of six hours;* and, at the same time, exposed to a temperature of 71 to 77° of Fahrenheit (a London porter would pronounce this impossible); and, during this time, they ascend and descend several thousand steps in pits, at an inclination of 45°. To prevent their shoulders from being hurt, (for the miners are generally naked to the middle,) they place a woollen covering under this bag. We meet in the mines, with files of fifty or sixty of these porters, among whom there are men above sixty years of age, and boys of ten or twelve years. In ascending the stairs, they throw the body forwards, and rest on a staff, which is generally not more than one foot in length. They walk in a zig-zag direction; because they have found, from long experience (as they affirm), that their respiration is less impeded, when they traverse obliquely the current of air, which enters the pits from without.

The leather-bags are used either for drawing up the ores or the water. These bags are attached, in the latter case, to ropes, which are drawn by horses. They seldom last more than eight or ten days, being destroyed by friction against the sides of the shaft. A bag, full of water, weighs about 1250lb. and which it is the *work of eight horses* to draw to the surface. Instead of stopping the course of the subterraneous streams, and conveying the water to pits, to be drawn off by machinery, they frequently direct it to the bottom of the mine, to be raised at leisure, at an immense expense, by the method above described.

Neither pumps, engines, nor rail-ways, are used by the miners; yet the immense wealth accumulated by individuals, notwithstanding such barbarous management, is scarcely credible. The former proprietors of the mine Valenciana, which this Company have now acquired, were amongst the richest individuals in the whole world; and they drew their wealth from this mine, in a very few years. The following is their history.

For a whole century, this mine was forsaken; till, in the year 1760, a Spaniard, who went over very young to America, began to work this vein in one of the points, which had, till that time, been believed destitute of metals. M. Obregon (the name of this Spaniard) was without fortune; but, as he had the reputation of being a worthy man, he found friends, who, from time to time, advanced him small sums to carry on his operations; and yet the expenses greatly surpassed the value of the metallic produce. With a passion for mining, equal to what some display for gaming, M. Obregon preferred submitting to every sort of privation, to the abandoning of his undertaking. In the year 1767, he entered into partnership with a petty merchant of Rayas, of the name of Otero. Could he then hope, that in the space of a few years, he and his friend would become the richest individuals in Mexico, perhaps iu the world? In 1768, they began to extract a very considerable quantity of silver minerals from the mine of Valenciana. In proportion as the shafts grew deeper, they drew from the *pertinencia de Dolores* enormous masses of sulphuret of silver, mixed with native and red silver: from that period, till 1804, the mine of Valenciana has continually yielded an *annual produce* of more than 583,380*l.* sterling. There have been years so productive, that the net profit of the two proprietors of the mine has amounted to the sum of 250,000*l.* sterling.

Query, on an improved Hand Loom. By a Correspondent.

Sir, *Halifax, December* 20, 1823.

In the Number of the New Monthly Magazine for September last, page 409, there is a short description of an improved Hand Loom, which has received the appellation of the Dandy Loom: it appears from the account, that the improvement is considered of some importance, by those manufacturers who are in possession of it. In this part of the country there are very few power looms, the common hand loom being used almost entirely; any improvement, therefore, in that loom, must naturally excite the attention of those individuals who are interested in its use. You will much oblige several of your manufacturing subscribers in this neighbourhood, as well as your humble servant, if you can procure a proper description of the abovementioned loom, and insert the same in your valuable work. It is scarcely necessary to add, that practical information, such as is here requested, must tend to augment the value of the Technical Repository. In conclusion, I beg leave to remind you of the promise, in page 212, of Vol. II.

I remain, Sir, your obedient servant,

T. GILL, *Esq.* A MANUFACTURER.

Observations by the EDITOR.

We insert this Letter from our worthy Correspondent, notwithstanding his modest request to the contrary, being convinced that we cannot express his wishes in better terms. We have, however, changed the signature, so that no clue to the writer can be gathered therefrom.

We must here, as on other occasions, solicit the assistance of those of our Readers who may be able and willing to afford the necessary information. And beg to assure our Correspondent that we have not forgotten the promise he alludes to.

Query, on a Carriage propelled by a Person seated in it. By a CORRESPONDENT.

SIR, *London Institution, Dec.* 30, 1823.

As an occasional Contributor to your Monthly Repository of Science, I beg to inclose the copy of an article taken from a Plymouth Paper, and which appeared in the Morning Post and Chronicle of the 23d Instant; and to request information upon the subject thereof. If the facts therein stated are true, the Invention must be considered as the greatest achievement of human industry and mechanical research that has ever been submitted to public notice. If false, the fallacy of the statement ought to be immediately exposed.

I am, Sir, yours, &c.

W. H. P.

"The carriage, the property and invention of the Proprietor of the Exhibition of the Indian Venus &c., lately exhibited in these towns, and which travels without the intervention of either horses or steam, left this town (Plymouth) last Tuesday morning, for Tavistock, amidst a concourse of persons, who were much surprised at the ease and velocity of its movements. It is propelled by machinery, which is put in motion by the person who sits in the carriage. The vehicle is very light, and has three wheels."

Remarks by the EDITOR.

We greatly fear that this article is a mere puff, inserted in the Plymouth Paper to attract public notice; and that, although the proprietor may, in fact, start in his vehicle, and even propel it a short distance, by his personal exertions, as we have seen many others do; yet, that he would soon substitute the power of a horse, to complete his journey.

At any rate, should there be any thing really meritorious in the invention, we shall be glad to be informed thereof, by such of our Readers as may be able to afford the requisite particulars.

Queries, on Hydro-pneumatic Blow-pipes. By a CORRESPONDENT.

SIR, *Hereford, Jan.* 1, 1824.

IF I shall not intrude upon your kindness too much, may I beg the favour of you to state in your next Number, in your Notice to Correspondents, where Tilley's Blow Pipe (which, in your Number for November last, is stated to be sold, in Copper tinned, for *2l.* 12*s.* 6*d.*) is to be procured. I see, in Newman's Catalogue, Hydraulic Blow-Pipes mentioned from 30*s.* to 42*s.*: and a ditto, on Toft's plan, at 4*l.* 4*s.* 0*d.* Perhaps you will have the goodness to say, if the latter has any advantages equal to the increased price;

and which of the three (if Newman's and Tilley's are not on the same principle) is most useful generally, in Chemistry, Mineralogy &c. &c. I am really sorry thus to trouble you; but, at this distance from the metropolis, I have no opportunity of ascertaining the merits of the instruments from inspection; and others of your subscribers may be in the same predicament. A very few words will suffice, as your recommendation will be conclusive.

I am, Sir, a Subscriber,

T. Gill, Esq. AB INITIO.

Observations by the EDITOR.

In reply to our Correspondent's Queries, we are sorry that we cannot inform him where Tilley's Apparatus, *in tinned copper*, is to be procured at the price mentioned by Tilley, in his communication to the Society of Arts &c. Mr. Tuther, of High Holborn, philosophical instrument maker, is now constructing some, in consequence of our re-publishing the article. We conceive, that Mr. Newman's are made of tinned *iron*, and, of course, far less durable, than when made of tinned *copper*. Toft's, or rather *Cuthbert's*, from whom he borrowed the idea of it, without acknowledgment, possesses no advantages over Tilley's to make amends for the increased price of it.

Leghorn Straw Plait.

The Dublin Society, having offered premiums, in July last, for the best imitation of Leghorn-straw plait, twenty-four specimens were exhibited, which had been fabricated by persons living in various and widely-remote parts of Ireland. On an examination of the merits, the premiums were adjudged as follow:—

"To Miss Mary Collins, of Plattin, near Drogheda, a gold medal, value 10*l.*; being the first premium for the finest and evenest plait made from the *avena flavescens*, or yellow-oat grass, and exhibited under the form of a small fancy hat.

"To Miss Susannah Goimley, of Kiltimon, near Newtown, Mount Kennedy, the silver medal, and 5*l.*; being the second premium, for plait made of the *cynosurus cristatus*, or crested dogstail-grass, and exhibited under the form of a very tasteful bonnet.

"To Miss Christiana Campbell, of Londonderry, the silver medal; being the third premium, for plait made of the *agrostis vulgaris*, or common bent-grass, and exhibited under the form of a very tasteful bonnet."

The Examining Committee stated, that one of the persons, whom they had called to their assistance, informed them he had seen in Paris a Leghorn straw hat, plaited purposely for the Dutchess of Berri, the value of which was estimated at 1000 francs; and that, in his opinion, the straw hat to which the Committee have adjudged the first premium, is of a texture equally fine and curious.

LIST OF PATENTS FOR NEW INVENTIONS,

which have passed the Great Seal, since Dec. 27, 1823.

To Thomas Greenwood, of Gildersoun, near Leeds, Machine-maker; and Joseph Thackrah, Surgical Mechanic, of Leeds, both in the county of York; for certain improvements on, or substitutes for, Pattens and Clogs. Dated Dec. 27, 1823.—To be specified in two months.

To John Vallance, of Brighton, in the county of Sussex, Esq.; for an improved method or methods of freezing Water. Dated Jan. 1, 1824.—In six months.

To Francis Devereux, of Cheapside, in the city of London, Merchant; for certain improvements on the Mill or Machine for grinding Wheat and other articles; commonly known by the name of the French Military Mill. Dated Jan. 8, 1824.—In six months.

To Joseph Foot, of Charles Street, Spitalfields, in the county of Middlesex, Silk Manufacturer; for an improved Umbrella. Dated Jan. 15, 1824.—In six months.

To John White, of the New Road, in the parish of St.

Mary-le-bone, in the county of Middlesex; Architect; for a Floating Breakwater. Dated Jan. 15, 1824.—In two months.

To John Finlayson, of Muirkirk, in the county of Air, Farmer; for certain improvements on Ploughs and Harrows. Dated Jan. 15, 1824.—In six months.

To Jean le Grand, of Leman Street, Goodman's Fields, in the county of Middlesex, Vinegar Manufacturer; who, in consequence of a communication made to him by a certain foreigner residing abroad, and discoveries by himself, is in possession of certain improvements in fermented Liquors, and the various products to be obtained therefrom. Dated Jan. 15, 1824.—In six months.

To William Gulleridge, of Dean Street, St. Fin Barrs, in the county of Cork, Musician, and Land Surveyor; for certain improvements on the Clarionet. Dated Jan. 19, 1824.—In two months.

To George Pollard, of Rupert Street, in the parish of St. James, in the county of Middlesex, Brass Founder; for certain improvements on Machines or Machinery, for levigating or grinding Colours, used in the various branches of Painting; which machinery may be worked by any suitable power, and is applicable to other useful purposes. Dated Jan. 19, 1824.—In two months.

To James Russell, of Wednesbury, in the county of Stafford, Gas-Tube Manufacturer; for an improvement in the manufacture of Tubes for Gas, and other purposes. Dated Jan. 19, 1824.—In two months.

To Simeon Broadmeadow, of the town of Abergavenny, in the county of Monmouth, Civil Engineer; for a new and improved method of manufacturing and purifying Inflammable Gases, by the admission and intermixture of atmospheric air. Dated Jan. 19, 1824.—In four months.

To Howard Fletcher, of Walsall, in the county of Stafford, Saddler's Ironmonger; for certain improvements in Tanning Hides and other Skins. Dated Jan. 19, 1824.—In two months.

THE
TECHNICAL REPOSITORY.

XLIII.—*On the Manufacture of Ceruse, Krems-White, or White Lead; and, particularly, of the celebrated Ceruse of France.*

(Continued from p. 128.)

The author introduced a little of the paste into a large globular glass vessel, perfectly clean; and after having poured upon it muriatic acid at three degrees, he violently agitated the vessel, in order to bring the acid into contact with all the molecules of the paste. A strong effervescence was quickly manifested: he then allowed it to remain at rest, with the vessel unstopped; so that if any sulphuretted hydrogen gas had been disengaged, it might escape: the vessel, whether more or less filled with carbonic acid, he then closed with a stopper, that would not communicate any colour; and then briskly agitated it for some time, and decanted the liquor. These washings were repeated, until he had obtained the whiteness he desired; and he then finished, by another washing in a large quantity of water.

M. Dall'armi assures us, that he has thus obtained, by means of these acidulous washings, a white fully as beautiful as that of *Krems*. In order to give it the smell and hardness which characterize that article, he says, that it is sufficient to give the whitened paste, before putting it into the moulds, a last washing, with perfectly colourless vinegar. The small quantity of acetate which is formed, crystallizes, and dries with the mass of the ceruse, binding its molecules together like a cement.

The author likewise advises us to whiten the ceruse in casks of white wood, turning upon pivots; whose insides should be perfectly free from any metal.

He further assures us, that a perfect white will never be obtained, unless the wood of the casks be penetrated with the ceruse, and have lost all colouring matter. As very little acid is required, this operation would not greatly enhance the price of the ceruse.

We see, from the preceding observations and the latest analysis, that all that is required to obtain a beautiful ceruse, by the means above described, is, to oxidate the lead slowly, and to combine this oxide, as fast as it is produced, with the carbonic acid. It was long before the manufacturers knew how to appreciate justly the various influencing causes, in this manufacture: and it is only since chemistry has shone forth in a more resplendent manner, that it has been possible to disengage this art from the old empirical methods, and to obtain superior products always identical. The Society of Encouragement at Paris, by various prizes, singularly contributed to this important result, by continually awakening the zeal of the manufacturers engaged in this line of business: and such has been their success, that, within a few years, a great number of establishments of this kind have been formed in France; whilst, formerly, we did not possess one. It is rendering an essential service to one's country, to exempt it from being tributary to strangers for a product in such great demand. If a few prejudiced persons, although perhaps, in some respects, of but little consequence, still favour the importation of this article, let us hope that our renewed efforts will shortly prove sufficient to triumph over every obstacle, and that we shall entirely throw off the yoke.

It is easy, in the present state of science, to render an exact account of every phænomenon which presents itself during the formation of ceruse, so that it may be well understood. It is certain, in fact, that this product cannot be formed, unless by the method we have described, wherein the metal is plunged into a hot, humid atmosphere, completely charged with oxygen and carbonic acid. It will be for us to examine, therefore, the degree of importance attached to each of these conditions, and the manner in which they can be most effectually brought into action. Every one knows the degree of influence exercised by heat and humidity, in chemical combinations. The one, by dilating the molecules, diminishes their cohesion, and allows them to form new combinations: the other is an indispensable vehicle, which serves as a bond, in the re-union of the various molecules, penetrating them, softening them, and so mingling them with one another, that they are brought into contact, and cemented together: it often, and particularly in the present case, forms an essential part in the combination. As for the oxygen and the carbonic acid, their presence is evidently necessary; since these are the bodies which alone combine with the metal. The smoke employed by the Dutch, the tan, or the fermented straw which has been substituted for it, not only act in producing the necessary elevation of temperature, but, according to the opinion of many, furnish also a part of the carbonic acid which enters into the composition of the ceruse. Nevertheless, it cannot be doubted, that another part of this carbonic acid is formed by the decomposition of the vinegar itself, or of the foreign matters which are added to it. In this operation, the vapours from the vinegar are condensed, by degrees, upon the leaves of lead which are exposed to its contact: the great affinity of the metal for oxygen causes the decomposition of this acid: one portion of its oxygen seizes upon the lead; whilst another portion, in the form of carbonic acid, unites with the oxide formed, and constitutes the carbonate. Nevertheless, we ascertain, from positive experiments, that pure vinegar is not sufficient for the production of ceruse: this vinegar must contain certain substances, such as tartar, lees, &c., which are susceptible of producing carbonic acid by their spontaneous decomposition; or, perhaps, the carbonates are formed from the decomposition of the vinegar itself.

When Bergmann, Chenevix, and others, were endeavouring to prove that well-prepared ceruse was really a subcarbonate of lead, the chemists thought they should be able to produce it at will, from double decompositions; and they had their choice, amongst all the soluble subcarbonates and all the soluble salts of lead: but the most difficult condition to fulfil, was, to manufacture this product at the low price of foreign ceruse. Among the multitude of methods which were proposed to the Society of Encouragement, at its meeting in the year 1809, that of MM. Brechoz and Leseur, as practised at Pontoise, merited the preference, as it afforded the ceruse at the price so long required. The Society of Encouragement was greatly applauded for the judgment it displayed at this period: and, perhaps, never was recompence more justly decreed. Indeed, this manufactory, then only in its infancy, has since so augmented, that it is become, under the direction of MM. Roard and Brechoz, almost colossal; and this in spite of the numerous establishments which have been formed in its vicinity.

We will endeavour to give a precise idea of their process; but without, however, entering into certain details which belong wholly to the manner of executing it; and which, if divulged, would hazard the existence of this fine manufacture, now become a sort of national conquest to France.

The same oxide may be combined in different proportions with the same acid; constituting different salts, which chemists have distinguished under the denominations of *sub-salts*, of *salts*, properly so called, and of *super-salts*. Few oxides are, however, susceptible of these three degrees of combination. The protoxide of lead only affords two, with the acetic acid; namely, the *neutral acetate*, or the ordinary Salt of Saturn; and the *sub-acetate*, formerly known, in pharmacy, under the name of the Extract of Saturn: and of these, the *sub-salt* is the most remarkable; as it is extremely soluble, which is not generally the case in these kinds of combinations: but there is a property which is common to, and also possessed by, the sub-acetate of lead, in which the last portions of oxide, changed into the neutral and sub-salts, are less attracted by the acid than the others; and it is consequently much more easy to free them from their combinations than the first: thus an agent which has not sufficient energy to separate the oxide from a neutral salt may nevertheless free it from this second portion of oxide, which constitutes a sub-salt, and forms a combination apart. It is this property which MM. Brechoz and Leseur have so happily turned to profit, that forms the basis of their manufacture. The process consists in taking the sub-acetate of lead; and causing to pass through its solution a current of carbonic acid gas, which precipitates, in the state of a sub-carbonate, the oxide of lead in excess in the neutral acetate, which remains in solution. We shall see that this change is thus effected:

The neutral acetate of lead, which contains, in the 100 parts,

26 of acid,
58 of oxide,
16 of water,

requires, to pass to the state of sub-acetate, two other proportions of oxide; that is to say, that 100 parts of this salt are susceptible of dissolving 116 parts of oxide of lead; and it is not even necessary, in order to produce this combination, to have recourse to the action of heat: it is as perfectly well effected in the cold. We believe that, in the manufacture of ceruse, it is unnecessary to employ the crystallized acetate of lead: as we can directly form the sub-acetate of litharge and the pyroligneous acetic acid. This preparation is easily made in the cold, by mere trituration in proper vessels. It is requisite that an excess of litharge be used, in order to be certain of attaining a proper super-saturation. Now 65 kilograms of pyroligneous acid, at 40 acidimetric degrees, or 8° of the ordinary areömeter, require, to form the neutral acetate, 58 kilograms of litharge. It then follows, as we have before stated, that we must make use of at least 174 kilograms of litharge to obtain the sub-acetate with the same proportion of acid: this is generally diluted with 15 to 20 parts of water; of which a portion is added before, and a portion after the solution. It is left to repose; and the residuum is again acted upon by a fresh portion of acid, in order that all soluble matter may be extracted from it; there remains from 0,01 to 0,015 parts that the acid will not attack, and which is composed of lead, iron, copper, some earthy parts, and silver in the proportion of about 4- to 6-thousandth parts.

When the solution is become clear, it is decanted into large covered tubs, very wide and shallow: into these the carbonic acid is made to enter very slowly, and through a great number of tubes, so as to multiply the surfaces of contact as much as possible. This acid may be produced in different ways, according to circumstances: sometimes by the burning of charcoal, as is done at Clichy; or by the decomposition of a carbonate, by means of an acid: but, in all cases, it is an essential requisite that the carbonic acid gas do not contain any portion of sulphuretted hydrogen. It becomes then indispensable to wash the gas, and even, for a greater certainty, to add to the washing-water a little acetate of lead, in order to be sure that not even the most minute portion of sulphuretted hydrogen remains.

The carbonic acid, whose points of contact become thus infinitely multiplied in order to favour its action, determines the precipitation of all the second portion of oxide which constitutes the sub-carbonate: it likewise produces another effect; for the solution, instead of being neutral, becomes slightly acid. When the precipitation is finished, the whole is passed into a shallow tub, and left at rest for some hours: the liquid is then decanted, to be combined with a fresh portion of litharge. The deposit is next washed with a small quantity of water, which is added to the first liquor; and the washings are continued, till the water no longer extracts any thing, but comes off perfectly colourless; it is then only that the carbonate of lead must be put to drain, for the purpose of being afterwards moulded in pots. It however sometimes happens that the washings are not carried to this excess; because, in commerce, for the purpose of satisfying the taste of some customers, the ceruse must have a blueish tint. The copper contained in our litharge, and which also dissolves in the vinegar, will produce this effect, if not completely washed out. It is very rare that the ceruse of commerce is equal to that obtained by this operation: its tint is not such as is sought for: it is generally preferred when it has either a blueish or a greyish tint, and has not a milky whiteness. This second shade is easily obtained, by adding a little common lamp-black; but the mixture must be very exactly made, in order to preserve an uniformity of tint. When all these preparations are finished, it only remains to mould the ceruse into small conical loaves; which has no other purpose than to imitate the form that the Dutch have always given to this product. This operation consists in putting the ceruse, well drained, by a little at a time, into unglazed earthen pots, into which it must be pressed as closely as possible: the vessels, thus filled, are then put into stoves; where they remain, till the loaves have acquired, by the loss of moisture, a considerable shrinkage, so that they detach themselves from the vessels, and are easily removed: they are then reversed upon tables, to undergo the last degree of desiccation; and, finally, they are wrapped up in pale-blue paper, which causes them to reflect a more agreeable tint.

In all this process, nothing is more injurious to the workmen, than the potting, which we have mentioned. Whatever precautions may have before been taken, this serious inconvenience has never been prevented. Neither the greasy applications recommended by M. Dall'armi, nor the gloves which they force the workmen to wear, have been sufficient to prevent the most serious accidents from the preparations of lead; and no better means have been devised, than to change the workmen every fortnight. That they were obliged, at the commencement of this manufacture, to imitate the form given by the Dutch, in order to succeed in overcoming prejudice, may be readily conceived; but might they not now, as this new method is properly appreciated, content themselves, by simply drying the ceruse in small lumps; and by this means avoid a dangerous manipulation, which obliges them to handle each pot, in order to press the ceruse into so compact a form. It is possible that the same end may be equally as well attained, by using small conical bags, or linen hose; which, being once filled, might be suspended open; as the weight of the matter, and the porous texture of the linen, would effectually contribute to a quick desiccation.

I have already mentioned, that the liquor from which the precipitation of the sub-carbonate has been made, might be afterwards employed, with a fresh portion of litharge, to reproduce other sub-carbonate of lead, intended to be precipitated in the same manner, by the carbonic acid. I should add, that this manipulation may be repeated indefinitely, but that the dissolving force of the liquor will be always decreasing; so that they would be obliged each time to diminish the quantity of the litharge, or rather, as is really now the practice, to add such a quantity of vinegar as may be capable of restoring things to their primitive state. The causes of this loss, which is somewhat considerable, are, that the last washing-waters, which are too weak to be profitably employed, will still carry off with them some sub-acetate of lead, which contains more oxide than that which we have mentioned; and which, being almost insoluble, accompanies the ceruse in its precipitations, and cannot be subtracted from it, but by repeated washings.

After having described the different methods in use for the manufacture of ceruse, it only remains for me to make some observations on the comparative qualities of the products. For a long time, and even at present, the ceruse of Clichy has been found fault with, as not *covering* so well as that manufactured by the Dutch method. They pretend that the molecules of the latter are closer, and the colour furnished by it possesses a much greater body;

whilst that obtained by precipitation is in more distinct particles, lighter, and almost transparent; so that it requires a greater number of coats to produce the same effect. These censures, are, in some measure, well founded; but we may say with truth, that this inequality every day decreases; and every thing induces us to believe, that, in a very little time, no difference will be remarked. Unfortunately, there is more than one difficulty to overcome, in order to attain this end; for there are a great number of persons who are much interested in exaggerating the faults of the ceruse of Clichy: I allude to certain merchants, who are not over scrupulous; and who daily declare to their customers, that this ceruse is of a bad quality, and far inferior in value to the Dutch; and this with the dishonest intention of selling the ceruse of Clichy at a very high price, and making it pass for Dutch ceruse.

In order to compare two qualities of ceruse, we must have regard to a condition which the painters frequently neglect in their trials: they prepare two specimens of colour, and, spreading them over equal surfaces, judge which of the two will cover the best: but they should likewise compare the weight of the ceruses employed; for if one is lighter than the other, and they have only compared it in volume, they will fall into an error: it is requisite to see, if, in equal weights, they obtain like results.

It is generally believed that the differences observed between the ceruse of Clichy and others is wholly owing to the circumstances under which this product is formed. There is no doubt but they singularly influence it, and that this greater aggregation partly depends on the longer time that the combination requires to effect it;* but I rather think that the articles are not united in the same proportion. I have comparatively tried Krems White and sub-carbonate by precipitation; and the latter has given me a much greater proportion of carbonic acid than the other.

R.

* It has been observed, that the colder the carbonic acid was, in its passage through the solution of the sub-acetate, the more density the precipitate acquires.

XLIV.—*On British White Herrings, cured equal to the best Dutch Herrings.* By Mr. JAMES FREDERIC DENOVAN*.

SIR; *Leith, Oct.* 31, 1818.

I BEG leave respectfully to acquaint you, that I have shipped by the smack Hope, Francis Ord, master, for London, a sixteen-gallon barrel of white herrings, cured by me in the manner of the Dutch, in order to be laid before the Society of Arts, &c. The herrings contained in this cask are a mixture of those cured by me on the west and east coast of Scotland, in the prosecution of a plan to compete with the Dutch in the continental markets.

It is now four years since I planned and entered on this undertaking; and, although the scale is limited, I flatter myself that the execution has at least kept pace with the design. Having acquired a thorough knowledge of the Dutch language, during a residence in that country in the early part of my youth, I returned to Holland about four years ago, for the express purpose of collecting, from all available sources of information, such particulars as might enable me to carry through my undertaking with success. The year after my return, I made it my business to visit the different fishing stations in Scotland, and to be an observer of the different modes of cure practised by my countrymen. Wherever I went, I was sorry to find the most eminent and experienced fish-curers not only deaf to my remonstrances, on their method of putting up herrings, but strongly prejudiced in favour of their own system; and that they invariably used Liverpool salt at all times, and for every species of herrings they cured, which were thrown together indiscriminately. The year following (1817,) having provided myself with a complete stock of Lisbon, Cadiz, and St. Ube's salt, and having brought from Maas Sluis (in Holland)

* From Vol. XXXVII. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.—The Society voted its premium of Fifty Guineas to Mr. Denovan, for his improvements; and he has since received another premium of a similar amount, and a bounty of Fifty Pounds; making, in all, the sum of upwards of One Hundred and Fifty Pounds, awarded to him by the Society, for his unwearied and successful exertions in promoting this great national object.

six of the most-experienced gutters and packers of that country, I proceeded to the West Highlands of Scotland, with the intention of curing a quantity of the early herrings of Lochfine, and exporting them to Hamburgh, in competition with the Dutch jagers: but, owing to the Dutchmen, I had engaged, being retarded in their passage to this country, my design was frustrated, and the Dutch herrings reached that market before me. However, it was admitted, by the most-experienced dealers in Hamburgh, when my shipment arrived, consisting of forty-barrels, that they were not only as well cured as the Dutch, but that the fish were, in themselves, of superior quality. Knowing, from observation and experience, that the herrings which frequent the bay betwixt Dunbar and Eyemouth, in the month of August, are of the species best suited for later importation to the German market, I carried my Dutchmen to Eyemouth, and cured openly, for the instruction of those who chose to avail themselves of it, about 300 barrels, exactly in the Dutch mode, which I afterwards exported to Hamburgh. These herrings were sold at a price which would have yielded me a decent profit; but, unfortunately, the House of Daniel Lane, jun. and Co. to whom my herrings were consigned, suspended payment; and to this moment, I have not received a single sixpence in return; although it may well be conceived, that, as my operations were attended with extra outgoings and expenses, my loss must have been considerable.

Although my circumstances could ill admit of such a blow, I was determined to make another effort, and, by perseverance and exertion, try to recover the loss I had suffered; accordingly, in the month of May last, I again brought over four gutters and packers from Maas Sluis; and having procured a vessel of about 70 tons burthen, and provided her with every necessary, I proceeded to Lochfine, which I reached on the 27th of that month. In order to ensure success, I engaged and gave a bounty of twenty guineas to one of the most expert fishers and experienced pilots of Newhaven (W. Main), not only to pilot the vessel to the different heads and bays betwixt Tarbet and the Isle of Arran, but to endeavour to stimulate the Highlanders to follow his example, by casting his nets before them, along the coast. I also sent notices to the different Highland villages, that bounties would be given to those who caught the first sound herrings; and urged them to action, by distributing oatmeal and other provisions to their families; and I invited them to send their boys on board, to learn the Dutch method of gutting and packing the herrings.

My expectations were so far answered, that, on the 4th of June, I obtained four barrels of herrings: and although the great proportion was of the *maatze* species, still there was among them a considerable number of full herrings of excellent quality: of these, when carefully assorted, I sent to London a quarter barrel, which was presented to His Royal Highness the Prince Regent; and it was certainly very gratifying to me, to be informed that his Royal Highness considered the herrings to be the finest he had ever eaten; while Sir Benjamin Bloomfield gave it as his opinion, that they were superior to those he had tasted in Holland. It has long been a custom with the Hollanders to send the first barrel of herrings taken at sea, to their Stadtholder; and the fortunate individual who can do so, receives a premium of a thousand guilders. But such are the defects of the British law, that the fish-curer who removes or exports his herrings, without allowing them to lie fifteen days in salt, to entitle them to be branded by the Fishery Office, forfeits the usual bounty, of four shillings per barrel! Thus, instead of any inducement being held out by Government to individuals, to compete with the Dutch in the continental market, they are absolutely discouraged from doing so: and, although I outstripped the Dutch with a fleet of 278 doggers, and supplied the table of my Prince with the *first herrings taken on the British coast,* previous to the King of the Netherlands receiving his compliment, what has been my recompence? I do not mean that this should be regarded as a reflection on the Legislature, but as a defect and grievance which, through such a channel as the Society of Arts, &c. may meet redress; for I flatter myself, that were it represented in the proper quarter, this glaring error would be immediately corrected, so as to put the British fishermen on an equal footing with those of Holland.

After sending off the quarter barrel of herrings to London, I engaged a fast-sailing schooner, called the Two Sisters, (Komeyer, master,) which was then lying in Leith harbour, to act as a jager. I sent her, through the Canal, to Greenock, to receive, and run to Hamburgh with, fifty barrels of my herrings, so soon as they could be cured, and shipped on board her; and I flattered myself, from the arrangements I had made, that I should not only have the first herrings in the German market, but that the herrings I imported would be of a superior quality to those of Holland. In this, however, I was grievously dissappointed; for, owing to the breaking down of one of the banks between Kelvin and Greenock, the Canal was in consequence shut, and my vessel, with my fifty barrels of herrings on board, unfortunately locked in, for twelve days! After getting her through the Canal to the Frith of Forth, she not only met with adverse winds, but was so much becalmed at sea, that she made a passage of no less than eleven days to Hamburgh; and the market, having, in the interval, been filled, or rather glutted, with herrings, by the jagers of Holland, Embden, and Altona, my fifty barrels only netted 123*l.*; and, as they stood me in fully 6*l.* per barrel, my loss was about 200*l.* Immediately, however, and while the schooner was locked up in the Canal, I got forward to Leith a few kegs of herrings, which I shipped, by the smack Edina, (J. J. White, master,) to Hamburgh. They arrived *only two days* after *the first Dutch jager*, and sold at the rate of 15*l.* per barrel. Had nothing befallen the schooner, and had the fifty barrels reached Hamburgh at the same time as the Edina, I should certainly have realized about 400*l.* sterling: and had the schooner got there before the Dutch jager, I should have gained 200*l.* or 300*l.* more; for the Dutch got from 20*l.* to 25*l.* sterling, per barrel, for their herrings; which, it is admitted in Hamburgh, were of inferior quality to mine. *The importation, however, of these kegs, and of the fifty barrels afterwards, has certainly done much for the British fishery; by giving it a character, in the German market, which it never before possessed.*

Although my project at Lochfine had the effect of making the Highland fishermen try the fishing much earlier than usual, it did not operate in my favour in the end; for the proprietors of the *fresh*-fish wherries at Glasgow, on hearing that I was successful, immediately dispatched their boats to the fishing-ground, and bought up the herrings from the Highlanders, to carry to that market, in a fresh state, at such a high price, that they were actually retailed in that city at 3*d.* per fish. It was even with difficulty that I could obtain herrings, from the boats, at the rate of 5*s.*, 6*s.*, 7*s.*, and even 8*s.* per hundred fish. After I had dispatched the schooner with the fifty barrels for Hamburgh, and had cured about twenty barrels, to be done up in kegs for the supply of the Edinburgh market, I gave up the attempt, and carried my Dutchmen to Eyemouth, as in the preceding year: for even at the lowest rate (say 5*s.* per hundred) I could not, as the season advanced, salt and export these herrings without suffering a loss.

The example I set at Lochfine, however, was not without its advantages: it certainly was the means of employing many idle men, who were on the point of emigrating to America: and, by having invited on board the sons of the fishermen, and having instructed them carefully in the Dutch mode of gutting and packing, I shall be enabled next year to prosecute my undertaking, without the aid of Hollanders.

At Eyemouth, the fishing was, in general, but very limited; and, owing to the boats at that port having been previously engaged to the curers resident there, I could only procure, and salt, ninety and a half barrels, of prime, full, herrings, for exportation; and fourteen kegs for home consúmption and sample. These ninety barrels I sold to a respectable merchant and fish-dealer from Hamburgh, at thirty-seven shillings per barrel; being six shillings per barrel above the market. This merchant left Leith some days ago, for Hull; otherwise I should have obtained a certificate from him, expressive of his opinion, as to quality and cure: but I have written to him, to send me such a document; and, should it arrive in time, it will accompany this Letter.

Last year, I sent sample-kegs of my herrings to several public Characters, both in Edinburgh and London, to learn their opinions on the mode of cure I had adopted: and I have used the freedom to send up a few of the Letters received from these Gentlemen, for the perusal of the Society. I regret, however, that the existence of this very laudable Institution only came to my knowledge within the last eight days. Had I known it last year, I would have forwarded samples for its inspection. Although I must account myself a stranger to the rules and regulations of the Society, yet, aware of the liberality of all English Institutions of that nature, I humbly submit to their consideration a faithful and true sketch of my proceedings; with a sixteen-gallon barrel, containing a *just* and *fair* specimen of the herrings cured by me, as well at Lochfine as in the North Sea: they may easily be distinguished from one another, by the manner in which they are gutted. The North-Sea herrings have the gut hanging out, in the manner of the Dutch, which has the effect of enriching the pickle: while those of Lochfine are *clean gutted;* a measure absolutely necessary for their *perfect* preservation; for the quantity of fixed oil which proceeds from the gills and gut of the Lochfine herrings, in the early part of the season, is so great, that it would, by allowing the gut to remain, tarnish the scales, and, to use the curer's phrase, *gild* the herrings.

The herrings contained in the sixteen-gallon barrel are cured in the manner described in my certificate: and any further information which the Society may wish to procure, in regard to the White-herring fishery, I will communicate with pleasure, by the way of Question and Answer.

For the last two years, I have been in correspondence with the British White-Herring Fishery Board at Edinburgh, to whose inspection I submitted several specimens of my herrings: and I also corresponded with the Commissioners individually; as will appear from their Letters, herewith sent. As these gentlemen were perfectly aware of the exertions I had used, and the money I had expended in the attempt, I supplicated their interference with Government in my behalf, to get some assistance, to enable me to carry through my undertaking; but, although these gentlemen declare my herrings to be not only a great improvement on the British mode of cure—to be *most excellent*—and that they heartily *wish* me success in my undertaking—yet they conceive it (as they say) to be entirely out of their line to recommend any fish-curer to Government. The project I have embarked in may be attended with difficulties and disappointments, but it is evident that perseverance will overcome them; and, as it embraces an object of great national importance, I flatter myself, if Government knew my situation, they would assist me. But, having no friend at Court, I fear the story of a friendless and obscure individual would hardly be noticed: I must therefore proceed with the means I possess. These means are indeed very slender; but still, perseverance, with due exertion, may do great things: and, although untoward circumstances have occurred in the way of my undertaking, they were such as I could not have foreseen: and if, in the succeeding year, I am so fortunate as to anticipate the Dutch in the German market, I shall be amply rewarded, without the assistance of any one.

It will afford me much pleasure to learn that the specimen of my herrings meets the approval of the Society; and, should that laudable Institution feel itself warranted in giving me any encouragement, I shall be most grateful for their bounty. At all events, whether the present specimen meet the approval of the Society, or not, I hope they will give me leave, when, next summer, I repeat my offering to the Prince, to send the Society a portion of the first-fruits of my labour.

I am, Sir, &c. &c. &c.

A. Aikin, *Esq. Secretary, &c. &c.* J. F. Denovan.

Description of the Process adopted by J. F. Denovan, *in curing White Herrings, in the manner of the Dutch, at Lochfine.*

When the herrings are brought alongside the salting-vessel, in the fishing-boats, they are counted over, and received into a large net-bag, with an iron hoop, and handle five feet long; and conveyed aft in the vessel, under an awning, to prevent their being tarnished by the sun or showers. Four large baskets are then placed to receive the different sorts; viz. *maatzes*, full-sized, prime, full herrings; and *spent-fish, shotten-fish*, and *stragglers*; which three last denominations are packed together. The utmost care and attention was paid to the assorting: two men were employed in packing; and four men, and as many boys as chose to come aboard, were employed in gutting. The gutters use a small knife with a long sharp point, about two inches long in the blade, and four inches in the handle, with a loop-hole through the latter, to admit the little finger, and prevent the blade from cutting the thumb of the left-hand, which it is otherwise apt to do. The blade of the knife, near the handle, is flattened; and a piece of soft leather tied round it, to prevent it from hurting the forefinger of the *right-hand*; while the forefinger of the *left-hand* is covered with a thick leather thimble, to prevent the long point of the knife from running into it. Each gutter has, at his right-hand, an oblong wooden trough, about four feet in length, covered thinly with fine Cadiz salt, into which he throws the herrings (previously assorted), as they are gutted. In gutting, the point of the knife (which is longer than that used by the British) is run through the neck, between the gill and the bone: the long small point perforates the bone: it is then drawn back; and, by turning the forefinger of the right-hand round the head of the herring, and catching the point of the knife, the gills, stomach, and gut, are pulled out, betwixt the first and second fingers of the right-hand. When each gutter has emptied his basket, by gutting the herrings and throwing them into the wooden trough, a quantity of fine Cadiz salt is thrown over them, and mixed with his hands to and fro, until the salt has taken due effect, and the herrings will not slide off the hand, or the wooden shovel with which they are also turned over. The packer then begins to pack. First, an equal quantity of Lisbon and Cadiz salt, with one-third of St. Ube's salt (pounded in a mortar), is strewed equally on the bottom of the barrel: the packer then lays a row of herrings down on their backs, with the head of the one to the tail of the other, which he strews over with salt: the next row is laid across the first; and so on, strewing salt on each, until the barrel is filled, when the whole are pressed down with a piece of round wood: four pounds weight of salt is then strewed over the top, and the cask headed up. The packer then marks, on the side of the cask, the date; and the curer enters the same in his journal. In three days afterwards, the barrels are opened, the superfluous pickle poured off, and preserved; and the barrel filled up, from another *of the same morning curing*.

The British statute requires the herrings to be fifteen days, until they can be branded for bounty; but experience has proved that *ten days are perfectly sufficient for priming*.

The casks are opened at the expiration of the fifteen days, and examined by the officer of the fishery; whose duty it is to see that the casks are properly filled up, before branding: but it is to be lamented, that the statute leaves it at the discretion of the curer to fill up the barrels with what herrings he thinks proper, and that without discrimination; for it is a fact that will not admit of contradiction, that the British curer knows nothing of assorting herrings, or ever attempts to practise it.

Many of the British curers will not allow their herrings to be pressed down, with the round piece of wood I have before mentioned; or, to use their own phrase, to be "*dunted;*"—and the reason is obvious: Their herrings are not assorted; consequently, those which are very full of milt and row (near spawning), when laid on their backs with small *maatzes* or spent-fish, must yield to the unequal pressure: but when properly assorted, it has the effect of causing the fixed oil to come up, with the pickle, to the top of the barrel; when it can be skimmed off with a round tin plate; which has an excellent effect, in preserving the fish in a sweet and sound state.

With the superfluous pickle, when freed of oil, I attempted the cure of mackarel; first gutting them, laying them in Cadiz and common-pan salt, and pouring the herring-pickle over them. I had not, however, an opportunity of trying this experiment to any extent; the season for that fish being nearly over when I reached Eyemouth: but from what I did cure in this way, I am satisfied that it will answer extremely well; and that mackarel, cured in that way, would find a ready market. In this way, the fish are preserved in a soft plump state, and the herring-pickle adds to their flavour.

It is much to be regretted that Government do not remove the duty from foreign salt, when it can be imported at a moderate price: for it is a certain fact, that all kinds of Liverpool salt are bitter; and our herrings can never possess the flavour of Dutch herrings, when cured with it.

Besides, the Lisbon and Cadiz salt is not only much more perfect, from an equal combination of the ingredients with which it is composed, but is a much more powerful antiseptic, and better adapted for preserving herrings in a warm climate.

At Eyemouth, exactly the same process was used; with the exception of St. Ube's salt, which is too strong for North-Sea herrings; and that, as the fish are much leaner there, the Dutch mode of leaving the long gut hanging out was implicitly followed. The herrings are, however, brought to the shore at Eyemouth; and cured, either on the quay, or in cellars. I preferred the latter, as the fish might be protected from the sun and rain; both of which never fail to injure the appearance of the herrings, in more respects than one.

CERTIFICATES.

Hamburgh, July 29, 1817.

Schadtler, Davids, John, and Co. merchants of the city of Hamburgh, declare, upon oath, that the thirty-nine barrels of herrings (one barrel having been used to fill up the others), which they received by the Waterloo (Capt. Claussen), and which were consigned to them by Messrs. J. F. and F. G. Denovan of Leith, were of an equal if not better quality than the herrings imported a fortnight ago from Holland and Embden: and, if they had arrived before them, would have fetched the price of, at least, twenty-five pounds sterling per barrel.

If these herrings had been salted with Lisbon salt, and the barrels had been made in the same manner as the Dutch, even the Herring Company here would not have taken them for Scotch herrings, which are not liked here at all, and are always to be got 50 per cent. cheaper than Dutch herrings:—which prejudice, however, might be entirely done away, in future, if the herrings were salted, packed, &c. in the way above mentioned.

SCHADTLER, DAVIDS, JOHN, & CO.

Sworn at Hamburgh, the 29th of July, 1817, before me,
ALEXANDER COCKBURN, His Majesty's Envoy Extraordinary in Lower Saxony.

Thinking it my duty to encourage this branch of trade, I have taken *particular pains* to ascertain the facts mentioned in this affidavit: and I now certify, to those whom it may concern, that, according to the best of my judgment, the statement is perfectly correct.

ALEXANDER COCKBURN.

Hamburgh, July 8, 1818.

At the request of Mr. Jurgen Bona Meyer, fish-curer, of this place, we, the undersigned sworn-brokers, have examined several barrels of Lochfine herrings, landed the day before yesterday, per the Edina, (J. J. White, master,) from Leith; and declare them to be of a superior kind of herrings to any hitherto, to the best of our knowledge, imported to our market from Great Britain; and which, in all probability, might have fetched the same high prices which were paid this week for the first Dutch, Embden, or Danish herrings, in case the Edina had arrived earlier in port:—for, in our estimation, the fish, as well as the mode adopted in curing them, are such as to entitle the said Lochfine herrings to the largest share in the consumption of our neighbouring markets; provided they be shipped rather early in the season, to this port.

Coinciding in the facts above related, we bear testimony to the same, by means of our signatures.

JOHN PAUL RIP INE.
JOHANN GERHARD MAAK

Concurring in the foregoing statement, I have to certify, that the aforesaid herrings are of Mr. J. Denovan's curing. And I deem it useful to add, that the said Lochfine herrings would even surpass in quality the Dutch herrings, if proper care could be taken to preserve the brightness of the scales.

JURGEN BONA MEYER, Fish-curer.

[*To be continued.*]

XLV.—*Answer to the Query in our last Number, On preserving Birds, and other Subjects of Natural History. By* G. F. Schmidt, *Esq.*

Sir, 12, *Windsor Terrace, City Road, Feb.* 10, 1824.

The query and information which are contained in your last Number, pp. 135 and 136, concerning the preservation of the *skins* of *birds, beasts,* and *snakes,* by wetting them with a solution of the chloride of mercury (corrosive sublimate) in alcohol, is a proof of the great attention you pay to whatever is really useful and practical.

Although I am not acquainted with Mr. Waterton's process, yet I can inform you, from actual experience, during a stay of several years within the tropics, where the myriads of ants, &c. will frequently destroy a valuable collection of natural history in the course of one night! that there is no better means of preserving *insects* from their ravages, than by means of a solution of corrosive sublimate in alcohol.

I should, however, observe, that insects are to be either wholly immersed in the solution, or only partially wetted with it. Amongst those that may be wholly immersed, I include the Orders *Coleoptera* and *Hemiptera:* and those that require only a partial wetting, are, the Orders *Lepidoptera, Neuroptera, Hymenoptera,* and *Diptera.* The reason why the latter do not require a complete immersion, is founded on the circumstance, that ants, moths, &c. to the best of my knowledge, never attack the wings, but only the bodies of insects: and as, in the Order *Lepidoptera,* the wings are the most beautiful parts of the insects, and must be taken the greatest care of, so it is requisite to use a fine hair-pencil, to dip it in the solution, and to wash over the body only of the insect completely with it, which will prevent it from being destroyed by those numerous and unwelcome ravagers, which are so prevalent in hot, and even in temperate climates. The Orders *Coleoptera* and *Hemiptera,* I before said, are to be wholly immersed, because it will save the trouble of partially wetting them, which always requires more time and nicety than the former process.

Concerning the immersion of the skins of *birds*, *beasts*, and *snakes* in the same solution, or its application to them in any other way, I cannot give any account of it, having never had occasion to put it to the test of experiment. According to my practice, it is much better to use a solution of *arsenic* and *soap in water*, and to wash the insides of the skins of birds, &c. with these ingredients, which will entirely prevent them from being attacked by insects. Such, at least, was the success I had during my travels, that, after five years had elapsed, not one skin was destroyed, or even damaged; and the skins of birds, in particular, kept so well, that they looked quite as beautiful as when the birds were first shot.

The manner in which the solution of chloride of mercury is to be prepared, is simply this:—Take a small tumbler, or a wine-glass, according to the size of the insects to be dipped; fill it with alcohol, and put a piece of chloride of mercury into it, about the size of a hazel-nut: when it is dissolved, the solution is fit for use.

I remain, Sir, with due regard, yours, &c.

T. GILL, *Esq.* G. F. SCHMIDT.

XLVI.—*On the Application of British Grasses to the Manufacture of Fine Plat. By* MR. WILLIAM COBBETT*.

SIR, *Kensington, April* 14, 1823.

AGREEABLY to your request, I now communicate to you a statement of those particulars which you wished to possess, relative to the specimens of straw and of plat which I have, at different times, sent to you for the inspection of the Society.

* From Vol. XLI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.—The Society voted its Large Silver Medal to Mr. Cobbett, for this Communication.

That my statement may not come too abruptly upon those Members of the Society who have not had an opportunity of witnessing the progress of this interesting inquiry, I will take a short review of the circumstances which led to the making of my experiments.

In the month of June 1821, a gentleman, a member of the Society, informed me, by Letter, that a Miss Woodhouse, a farmer's daughter, of Weathersfield, in Connecticut, had communicated to the Society a straw-bonnet of very fine materials and manufacture*; that this bonnet (according to her account) was made from the straw of a sort of grass called *poa pratensis;* that it was unknown whether the same grass would grow in England; that it was desirable to ascertain whether this grass would grow in England; that, at all events, it was desirable to get from America some of the seed of this grass; and that, for this purpose, my informant, knowing that I had a son in America, addressed himself to me; it being his opinion, that, if materials similar to those used by Miss Woodhouse could by any means be grown in England, the benefit to the nation must be considerable.

In consequence of this application, I wrote to my son James (then at New York), directing him to do what he was able, in order to cause success to the undertaking. On the receipt of my letter, in July, he went from New York to Weathersfield (about a hundred and twenty miles); saw Miss Woodhouse; made the necessary inquiry; obtained a specimen of the grass, and also of the plat, which other persons at Weathersfield, as well as Miss Woodhouse, were in the habit of making; and, having acquired the necessary information, as to cutting the grass, and bleaching the straw, he transmitted to me an account of the matter; which account, together with his specimens of grass and plat, I received in the month of September.

I was now, when I came to see the specimen of grass,

* See Vol. III. p. 128.

convinced that Miss Woodhouse's materials could be grown in England; a conviction, which, if it had not been complete at once, would have been made complete immediately afterwards, by the sight of a bunch of bonnet-straw imported from Leghorn; which straw was shewn to me by the importer; and which I found to be that of two or three sorts of our common grass, and of oats, wheat, and rye.

That the grass, or plants, could be grown in England, was therefore now certain, and, indeed, that they were, in point of commonness, next to the earth itself. But, before the grasses could with propriety be called materials for bonnet-making, there was the bleaching to be performed; and it was by no means certain that this could be accomplished by means of an English sun; the difference between which, and that of Italy or Connecticut, was well known to be very great.

My experiments have, I presume, completely removed this doubt. I think that the straw produced by me to the Society, and also some of the pieces of plat, are of a colour which no straw or plat can surpass. All that remains, therefore, is for me to give an account of the manner in which I cut and bleached the grass which I have submitted to the Society in the state of straw.

First, as to the season of the year, all the straw, except that of one sort of couch-grass, and the long coppice-grass, which two were got in Sussex, were got from grass cut in Hertfordshire, on the 21st of June. A grass headland in a wheat-field had been mowed during the fore-part of the day; and, in the afternoon, I went and took a handful here and a handful there out of the swaths. When I had collected as much as I could well carry, I took it to my friend's house, and proceeded to prepare it for bleaching, according to the information sent me from America by my son; that is to say, I put my grass into a shallow tub, put boiling water upon it until it was covered by the water, let it remain in that state for ten minutes, then took it out, and laid it very thinly on a closely-mowed lawn in a garden.

3d instant, referring to the numbers as placed on the plat and on the bunches of straw.

Pieces of Plat.	*Bunches of Straw.*	*Sorts of Grass.*
No. 1	No. 1	Wheat.
2, 3	2 & 3	Melica cœrulea; or, Purple Melica Grass.
4, 12	4 & 12	Agrostis stolonifera; or, Fiorin Grass; *i.e.* one sort of Couch-Grass.
5, 10	5 & 10	Lolium perenne; or, Ray-Grass.
6, 11	6 & 11	Avena flavescens; or, Yellow-Oat Grass.
7, 15	7 & 15	Cynosurus cristatus; or, Crested Dog's-tail Grass.
8, 13	8 & 13	Anthoxanthum odoratum; or, Sweet-scented Vernal Grass.
9, 14	9 & 14	Agrostis canina; or, Brown-Bent Grass.

These names are those given at the Botanical Garden at Kew. But the same English names are not, in the country, given to these sorts of grass. The Fiorin grass, the Yellow-oat grass, and the Brown-bent, are all called Couch-grass; except that the latter is, in Sussex, called Red-robin: it is the native grass of the plains of Long Island, and they call it Red-top. The Ray-grass is the common field grass, which is, all over the kingdom, sown with clover. The farmers, in a great part of the kingdom, call it Bent or Bennet-grass; and sometimes it is called Darnel-grass. The Crested Dog's-tail goes, in Sussex, by the name of Hendon Bent, for what reason I know not. The Sweet-scented Vernal grass I have never, amongst the farmers, heard any name for. Miss Woodhouse's grass appears, from the plants that I saw, to be one of the sorts of Couch-grass. Indeed, I am sure that it is a Couch-grass, if the plants I saw came from her seed. My son, who went into Connecticut, who saw the grass growing, and who sent me home a specimen of it, is now in England: he was with me when I cut the grass in Sussex; and he says that Miss Woodhouse's was a Couch-grass. However, it is impossible to look at the specimens of straw and of plat which I have sent you, without being convinced that there is no want of the raw material in England. I was, after first hearing of the subject, very soon convinced that the grass grew in England; but I had great doubts as to the capacity of our sun. Those doubts my own experiments have completely removed; but then I was not aware of the great effect of the scalding; of which, by the way, Miss Woodhouse had said nothing, and the knowledge of which we owe entirely to my son James's journey into Connecticut.

Having thus given you an account of the time and manner of cutting the grass, and of the mode of cutting and bleaching; having given you the best account I am able as to the sorts of grass to be employed in this business; and having, in my former communications, given you specimens of the plat wrought from the several sorts of straw; I might here close my Letter: but, as it may be useful to speak of the expense of cutting and bleaching, I shall trouble you with a few words relating thereto. If there were a field of Ray-grass, or of Crested Dog's-tail, or any other good sort, and nothing else growing with it, the expense of cutting would be very little indeed, seeing that a scythe would do the business at a great rate. Doubtless there will be such fields; but, even if the grass have to be cut by the handful, my opinion is, that the expense of cutting and bleaching would not exceed four-pence for straw enough to make a large bonnet. I should be willing to contract to supply straw at this rate for half-a-million of bonnets. The scalding must constitute a considerable part of the expense; because there must be fresh water for every parcel of grass that you put in the tub. When water has scalded one parcel of cold grass, it will not scald another parcel. Besides, the scalding draws out the sweet matter of the grass, and makes the water the colour of London porter. It would be very good, by the bye, to give to pigs. Many people give hay-tea to pigs and calves, and this is grass-tea. To scald a large quantity, therefore, would require means not usually at hand; and the scalding is an essential part of the business. Perhaps, in a large and very convenient farm-house, with a good brewing-copper, good fuel and water handy, four or five women might scald a waggon load in a day; and a waggon would, I think, carry straw enough (in the rough) to furnish the means of making a thousand bonnets. However, the scalding might take place in the field itself, by means of a portable boiler, especially if water were at hand; and, perhaps, it would be better to carry the water to the field, than to carry the grass to the farm-house; for there must be ground to lay it out upon, the moment it has been scalded; and no ground can be so proper as the newly-mowed ground where the grass has stood. The space, too, must be large for any considerable quantity of grass. As to all these things, however, the best and cheapest methods will soon be discovered, when people set about the work with a view to profit.

The Society will want nothing from me, nor from any body else, to convince it of the importance of this matter: but I cannot, in concluding these communications to you, Sir, refrain from making an observation or two on the consequences likely to arise out of these inquiries. The manufacture is one of considerable magnitude. Not less than about five millions of persons in this kingdom have a dress which consists partly of manufactured straw; and a large part, and all the most expensive part, of the articles thus used, now comes from abroad. In cases where you can get from abroad any article at less expense than you can get it at home, the wisdom of fabricating that article at home may be doubted. But, in this case, you get the raw material by labour performed at home; and the cost of that labour is not nearly so great as would be the cost of the mere carriage of the straw from a foreign country to this. If our own people had all plenty of employment, and that, too, more profitable to them and to the country than the turning of a part of our own grass into articles of dress, then it would be advisable still to import Leghorn bonnets; but the facts being the reverse, it is clear, that whatever money, or money's-worth things, be sent out of the country in exchange for Leghorn bonnets, is, while we have the raw material here for next to nothing, just so much thrown away. The Italians, it may be said, take some of our manufactures in exchange: and let us suppose, for the purpose of illustration, that they take cloth from Yorkshire. Stop the exchange between Leghorn and Yorkshire; and does Yorkshire lose part of its custom? No: for though those who make the bonnets out of English grass prevent the Leghorners from buying Yorkshire cloth, they, with the money which they now get, instead of its being got by the Leghorners, buy the Yorkshire cloth themselves; and they wear this cloth too, instead of its being worn by the people of Italy:—aye, Sir, and many now in rags will be well clad, if the laudable object of the Society be effected! Besides this, however, Why should we not export the articles of this manufacture? To America, we certainly should: and I should not be at all surprised if we were to export them to Leghorn itself.

Notwithstanding all this, however, if the manufacture were of a description to require, in order to give it success, the collecting of the manufacturers together in great numbers, I should, however great the wealth that it might promise, never have done any thing to promote its establishment. The contrary is happily the case: here all is not only performed by hand, but by hand singly, without any combination of hands. Here there is no power of machinery or chemistry wanted: all is performed out in the open fields, or sitting in the cottage. There wants no coal-mines and no rivers to assist, no water-powers, nor powers of fire. No part of the kingdom is unfit for the business. Everywhere there are grass, water, sun, and women and children's fingers; and these are all that are wanted. But, the great thing of all is this; that, to obtain the materials for the making of this article of dress, at once so gay, so useful, and in some cases so expensive, there requires not a penny of capital. Many of the labourers now make their own straw-hats, to wear in summer,—poor rotten things, made out of the straw of ripened grain! With what satisfaction will they learn, that straw twenty times as durable, to say nothing of the beauty, is to be got from every hedge! In short, when the people are well and clearly informed of the facts which I have, through you, Sir, had the honour to lay before the Society, it is next to impossible that the manufactory should not become general throughout the country. In every labourer's house a pot of water can be boiled. What labourer's wife cannot, in the summer months, find time to cut and bleach grass enough to give her and her children work for a part of the winter? There is no necessity for all to be platters. Some may cut and bleach only. Others may prepare the straw, as before mentioned in this Letter (p. 171). And, doubtless, as the farmers in Hertfordshire now sell their straw to the platters; grass-collectors, and bleachers, and preparers, would do the same: so that there is scarcely any country-labourer's family that might not derive some advantage from this discovery. And, while I am convinced that this consideration has been by no means overlooked by the Society, it has been, I assure you, the great consideration of all, with,

Sir, &c. &c. &c.

W. COBBETT.

XLVII.—*On Native and Artificial Carbonates**.

(Concluded from p. 120.)

ONE of the principal groups established by mineralogists amongst the carbonates of lime, is that known by the name of *calcareous spar*. Under this denomination, we know more than a hundred and fifty varieties, which exteriorly

* From the *Dictionnaire Technologique*.

present no kind of similarity, but which, nevertheless, may all be reduced, by a laminated cleavage, to the same primitive form; which is, an obtuse rhomboïd, whose incidental surfaces, measured by the goniometer, are found to be 105° 5″ and 74° 55″.

Calcareous spar has a laminated texture: its laminæ are plane, and well defined; and are separated easily by cleavage: but, whatever may be the secondary form of the crystal, it readily assumes its primitive rhomboïdal form. This property, added to the great multiplicity of forms which this carbonate presents, has rendered it of the greatest utility in the study of crystallography; and, indeed, it has served as the base of the ingenious system founded by the celebrated Haüy.

Calcareous spar is generally colourless and transparent; such as that which we receive from Iceland, and which has been lately employed, with great success, by men of science, in studying the properties of the polarization of light. At the Hartz, and at Andreasberg, it is found of a milky whiteness: sometimes it is to be met with of a violet, yellow, red, or green colour: but, in general, its colours are uniformly diffused, and but little variegated. Calcareous spar is found in nearly almost every kind of formation; but it is more rare in the primitive, than in the secondary ones.

The most remarkable varieties of carbonate of lime produced by crystallization, are those known by the names of *lamellar* and *granular calcareous spar;* which include almost all the varieties of marble. Some of these marbles are colourless, and almost transparent; such as those of Paros and Carrara. Others contain foreign matters, which cause them to be more or less beautifully veined; and these are greatly sought after, for the formation of ornamental subjects.

Carbonate of lime being soluble in an excess of its own acid, and this acid being naturally produced under an infinity of circumstances, its solution is frequently effected:

and we meet with it in many different springs; such are those of Saint Philip in Tuscany, Saint Allyre in Auvergne, &c.; but these springs have, as we know, the property of depositing a great portion of the calcareous earth held by them in solution, and thereby form real incrustations, in all the varieties of *calcareous concretions*. These incrustations are known by the name of *stalactites*, when they are composed of masses, not very large, and composed of stratified layers nearly parallel or wavy, and often of various colours. They are called *calcareous alabaster*, when the masses are considerable, and susceptible of receiving a beautiful polish. The *stalactites* are formed by water, which, exuding through calcareous rocks, drops into large caverns. As the drops fall, they deposit the carbonate of lime which they contained, and form cylinders, which are suspended from the roofs of the caverns.

In all these cases, the chemical phænomena are absolutely the same; for the carbonic acid escaping into the atmosphere, the calcareous carbonate which was held in solution by it is deposited. The encrusting property of many springs has been profitably employed, either in imitating petrifactions, or in casting bas-reliefs: it is sufficient, in fact, either to plunge any article into the water, and allow it to remain a longer or shorter time, according to the thickness of incrustration we wish to obtain; or to expose the moulds to the spray of the falling water.

When the carbonate of lime, instead of being held in complete solution, has been only momentarily suspended in water, it is deposited under the form which mineralogists term the *carbonate of lime in sediment*, and is always known by its compact and coarse texture; though we sometimes remark laminæ in it, which indicate that a part of it has been held in solution. Most of the marbles belong to this class, and generally consist of stones held together by the carbonate of lime. They are seldom of one colour only, but generally present a great number of shades, disposed in veins or spots. When these spots are angular and separate, we see that the mass is composed of fragments of marble held together by a cement: it then takes the name of *breccia*; and it is also called *lumachella*, when it is chiefly formed of broken shells.

Among the carbonates of lime from sediment, may also be placed the compact limestones, and the coarse and finer chalk. The first are scarcely to be distinguished from marble, of which they have nearly the same consistence, and a close grain; but their colours are duller, and vary between a yellowish white, an ash grey, and a brown; and they cannot receive so high a polish. They are to be met with in thick strata with parallel layers between them, but rarely horizontal: they sometimes constitute whole mountains; some being known of 3600 metres in height. The stone found in the environs of Pappenheim and Ratisbon, which is used for lithographic printing, is a variety of compact limestone. It is also in this class that we rank the transition limestones of the Alps and Jura; these are composed of the fragments of organized bodies, and are found lying between the primitive and the secondary earths.

The chalky carbonate of lime is characterized by its soft texture, its white colour, and its earthy aspect, without affording any signs of crystallization: it contains as pure a carbonate of lime as the spar; but it is also mechanically mixed with silex, magnesia, and alumine, in various proportions. Chalk is frequently found in extensive masses, of all dimensions: it constitutes entire chains of hills, and extends over a considerable part of the globe. One very remarkable thing in the beds of chalk, and which indicates its stratification, is the silex with which it is accompanied, and which, in the kidney form, is disposed in regular strata. The cause of the presence of this silex has not been explained by geologists in a satisfactory manner: they suppose that it may be owing to a kind of crystallization, effected by the agglomeration of the siliceous molecules which were disseminated in the chalk at the moment of its precipitation; and we observe similar effects to take place in our laboratories, and real crystals to be produced in the midst of a deposit formed of solid molecules very minutely divided.

The *coarse limestone* or *building stone of Paris* appears to be of a formation later than that of the chalk, and to belong to the newest formation: it is almost always lodged in the high chains of primitive mountains; and encloses a great number of shells, of various sorts. In general, this carbonate of lime has a loose texture, a coarse grain, and is easily shaped by cutting instruments: it is not susceptible of receiving any polish; nevertheless, it varies in its properties; and is sometimes met with sufficiently hard to be profitably employed in sculpture: such is that of Nanterre, near Paris.

The carbonate of lime is not always met with as pure as the varieties which we have mentioned: it often encloses, in its crystallization, substances entirely foreign to it; and it then constitutes a new series of varieties, which are denominated *mixed carbonates of lime:* these additional substances consist principally of silex, as in free-stone; as also of metallic matters, and bitumen. In almost every case, the carbonate of lime is not altered, in its crystalline form, by the presence of these foreign matters. We have an evident proof of this, in the freestone of Fontainebleau, which possesses all the regularity of the rhomboïdal carbonate of lime, although it contains but a very small proportion of lime.

The uses of carbonate of lime are so well known, that it becomes almost unnecessary to point them out: in fact, there is hardly any person who is not familiar with them, and knows likewise that marbles, breccias, lumachellæ, &c. are employed in the manufacture of objects of ornament, and the coarser limestones in the construction of buildings; that the compact limestones, from certain places, are used for lithography; and that chalk is employed in many various ways.

Sub-carbonate of copper.—This salt exists in nature in two different states, which are distinguished principally by their colour. One is of a very fine green, smooth, and formed of concentric and irregular zones: this is the *malachite* of the jewellers, of which trinkets and ornamental vases are formed. The other is the *mountain blue*, possessing an uniform and very fine tint: this crystallizes in prisms. They are both met with in almost all copper-mines: the most beautiful malachites are brought from the mines of Siberia; and, at Chessy, near Lyons, they find the most beautiful blue carbonate. Hitherto, no positive cause has been assigned for this difference of colour; and the mineralogists regard them as forming one species. M. Vauquelin has, however, found a trifling difference in their composition. According to his analysis,

	Blue Carbonate consists of	Green Carbonate consists of
Water	6,5	8,75
Carbonic acid	25	21,25
Copper	56	56
Oxygen	12,5	14
	100.	100.

An artificial carbonate of copper is prepared, which enters into the composition of various enamel colours; and which, when mixed with the oxides of manganese and cobalt, is also used for painting earthenware, in the potteries. In order to obtain this sub-carbonate, they generally use the sulphate of copper, which is decomposed by the sub-carbonate of potash of commerce: both these salts are used in a state of solution, and in proper proportions. The sub-carbonate of copper, being insoluble, forms an abundant precipitate, when the two solutions are mixed together: nevertheless, it retains a great quantity of water in combination, and is washed with difficulty. Its colour is an apple-green; and is greatly heightened, if washed with warm water.

The facility with which the sub-carbonate of copper parts with its acid causes it to be used as a protoxide of copper: it is sufficient, in order to bring it to this state, to heat it very gently on an iron plate; and it is used in this manner by the painters on earthenware; or the carbonic acid may be driven off by boiling it in water.

Sub-carbonate of iron.—Many authors distinguish two sub-carbonates of iron; but there really exists only one, which is formed with the protoxide. This combination is sometimes, though but rarely, found in nature. There are only two places where it is met with; namely, at Baigorry, and at Eulenloch. Certain mineral waters contain it in solution, caused by an excess of carbonic acid; and they deposit it in proportion as this acid evaporates into the atmosphere.

In order to obtain the sub-carbonate of iron, we take a solution of the proto-sulphate of iron, into which we pour a solution of the sub-carbonates of soda or potash: an abundant precipitate is soon formed, which, at first, is greenish, but turns to a rusty colour as it absorbs oxygen from the atmospheric air, because the protoxide passes to the state of a deutoxide; but then it has no longer an affinity for the carbonic acid, which is set free according as the super-oxidation takes place, at which point, if not prevented, it precipitates, from contact with the air; and, in the end, nothing is obtained, but an hydrated tritoxide, which is nevertheless sold, in commerce, under the name of the *sub-carbonate of iron.* If we would really obtain the sub-carbonate, the precipitation must be effected in a well-stopped bottle: it must be allowed to remain at rest, the water be decanted by means of a siphon, the precipitate well washed with boiled distilled water, and, finally, be dried and preserved in the shade, not allowing it to come at all into contact with the air.

In pharmacy, they prepare a kind of sub-carbonate of iron, by exposing iron filings in contact with a humid atmosphere: the iron oxidizes, and absorbs a small portion of carbonic acid. When there is a certain quantity formed, they triturate the filings with a small quantity of water, in order to separate the oxide; and then pour off the water, and dry it. This is the *aperitive saffron of Mars*, of the Ancients.

Sub-carbonate of magnesia.—This salt, which is greatly employed in medicine, is always produced by art: it is, however, found native, in Piedmont, Ireland, and some other countries; but not sufficiently pure to be taken internally, as it contains a considerable quantity of silex. The English prepare almost all that is sold in commerce: *they*, only, have succeeded in obtaining that beautiful whiteness, and extreme lightness, which are so much sought for in this medicine. It is presumed, however, that a few experiments would be sufficient to enable us to obtain the same results.

We will point out what appears to us most likely to attain this end.—It is from the double decomposition of sulphate of magnesia, the sub-carbonates of pot-ash or soda, that they obtain the sub-carbonate of magnesia.

We have already said, that two essential qualities are sought for in the sub-carbonate of magnesia, viz. whiteness and lightness. The former depends on the purity of the matters employed; for magnesia is naturally white; but its sulphate generally contains a certain quantity of iron, and sometimes of manganese: now the presence of these oxides is sufficient to discolour the precipitate; and we must necessarily have recourse to the ordinary methods of purification, in order to separate these foreign bodies. These means consist in re-crystallizing the salt, or, rather, in precipitating the metallic oxides, by adding to the solution a small quantity of the hydrosulphate of ammonia: it is then made to boil, in order to drive off the excess of the hydrosulphate; then filtered; and, lastly, the alkaline solution is added. All that we have before said, with respect to the sulphate of magnesia, is also equally applicable to the sub-carbonate, in respect to this operation; for it is evident that the inconvenience would be the same, if the latter contained any metallic substances. We might also succeed in completely separating the foreign substances contained in the sulphate of magnesia, by adding a very small quantity of alkali, and agitating them together for a long time. The first precipitate obtained, would carry down the metallic oxides; because they have less affinity for the acid, than the magnesia has. We may be certain of the complete purification of this salt, when, on testing its solution with a few drops of hydrosulphate, no precipitate is formed.

It now remains to point out how we may succeed in giving to the magnesia the desired lightness. That which appears to us the most advantageous in this case, is, first, to dilute the solutions greatly, in order that the molecules of the precipitate may be as much divided as possible; secondly, not to allow the precipitate to dry slowly, because then the molecules approach each other by degrees, and acquire a greater density; whereas, when the water is removed from them suddenly, they occupy nearly the same volume as when they were separated by the water. We should then place the precipitate in a stove, upon a thick bed of very dry plaster of Paris; as the heat of the stove, and the avidity of the plaster for water, are two causes which would very effectually concur in quickly drying the sub-carbonate.

We sometimes find, in commerce, a magnesia which is adulterated with chalk. It is extremely easy to perceive this fraud; not only by the increased weight given to it by this addition, but also from its appearance when treated with sulphuric acid diluted with water: as the magnesia is entirely dissolved, when it is pure; but forms an insoluble deposit, when it contains foreign matters.

This salt contains, according to Klapróth:	Carbonic acid	33
	Magnesia	40
	Water	27
		100

The sub-carbonate of magnesia dissolves, like lime, in its proper acid; but, in proportion as the excess of the acid evaporates, the magnesia is deposited, in the state of a neutral carbonate, in the form of small rhomboïdal prisms, which become opaque, when exposed to the air.

Sub-carbonate of Manganese.—This is obtained in the same manner as that of copper. Instead, however, of the sulphate, the muriate is generally used; because they have this article more readily at hand, it being the residuum of the preparations of chlorine, and the chlorates. The sub-carbonate of manganese, when it is pure, is perfectly white; but as it is difficult to separate from it the last portions of iron, so it is seldom obtained but of a yellowish colour: its acid quickly flies off, where it is acted upon by heat; and they thus obtain the black oxide of manganese, possessing a beautiful velvet-like appearance, which forms the basis of the ink used by the china painters in the potteries. To obtain this article of the finest quality, it is requisite that the calcination be effected on an iron plate, and at the lowest temperature possible; otherwise, a yellowish-red oxide will be formed.

The sub-carbonate of manganese contains the oxide at a *minimum*; and, in proportion as the acid flies off, it takes up that oxygen from the atmospheric air, which is requisite to cause it to pass to the state of a peroxide. This salt contains, according to John, at a *minimum*,

Manganese	55,84
Carbonic acid	34,16
Water	10
	100

Saturated Carbonates.—There are only three saturated carbonates prepared; viz. those of pot-ash, soda, and ammonia. Each of the three may be obtained by causing to pass through their concentrated solutions a current of carbonic acid gas: but it is often more expeditious, and convenient, to prepare those of potash and soda, by the addition of a portion of the sub-carbonate of ammonia to the concentrated solution of their sub-carbonates. The saturated carbonate of soda is prepared in England, for *soda-water*, in the following manner: Take six parts of well-purified sub-carbonate of soda, and add to it four parts of very white sub-carbonate of ammonia; then dissolve the whole in four parts of distilled water, which is evaporated over a water-bath till a pellicle is formed; it is then allowed to cool. The ammonia is partly dissipated; and the carbonic acid which was combined with it, seizes the sub-carbonate of soda, and effects its saturation. There is formed on the surface of the liquid, a solid, opaque, crystalline pellicle, which is the neutral carbonate: a portion of it is also deposited at the bottom, and on the sides of the vessel. These plates of carbonate are removed, and laid to drain over funnels: the desiccation is finished in a stove. When the crystals assume a regular form, and preserve their transparency, they have become a sub-carbonate; as will be also readily perceived, from their alkaline taste.

The mother-waters must be evaporated over a water-bath, and not be suffered to boil; otherwise the carbonic acid would be dissipated, and a sub-carbonate be reproduced.

This means of procuring the neutral carbonate is more expensive than the former one described; but the product is more beautiful, and more quickly obtained. The English consume a large quantity of it in that kind of preparation denominated *sodaic-powders*, which consist of 44 grains of the neutral carbonate of soda, and 32 grains of either the tartaric or citric acids, both being well pulverized. An extempore *soda-water* is formed of these ingredients, by first dissolving the tartaric or citric acid in a glass of water; and on the neutral carbonate being added, a brisk effervescence takes place, and the liquid must be instantly swallowed.

In chemistry, the neutral carbonates are sometimes used for analysis: we can thus separate magnesia from other earthy or metallic substances, by adding the saturated carbonate of pot-ash to their saline solutions. The carbonic acid holds the magnesia in solution, and the other carbonates produced are precipitated: the liquid is then filtered, and submitted to ebullition to drive off the excess of carbonic acid; and the magnesia precipitates in its turn. The same means are likewise applicable to the separation of manganese from iron.

XLVIII.—*On improved Taps for Wooden and Metal Screws, Invented by Mr.* C. A. SIEBE, 406, *Strand.**

WITH FIGURES.

SCREWS vary from each other, not only in magnitude, but also in the direction and numbers of their threads: hence there are right- and left-handed screws; also single, double, and treble screws. The apparatus of Mr. Siebe *enables the workman, with the same tool, to form either right or left, single, double, or treble, wooden hollow screws, of the same diameter.* The screws capable of being made by these implements, although very far from being mathematically accurate, will be found to be quite as good as the hollow screws made in the usual way, and adapted to the purposes of various articles of domestic furniture, and to the commoner kinds of machinery.

The cutter of the tap for wooden screws is a thin quadrilateral piece of steel, of the length and breadth of the required screw, and having its longitudinal edges cut into teeth; the teeth in one row being opposite to the intervals in the other, and, therefore, representing the section of a screw, the teeth being sections of the threads.

A cylinder of hard wood has a slit sawn down its middle, to receive the cutter, which is to be rivetted into its place. The cylinder terminates in a flat head, for the purpose of

* Chiefly extracted from Vol. XLI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce; with some additional particulars by the Editor.—The Society voted its Silver Vulcan Medal, and Five Guineas, to Mr. Siebe, for these improved taps.

receiving a key, or lever, to turn it by, and in order to overcome the friction experienced in cutting the hollow screws.

In order to use this tool, a cylindrical hole, equal in diameter to the cylindrical stem of the tool, is to be bored in a piece of wood; and the serrated cylinder being then introduced, on giving to it a proper circular or spiral motion, will form a right- or left-handed screw, according to the direction in which it is turned; and, by first entering two or three threads, by means of a very simple cutter, fig. 5, the same tap will cut a double- or treble-threaded screw.

References to the Figures of Mr. Siebe's Screw-taps.

In Plate VI. fig. 1, is the tap for wooden screws: it is composed of a cylinder of box, or other hard wood, *a, a,* sawn down the middle, as shewn in fig. 2; and of a steel blade, *b, b,* fixed in the wood, by two or more rivets, *c, c.* The piece of hard wood, being first made into a screw, in any of the usual methods, the blade is fitted into the slit, and secured by temporary pins: teeth are then filed in each side of the blade, to fit the wooden threads of the screw: the blade is then removed; and the threads are just turned off, leaving the stem cylindrical. The blade has also its teeth, towards the point, tapered gradually away, so that the first teeth are no bigger than the cylinder, as shewn in fig. 3; and, after being hardened and tempered, it is riveted in its place. Previously, however, the cylinder must be cut away, on each side, a little, as shewn at *d, d,* in the end view of it, fig 4, to make room for the cuttings. As the cylinder fits the hole exactly, and the blade is taper, it secures a gradual and steady cut, which may be either to the right or left hand.

Fig. 5. is a V-tool, (*e,* is a section of its cutting edge,) to begin the double or treble threads, in order to get a proper lead.

Fig. 6, shews a treble-threaded hole. A cut is made with the V-tool at 1; and then another at 2, which shall slope under that at 1, leaving one thread. Another, or third cut is then made at 3, to slope under 2; which, if continued, would leave two threads under 1, and three threads under 3; and thus give the lead for a treble thread.

Fig. 7, shews a steel tap, for metal screws.

Fig. 8, is an end view of it, shewing how the steel screw has been filed away, to leave the threads of it, on each side, like teeth, and quite sharp. It had, at first, been made like a plain screw, with the threads behind, at *f*, turned off: it was then filed square, and the threads (or teeth, as they may now be called) at two opposite sides were filed away, to the bottom of the teeth, and to coincide with the plain cylindrical part at *f*. These taps cut the better, the nearer the plain or cylindrical part fills the hole.

The intent of this tap is, to form right- or left-threaded screws, exactly of the same rake; which are particularly useful for making the two dies, or jaws, used in the universal-chucks for turning-lathes, approach towards or recede from the centre uniformly, a circumstance of the utmost importance to their utility. For the purpose of making right and left single-threaded screws, Mr. Siebe prepares a soft steel plate, of a proper size and thickness; having three cylindrical holes made in it, two of them being the exact diameter of the bottoms of the threads of the screw, and the third opened, to serve as a gauge for the size of the cylinders to be tapped or screwed in it. The tap is then turned towards the right, in one of the first-mentioned holes, and towards the left in the other, until the threads of the hollow screws become perfect: two opposite sloping notches are then filed in each screwed hole in the plate (as shewn in fig. 9), but which do not pass through the bottom threads; and the plate is then hardened and tempered for use, as usual.

The same tap may be also used for making double or treble right- and left-handed screws; double or treble entering gaps being, however, previously made in the holes of the plate, as in the case of the wooden screws, but with a chisel; and the tap must be carefully entered either way, according to the kind of screw intended to be cut. This operation, however, requires skill, and the hand of an experienced workman to succeed well in it.

It is not absolutely necessary, in making a tap for wooden screws, to have an original screw to begin with, as above mentioned; but only a wooden cylinder, of the diameter of the bottoms of the threads, with a slit made in it to receive the blade: and the gaps or teeth on each side of the blade may be readily made in it, by dividing and filing them carefully; observing, as before said, to make a tooth and a gap opposite to each other. In this way, a tap for cutting the large wooden female-screws used in carpenters' vices, presses, &c. may be readily and cheaply made; whereas a large tap of the usual construction is an expensive article. The solid screws may also be turned with a corresponding serrated screw-tool in the lathe, in the manner technically termed *cutting flying;* and thus both the solid and hollow screws may be made sufficiently exact for ordinary purposes, and at little expense in tools.

The steel blade, posited across the centre of the wooden cylinder, *is exceedingly well situated for cutting smoothly;* and performs its office with a facility that can only be known by an actual trial of it.

XLIX.—*On the Italian Varnish, or Polish, for Wood.*

WE are indebted to the kindness of H. W. Reveley, esq. (who acquired his knowledge of this beautiful art in Italy) for the following interesting particulars of the process.

PREPARING AND POLISHING THE WOOD.

The marks of the plane are to be completely obliterated, by means of the steel-scraper, as is usual in this country; but, instead of using glass-paper, of different degrees of coarseness and fineness, in succession, to remove the traces left by the scraper, pumice-stone, and cuttle-fish-bone, prepared as will be described, are employed in the process.

The pumice-stone must be sawn *across its grain, endways*, and be rubbed quite flat on its surface: the wood is then to be wiped over with raw linseed-oil; and the pumice-stone applied with the oil, by rubbing in a circular direction, until all traces of the scraper are effectually removed. The thick mixture of pumice-stone powder and oil is next carefully wiped off with a woollen cloth, and a fresh application of linseed-oil made; when the wood will be ready for the cuttle-fish bone, which is thus used. The hard crust which covers one side of the cuttle-fish-bone being carefully taken off, that part of the bone which it covered must be rubbed flat, and applied with oil, in the same manner as the pumice-stone, until it has, in its turn, completely effaced all the scratches left by the former: the mixture of cuttle-fish-bone and oil is then to be completely wiped away; and the wood finally polished, by dusting over it the fine dry powder of *soft burned* bricks (either red or yellow, according to the colour of the wood); rubbing it continually with a woollen cloth, and renewing the application of the powder, until the wood has acquired a beautiful polish: and, when all particles of the brick-dust have been carefully removed, it will be ready for varnishing.

THE VARNISH.

This resembles the French varnish in its chief constituent parts; being, like that, made of seed- or shell-lac, dissolved in alcohol: but, in order to correct its brittleness, a little bees'-wax and gum-elemi are added to it. Should the wood be dark-coloured, a portion of the gum-resin, termed *sanguis draconis* or dragon's-blood, may be added to the varnish, in order to deepen its colour.

APPLYING THE VARNISH.

The varnish is applied by enclosing *a sponge* in several folds of linen cloth, the outside one being of *fine linen*; and dipping the face of it into the varnish: a little Florence-oil is then to be applied, in the centre of the varnish, with the finger; and the varnishing proceeded with in the usual manner, by rubbing the whole surface of the wood over, with circular strokes, exactly as described in our former directions on the French Varnish or Polish*. It will require four days' time to complete a table; and the varnish will not, after all, be so thick as a sheet of paper.

ON GIVING A DARK STAIN TO WOOD.

Mr. Reveley recommends the application of the *nitrate of silver*, in a dilute state, to the wood, previous to commencing the polishing and varnishing processes. This hint may prove useful to gun-makers, who are in the habit of darkening the colour of their gun-stocks by rubbing them over repeatedly with linseed-oil in which alkanet-roots have been steeped; but, owing to the length of time required in this operation, the oil thickens, and effectually cuts off communication of the spirit-varnish (used in giving the stocks the French Polish) with the wood; and the consequence is, that the varnish frequently comes off the stock, in the course of a single day's shooting.

L.—*On the Hydraulic Engine constructed at Augsburg by the celebrated Mechanic* REICHENBACH.

WITH A PLATE.

(Concluded from p. 111.)

IN Plate III. fig. 1, of the present Volume, we have given a Plan of this Engine, and in fig. 2, an elevation of it;—in Plate V. fig. 3, a cross-section of it;—in fig. 4, a section of the water-wheel and its race;—and in Plate VII. we give details of several of the parts composing it, on a larger scale: in all of which figures, the same letters of reference indicate the similar parts of the Engine.

* See Vol. I. p. 356; and Vol. III. p. 350.

A, the cast-iron undershot water-wheel: it is fourteen feet in diameter, six feet six inches wide, and has twenty-four float-boards.

BB, two cast-iron pump-beams, with arms.

CCCC, four brass or gun-metal pump-barrels, eleven inches in diameter.

DD, the two brass valve-boxes.

EE, two brass sucking-pipes, five inches in diameter; having copper strainers, FF, at their lower ends.

GGGG, four other brass pipes, five inches in diameter, which communicate with the pump-barrels and valve-boxes.

HH, two cast-iron pipes, five inches in diameter, which conduct the water from the valve-boxes, to the pipe I.

I, a cast-iron pipe, seven inches in diameter, leading to the main.

KK, cast-iron headstocks or plummer-blocks, with brass collars, for the necks or pivots of the water-wheel shaft to turn in.

LLLL, other cast-iron headstocks, with brass collars, for the necks or pivots of the pump-beams, BB, to move in.

M, the wrought-iron crank, fifteen inches long: it has, besides one of the two necks or pivots upon which the water-wheel turns, two other necks; the one, three-and-a-half inches; and the other, three inches, in diameter.

N, the shuttle.

OO, screws, which regulate the rise or fall of the shuttle.

PP, large blocks of stone, which support the beams, BB, &c.

QQ, &c. openings made in the blocks of stone, for the purpose of affixing the lower screwed nuts to the bolts, *n*, *n*, &c. which secure the headstocks and pump-barrels in their places.

R, the reservoir, which receives the spring-water to be raised by the engine.

SSSS, the four pump-rods.

TT, the water-wheel race.

The cast-iron shaft, or axle of the water-wheel, consists of a hollow cylinder and two conical ends, with flanges, joined together by screws and nuts; having plates with square holes in them, at each end, *a, a,* through which pass the thick square stems, *b, b,* of the necks or pivots: the inner ends of the necks are made smaller than the fore-parts, and have shoulders, which abut against the smaller square holes in the inner plates, *d, d,* of the water-wheel shaft, and are secured firmly by keys or wedges, *c, c.* The cast-iron arms and rings are also united to the shaft by screws and nuts, as shewn in the different figures.

Fig. 5, is one of the brass valve-boxes, DD; *e, e,* the lower valves, and *f, f,* the upper ones; *g,* part of one of the sucking-pipes, EE; *h, h,* parts of two of the four brass pipes, GGGG; *i,* part of one of the two cast-iron pipes, HH; *k, k,* holes, for the screws to pass through, which secure the division-plate in its place in the valve-box.

Fig. 6, one of the cast-iron headstocks or plummer-blocks, K, K, or LLLL; *l,* the bottom-plate; *m, m,* holes for the screws *n, n,* to pass through, which secure the headstocks in their places on the blocks of stone PP; *o, o,* the sides of the headstock, through which pass the screws, *p, p,* with screwed nuts, which secure the brasses, *q, q,* and covering-plate, *r,* in their places: the nuts of the screws, *p, p,* are prevented from becoming unscrewed, by two small steel screws, which are screwed into the plate *r,* close to them. *s,* a hole in the plate *p,* communicating with another in the upper brass of the collar, to admit oil, to lubricate the neck or pivot.

Fig. 7, the iron crank, with one of the necks or pivots of the water-wheel shaft, and its two other necks; upon one of which is shewn, at *t,* part of one of the two connecting-rods, which communicate motion, from the water-wheel shaft, to the arms of the two pump-beams, BB.

Fig. 8, a section of one of the brass pump-barrels, with its piston in it: and fig. 9, a cross-view of the piston-rod, and a section of the piston.

The piston U is united with the piston-rod, by a ball and socket in its centre, which allows the piston-rod to play freely therein, and also permits the piston to turn, and change its place in the barrel, so as to prevent it from galling it. The lower hemispherical cavity, for the ball on the lower end of the piston-rod to lodge in, is made in the piston itself: and the upper one is formed in two semi-cylindrical pieces of brass, VV, which encircle the end of the piston-rod, and are themselves confined in their places by a brass-ring, WW, (shewn separately in fig. 10,) which is secured by screws to the piston; and between which ring, WW, and the shoulder, XX, the leathers of the piston are lodged. The ring WW, and the pieces VV, have a conical perforation in their centres, to allow the play of the piston-rod within them.

In figures 7, 8, and 9, is shewn the manner of uniting the connecting-rods with the necks of the crank, and the arms of the pump-beams; as also of connecting the piston-rods with those beams. The piston-rod *y*, or the connecting-rod *t*, have an iron staple or staples, *z*, *z*, fitted accurately to them, within which the brasses, *tt*, *tt*, are placed, which encircle the necks of the crank, or the cylindrical bolts, which are passed through holes in the arms and pump-beams, and secured by screws and nuts; and through the sides of the staples, and the ends of the connecting-rods and piston-rods, holes are made for the iron wedges, *tz*, to pass through, which are caused to act so as to allow of the proper motion of the brasses upon the necks or bolts; and the wedges themselves are prevented from coming out, by the steel screws, *s*, *s*, binding upon them.

After this detail of the various parts, the action of the Engine will be readily understood. The water-wheel, by its single crank with two necks, and the two connecting-rods, communicates motion to the arms of the two pump-beams (as shewn in Plate III. fig. 2): and each of these works two of the four piston-rods. The pumps, on the rising of their pistons, draw the water up from the reservoir, through the pipes EE, into the valve-boxes DD, through the lower valves, as shewn on the right-side of fig. 5, into their barrels; and on the descent of their pistons, force the water, so drawn up, through the pipes GG, &c. again into the valve-boxes, and through the upper valves, into the pipes HH (as shewn on the left of fig. 5), and from thence into the main-pipe I, which conveys it to a reservoir situated at the height of one hundred feet above the engine, from whence it flows to supply the different parts of the city.

The machine is exceedingly simple and well contrived, and does great credit to the skill of its celebrated constructor. We think the application of the ball and socket-joint to the pistons a very happy one, as it entirely does away with all *cross-strains.* It is beginning to be employed with the same intent in this country: and we have been lately informed, by B. Bevan, esq. Civil Engineer, that it is applied to the beam of a steam-engine of seventy-horses' power, constructed, under his directions, by Messrs. Murray and Co. of Leeds, in place of the usual cross-motions, and with the greatest success.

LI.—*On a new-invented Painter's Rest, or Substitute for the Maul-Stick.* By WILLIAM BROCKEDON, *Esq.**

WITH FIGURES.

SIR, 11, *Caroline Street, Bedford Sqare, May* 3, 1823.

THE painter's rest, which accompanies this Letter, needs little description to explain its use: it is intended as a substitute for the common maul-stick, the inconvenience of which has been often felt by painters; sometimes, from its increasing the pressure, to the fatigue of the hand which also supports the pallet; often, in spite of the padding with which the end is armed, doing injury to the picture, if not

* From Vol. XLI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.—The Society voted its Silver Isis Medal, to Mr. Brockedon, for this Invention.

quite dry. These disadvantages are obviated by the machine which I have the honour of submitting to the consideration of the Society. It consists of a frame, with feet of unequal length; the longest being always placed under the easel, that the pressure of the hand may not turn it over towards the picture. In the outer frame, a sliding-frame is made to raise, and be fixed by a ratchet: if the height required exceed the extent of the ratchet, the swing-frame will again extend the elevation, owing to its pivots being placed out of the centre.

The machine is capable of any adjustment, from a low sitting elevation to a very high standing one, and is firm enough to steady the hand perfectly.

I am, Sir, &c. &c. &c.

A. AIKIN, *Esq. Secretary, &c. &c.* W. BROCKEDON.

The following testimonials in favour of Mr. Brockedon's invention have been received from the artists whose names are subjoined:—

CERTIFICATES.

Russell Square, May 16, 1823.

Having attentively examined the painter's rest, invented by Mr. Brockedon, I have no doubt of its affording great assistance in painting works which demand delicacy of execution and minute accuracy. It may indeed be of considerable use to all artists who paint sitting; and would be needless or inconvenient, only in the execution of pictures of large dimensions, for which a standing posture and frequent retiring from the work are necessary.

THOMAS LAWRENCE, *P.R.A.*

SIR, *Argyll-Place, May* 16, 1823.

I think your invention of the painter's rest for the hand must be of great use to all painters of small pictures, and of much value to them: but in large compositions, the stick in the hand will be required; and to painters of great works, this invention can only become necessary in the last touches in finishing the work.

I am Sir, &c. &c. &c.

JAMES NORTHCOTE.

SIR, 8, *Buckingham-Place, May* 13, 1823.

The apparatus you have invented as a substitute for the maul-stick, appears to me so completely calculated to prevent the many difficulties and dangers resulting from the use of that most inconvenient of all the tools we artists work with, that I, as one, offer you my best thanks for a discovery that I think must ensure the gratitude of the whole fraternity, as soon as it is known to them.

I should like to have one as soon as possible.

I am, Sir, &c. &c. &c.

C. R. LESLIE.

SIR, 30, *Allsop's-Buildings, New-Road, May* 12, 1823.

I have examined your invention of the painter's rest, and find that it answers every purpose of the maul-stick, with the advantage of not touching the picture: it would answer in the execution of any of my works, and meets with my entire approbation.

I am Sir, &c. &c. &c.

JOHN MARTIN.

SIR, *Marlborough-street, May* 13.

After examining your contrivance for a painter's rest, I am satisfied that it possesses many advantages over the common maul-stick, providing against many of the accidents incident to the use of the latter; and that it will be found a valuable acquisition, particularly in works of minute execution.

I am, Sir, &c. &c. &c.

G. STUART NEWTON.

Reference to the Drawing of MR. BROCKEDON'S *Painter's Rest,—Plate* VI.

Fig. 10, a perspective view of the rest; *p p*, two standards framed together near the foot-board by a cross bar, and by the bar *z* at top; *q*, a rack cut in the right-hand one; *r*, the click catching in it; *s*, *s*, two other standards framed together only by the bars *t* and *v*, having rebates along their outsides, fitting into grooves in the inside of the standards *p p*, which serve as guides to them when sliding up and down. The frame *s s* is supported at any required height, by the click *r*; *u u*, a long frame, filling the space between the standards *s s*; it is fixed to these latter by the thumb-screws *w w*. The upper part of this frame forms the rest for the arm; and, in order to prevent it from turning on the screws *w w*, a pin or bolt *x* pushes in to fix it: this pin is shewn in fig. 11; it has a loop-hole, through which a smaller pin passes, to keep it to its place: by withdrawing the little bolt *x*, the frame *u u* may be turned half round on the screws *w w*, and then secured by them and by the bolt, as shewn by dotted lines, to give an additional elevation; the same rack, *q*, giving the intermediate height between this position and the former.

Fig. 12, shews a bird's-eye view of one foot *y y*, and standards *p* and *s*, and part of the frame *u*. The painter gives additional steadiness to the rest, by putting one foot on the foot-board *y y*, in front. The whole rest inclines from top to bottom about as much as an easel in use generally does; and the long feet go under the canvas, to let it approach near enough.

Fig. 13, is an enlarged view of the spring-catch, or click, *r*.

LII.—*On reducing Zinc from its Ores;—On making superior Cornish Retorts and Crucibles;—On* BRACONNOT'S *Blue Colour;—and, On the French Adulteration of White Lead with Whiting.—By a* CORRESPONDENT.

SIR, *Falmouth, Feb.* 19, 1824.

I AM under the necessity of troubling you once more, on the subject of smelting zinc, in consequence of your observations on my last Letter. I had the pleasure to know the late Mr. Sheffield, and have had an opportunity of conversing with him on the subject which is now before us; and also on smelting copper and lead: and I think that he was not quite so well informed on the process of making zinc, as he was on many other parts of metallurgy: and this may be accounted for, from the *secrecy* with which the operation has always been conducted: so secretly, indeed, has it been carried on, that, although many practical chemists have given descriptions of spelter-making in their works, not one of them, that I have seen, is correct. The following is what Murray says on the subject, in his "System of Chemistry;" and which you will find copied, almost verbatim, in all the works of our eminent chemists, who have noticed the subject. "Calamine is the ore that is always wrought. Being pounded, it is mixed with charcoal: the mixture is put into conical pots, closed at the head; an open iron tube being fixed in each, reaching nearly to the top, and descending through the bottom; and terminating in a vessel of water. The vapours of zinc, passing through the tube, are condensed in the water." Now calamine is not the only ore which is used; for zinc-blende is mixed with it. The whole of the calamine is not pounded; nor is charcoal the only substance with which it is mixed; nor does the description of the pots give a correct idea of their shape. The iron tube does not reach nearly to the top of the pot, for it does not even enter it at all; neither does it terminate in a vessel of water; nor are the vapours of zinc condensed in the water. I think, when you have seen the description of the process which I have promised you, and which is the exact method pursued in all the spelter-works, you will agree with me in these remarks; and will also, perhaps, be convinced that the pots which are now in use are, upon the whole, best suited to the operation. Having made these preliminary remarks, with a view of pointing out to you the possibility of Mr. Sheffield not having had an opportunity of acquiring much experience in the practical part of zinc-smelting, I shall now notice the observation which has induced me to write to you.

You say, "As to the zinc-pots requiring to be changed at every charge, we do not see the necessity of it; as a sufficient space might be left around the bottoms of the tubes, to receive the refuse of *several charges*, by only leaving out some of the perforations at the bottoms of the tubes." You are not aware, that the diminution of a charge in a spelter-pot does not amount to a third-part of its bulk: but if it were diminished, for example, after the zinc had been worked off, to one eighth part of its original bulk, it would be impolitic to let it remain, and introduce a fresh charge upon it; because the produce of zinc would be deficient in the exact proportion, viz. 84lb., whilst the expense of coals and labour would be exactly the same: and if another charge were worked off upon this reiduum, there would be a deficiency of metal, to the value of 8*l*. in one week's work;—and if you go on in this way, for several successive charges, the produce would be reduced almost to nothing. A considerable quantity of coal is put into the charge, which increases in bulk by the application of heat: the rough calamine remains in light spongy pieces, little reduced in size: the carbonaceous matter wastes only in proportion to the quantity of oxygen with which it combines from the ore: and the blende, which occupies but a small space in the pot, diminishes about one third part.

The Retorts, which I mentioned in my last Letter, as being very good, are made of pipe-clay 2 parts, and siliceous sand 1 part, the grains of which are about the size that will pass through a hole made by a stout pin. I mention this *particularly*; because *if the sand be coarser or finer*, the retorts will not be so good. This sand is found only in one place in this county, at the foot of a hill called St. Agnes' Beacon, on the north coast; and the clay is generally imported from Poole, in Dorsetshire.

Crucibles made with this composition also stand the greatest degree of heat that can be excited *in a wind-furnace*. I have used them in a furnace which produced a degree of heat equal to 166° of Wedgwood's pyrometer, and they were not fused. The Hessian crucibles, which are considered the best, are said to melt at 150° of that pyrometer.

In No. II. of the Third Volume of your Repository, you have given M. Braconnot's process for making a beautiful *Blue* Colour*. When I considered that the ingredients there mentioned are those which are used for making *Mineral Green*; with the exception of the *acetic acid*, which always produces a green colour with copper, I entertained some doubts about their making a *blue* colour. As I am connected with a colour-manufactory in this neighbourhood, I resolved to try the experiment, and to ascertain whether it would answer to manufacture it in a large way. I therefore followed M. Braconnot's directions very strictly; and I found, from the result, that my suspicions were verified; *for a fine pale green* was produced.—I think there must be a mistake in the translation from the French; for I am positive that a *blue* colour cannot be made by this process.

Before I conclude, I must say a few words, by way of caution, to those who may be induced to follow the example of the French, in adulterating their White Lead, which is mentioned in page 127 of your last Number; where it is said, "It has been found that a mixture (or 12th part) of chalk will give the ceruse those qualities which the workmen desire," and the chalk is to be whitened by means of *muriatic acid!!* I know, from experience, that chalk, or Paris White, added to white lead, will greatly injure its quality: it will make it turn yellow: and the presence of either of these substances will be immediately detected by the painter who understands his business. Barytes, which is

* From the Quarterly Journal, edited at the Royal Institution.

also mentioned, is not so objectionable: but pure white lead, ground in oil, will cover better, stand better, and look better, than any other mixture.—Honesty will always be found to be the best policy.

I am, Sir, your obedient servant,

T. Gill, Esq. R. E.

LIII.—*On the Fertilization of the Female Blossoms of Filberts.* By the Rev. George Swayne, *Corresponding Member of the London Horticultural Society.—In a Letter to the Secretary.**

Dear Sir, *Dyrham, near Bath, Jan.* 31, 1823.

We have it recorded, as an undoubted fact, in the Annals of Botany †, that the flowers of a male Palm-tree ‡ *(Palma major foliis flabelliformibus)*, which were carried from Leipsic to Berlin, a distance of twenty miles, and there suspended over the branches of a female tree of the same species, caused the latter to yield, in the first year of the experiment, above one hundred ripe fruit; and, on repeating it the second year, two thousand; though the tree had for thirty years preceding regularly blossomed, without ever perfecting fruit. There is some reason to believe, that, by a similar operation with the male flowers of the wild Hazel from the neighbouring lanes and hedges, in most cases within the distance of a single English mile, the fil-

* From Vol. V. Part III. of the Transactions of the London Horticultural Society.

† See Philosophical Transactions for the Year 1751. Vol. xlvii. p.169.

‡ The name of "*Palma major foliis flabelliformibus*," as given in the Paper of the *Philosophical Transactions* referred to, is not to be found in any of the works extant at that time, which treat on plants; and a difficulty has in consequence arisen, in ascertaining the particular species of Palm which was the subject of the experiment. Linnæus, in his *Disquisitio de Sexu Plantarum*, (*Amœn. Acad.* Vol. X. p. 125.) adverting to the fact, states this plant to have been *Phœnix dactylifera*, the Date Palm; and mentions his having young plants in his own garden at Upsal, raised from the *Dates* produced by the experiment. Sir James Smith, however, in a note to his *Introduction to Botany*, (3d edition, p. 245,) conjectures it to have been *Rhapis flabelliformis*, from the use of the terms "*foliis flabelliformibus*" in the original paper.

bert-trees in our gardens and orchards may be made to produce much more fruit than they commonly do.

When I first came to reside at Dyrham, (which was in the year 1806,) I found two young filbert-plants, about three or four years old (from suckers) or probably more, growing in a situation which I did not approve of; and caused them to be removed, and planted in a corner of a small garden, on a ditch bank which parted my neighbour's premises from mine. Here they were suffered to grow in their own way, with no cultivation, and scarcely any attention bestowed on them. As, after many years, they had borne none, or but little fruit, so little or none seemed to be expected from them: but casually passing by them in the second week in February, in the year 1820, I was rather surprised to see a considerable number of scarlet blossoms thereon, in a state of expansion*; but, at the same time, very few catkins; and those few seemed to be in a very imperfect state, not a single one being nearly prepared to discharge its farina. It immediately struck me, that the sterility of my filberts, hitherto, had been occasioned by a deficiency of male blossoms. At the same time it occurred to me, that the only probable remedy for the present deficiency, as the female blossoms seemed to be already prepared for male influence, was, to proceed, without delay, in quest of some male flowers of the common hazel, which I accordingly did; and after searching some sheltered parts of the neighbouring lanes, I at length found, on some very old wood, a few sprays of catkins just beginning to open. These I gathered, brought home with care, and immediately suspended on the upper part of one of my filbert-trees the most to windward. In a day or two after, I repeated my search, and obtained a few more; and so continued, whenever I took a walk, to bring home a few

* There had been, immediately preceding, a fortnight or three weeks of very fine and remarkably warm weather for the season, which had undoubtedly caused these blossoms to expand before their usual time, which commonly does not happen before the latter end of the month.

small branches bearing expanding catkins, and to hang them up upon different parts of my filbert-trees, for the space of a week or ten days; when the frost, which had been very severe in the early part of the preceding month of January, again set in with increased severity; so much so, indeed, that it killed and scorched up nearly all the catkins of the hazel, even those which had not shed their dust; and I entertained little doubt that the female blossoms of my filberts had shared the same fate: but it proved otherwise. In the course of the summer, perceiving some appearance of fruit, I gave orders that no person should gather a filbert from my trees: these orders, I have no doubt, were strictly observed. At the time of ripening, I collected the whole of the crop myself, and immediately weighed it. The weight was exactly two pounds. Now, although this would seem but a moderate crop for two filbert-trees (or rather bushes, for each has several stems) which had been growing nearly or quite twenty years, yet it was more than they had ever produced before, not only in any *one* year, but (I believe I may venture to say) in *all* the years of their previous existence; and if I calculate rightly, it is more than double the annual average quantity which the Rev. Mr. WILLIAMSON, in his valuable Paper on Filberts*, allows the Kentish orchards to produce: that is, supposing the trees in those orchards to stand six feet apart, or to occupy thirty-six square feet of surface each; which, as they are not suffered to grow more than six feet in height, I should suppose to be a proper distance†.

On the 28th of the November following (1820), taking a view of my filbert-trees, I observed so large a quantity of young catkins on them as induced me to count the number on two of the boughs; from whence I computed that there could not be fewer than one thousand five hundred. As I had never remarked so large a quantity on

* See Vol. II. p. 252.

† Mr. Williamson, whose trees are allowed to grow more in a natural state, has fifty-seven trees on three-hundred and sixty square yards of ground: these I calculate, therefore, to stand about seven feet apart.

them before, I concluded, that, from some cause or other, their constitution was altered, and that in future they would have no need of extrinsic assistance. But, on again making them a visit in the beginning of the succeeding February (1821), I found that more than three-fourths of the catkins had vanished. Still, I supposed there might remain sufficient for the purpose of fertilization: but whether so, or not, I had determined to leave my trees, the next season, to their own exertions. In the summer, I repeated my order, that my filberts were not to be touched; which I might as well have omitted, as there happened to be very little temptation. In the beginning of September (1821) I picked, I believe, every filbert on these trees; and, although I do not remember their number, yet I perfectly recollect that I grasped the whole at once in my single hand.

In the following month of October, before the leaves were well off, I cut short the boughs which had projected into the garden; thinned them considerably, by taking out some of the oldest, crooked, and stunted wood; and pruned what remained with some severity. At this time there appeared a pretty fair shew of young catkins, but by no means so many as in the autumn of the former year (1820). By the 26th of January following (1822), these catkins had nearly all disappeared; and of those few which remained, not one would have blossomed in any degree of perfection. However, as it was my intention to repeat the experiment of auxiliary catkins, I caused every remaining one to be carefully picked off; that, in the event of any fruit ripening the next season, the service of the fructifying dust might be subject to no uncertainty. On the 18th of February (1822) I caused several small branches of the catkins of the hazel to be suspended on them; as I intended that the operation should be performed only once; at which time, it is proper to state, I saw so very few female blossoms (from the bearing-wood having been so much diminished by the pruning in the previous autumn), that I concluded it to be impossible there could be much fruit; but that if there should be any, the pollen of the suspended amenta of the hazel must have a share in their production.

The next day (February 19th, 1822) I made a visit to the neighbouring farmer's orchard, who has a row of four filbert-bushes, which have been growing therein, quite in a state of nature, for forty or fifty years, and standing about six feet apart. These I examined minutely: the scarlet blossoms were in plenty, but I am confident there were not more than twenty catkins in any degree of perfection on the whole four bushes; and the owner's wife informed me that they had borne hardly any fruit for many years past. I then told her, that if she wished to have any filberts in the ensuing season, she must immediately procure some branches of catkins from the nut-bushes in the hedges, and hang them upon the tops of her filbert-trees. She seemed much delighted to hear that they could be made to bear by so easy a contrivance, and promised it should be done. I have since understood that it was done, the next day. On the 7th of August, 1822, before the filberts were ripe, and of course before I could suspect there might have been any diminution of them by depredation, I gathered every filbert I could find on my trees; and on counting and weighing the collection, I found the number to be eighty-six, and the weight half-a-pound. This was a much greater produce than I had reason to expect, from the scanty appearance of the female blossoms in the month of February; and proved, to my judgment, that the catkins of the hazel had wrought their due effect; more especially as there was not a single nut in the whole number without a kernel, even in a cluster of nine, which I found among them; nor could I observe a maggot in either of them*. On the last day of the same month (August 31st, 1821), my neighbour sent me six

* In a communication from Mr. Williamson, with which I was favoured on the 8th of March 1823, on this subject, he states that *last year not one filbert in forty was good, owing to the ravages of the nut-maggots.* But, Query, Might not the failure have been caused by a deficiency of farina?

pounds* of very fine filberts, as the produce of his four old stunted trees: he has no others.

If I rightly understand Mr. Williamson's description (in the Paper before referred to) of the Kentish method of pruning filbert-trees, the pruners, in their mode of operation, necessarily cut away a great proportion of the male blossoms, (for these, I beg leave to state, are for the most part produced towards the extremities of the strongest shoots,) in order to increase the number of female ones. Mr. Williamson indeed says, that, "in pruning, care must be taken to have a due supply of males, to fructify the female blossoms, or our previous trouble will be entirely useless:" but he does not say that the Kentish operators pay any attention to this important point; and I am rather inclined to suppose, that the original inventors of their method might have designedly cut away the catkins; on the principle formerly acted upon by many gardeners, who carefully picked off the male blossoms of their cucumbers, under the notion of being false blossoms. Whilst, therefore, I reflect on the great uncertainty of there remaining a due supply of males to fructify the females, under the unmerciful abscission† described to be annually practised in the filbert-orchards in the county of Kent,—in conjunction with the result of the above-detailed experiments,—I feel fully persuaded, that the possessors of filbert-trees, as well those who have adopted the Kentish method of pruning as those who never prune at all, would find their account in suspending a few small branches of catkins of the common hazel on the tops of their filbert-trees, at the

* Filberts were last season so scarce in the neighbourhood of Bath, as to sell from a shilling to fourteen-pence a pound, in the fruit-shops of that city.

† Mr. Williamson says (in the communication above referred to), "The leading-shoot is every year to be shortened two-thirds, or more; and the whole height of the branches must not be suffered to exceed six feet. Every shoot that is left to produce fruit, should also be tipped." Mr. PHILLIPS, in his "Pomarium," page 172, informs us, that "in Kent, the filbert-trees are not suffered to grow above five or six feet high; and are kept with a short stem, like a gooseberry-bush, and very thin of wood; somewhat in the shape of a punch-bowl."

season of dispersing their farina; not only as making an addition to the too scanty number of those naturally remaining thereon, after escaping from the knife of the pruner, the depredation of birds, and the inclemency of the winter; but (if my conjecture be well founded) as supplying them with pollen, of a more fertilizing nature than their own.

With respect to the extensive filbert-grounds in the neighbourhood of Maidstone; as it would be quite futile to recommend a levy of auxiliaries from the lanes and hedges, or even from the woods and coppices, for concerns of such magnitude; it may deserve the consideration of the occupiers, whether, under the continuance of their present method of pruning, it would not be worth while to try the experiment of introducing a few growing plants of the native or wild hazel into their plantations of filbert-trees (which last may be considered as exotics); and suffering them to grow at large, without attempting to despoil them of any of their golden honours: as I entertain a strong suspicion, that the very frequent failures of the filbert-crops (Mr. Williamson tells us that they totally fail three years out of five) are, in great measure, occasioned by a deficiency, either in number or in power, of the male blossoms. Without some such auxiliary dependence, I should much prefer Mr. Williamson's method of pruning to that of the Kentish pruners; how celebrated soever the latter may be, or how extensively soever it may be practised in the filbert-districts.

In whatever soil or situation I have seen filbert-trees growing, as well as the common hazel, they have been attended with a continual succession of suckers from their roots; or, if the latter have not been permitted to grow up, they have shewn a strong tendency to produce them: which would seem to indicate, that it is natural, and therefore necessary to the complete prosperity of those trees (or rather shrubs), that their wood should be often renewed, It appears to me, therefore, to be in direct opposition to this propensity of nature, to keep them always on the same stem; which I understand is the custom in Kent. I should rather think it more like pursuing the indication of this unerring guide, to permit several stems to arise from the same root; and, after a certain period, to be constantly cutting out some of the old worn-out wood, and training up some of the strongest suckers in its place. The more I contemplate this subject, the more am I convinced that there is much room for improvement, in the means of obtaining, regularly, adequate crops of this very agreeable fruit.

Your very obedient servant,

GEORGE SWAYNE.

LIV.—*On the Advantages of planting Forest-Trees amongst Furze.* By CAPTAIN JOHN HAWKINS.*

(Concluded from p. 132.)

THE land then was prepared for planting, in three different ways; viz. one portion was cleared of the furze-roots, ploughed, and sown to oats; a second portion was cleared by rooting out the furze with mattocks, without using the plough, which indeed could not have been worked; and the third portion underwent no other preparation but that of cutting off the growing furze with a hook.

Mr. Pontey undertook to plant fifteen acres and a half, by contract, between the first day of October 1818, and the first day of April 1819, at the rate of 2,750 young forest-trees per acre, of from one to two feet and a half high; and to fill up all vacancies during the two following years, excepting such trees as might be destroyed by the depredations of cattle; for three pounds per thousand trees. The other two acres of furze-brake, being very rugged and rocky, were planted, during the same season, by Richard Penny and other labourers, by the day. The remaining six acres, situate on the slopes of old slate-quarries, and on the sides of brooks, and other places not fit for cultivation, were

* From Vol. XLI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

planted in a similar manner, during the following season, by Richard Penny and others, by the day, without any further preparation to the land than cutting off the growing furze with a hook. The young trees were planted four feet asunder, amounting, in the whole, to 53,253 trees, averaging about twenty inches high.

In the Spring following the planting of the young trees, the furze-roots sprouted; and I caused the furze-shoots interfering with the young trees, together with the grass, brambles, and weeds contiguous to them, to be cut off with a hook, and placed around the roots of the young trees, leaving the furze-shoots, grass, &c. standing in the intervening spaces between the trees, to shelter them from the wind and storms. The same process was followed in the other portion of the plantations previously sown to oats, and likewise in that portion from which the furze-roots had been dug up with mattocks; repeating the process three different times during the first season, twice the second, and once the third year.

The parings of the furze, grass, &c. placed around the young trees protected their roots from the sun, retained the moisture in the land, and formed an excellent manure. The expense of the process was trifling; a man being able to accomplish about three parts of an acre in one day. The young trees have now completely overcome the furze and all other undergrowth, requiring no further care.

The result of the whole has been less failures among the young trees than Mr. Pontey, an old planter of upwards of thirty years' experience, has ever known; and although the same process of cutting the undergrowth was practised on every part of the plantations, and all of the young trees are exceedingly vigorous and luxuriant, still, contrary to all expectation, the young trees planted among the furze-roots have a decided superiority over the portion previously sown to oats, and to that cleared of the furze-roots with mattocks; there being scarcely any perceptible difference between the two last-mentioned portions.

As the method above described, of planting young forest-trees in brakes of furze, seems to be in every respect preferable to the common mode, and far less expensive; and, as the method of cutting the undergrowth, and placing it around the roots of the young trees, has produced uncommon vigour and luxuriance, and ensured less failures among the young trees, thereby securing the highly-desired object of bringing up all the trees of young plantations of the same age and growth, not only among the furze, but likewise on the land prepared for planting in the usual way, —I have been induced to lay the above account before the Society, accompanied, I trust, by a satisfactory Certificate.

I am, Sir, &c. &c.

A. AIKIN, *Esq. Secretary, &c. &c.* J. HAWKINS.

CERTIFICATE.

Plymouth, May 18, 1822.

I, John Pontey, of Plymouth, do hereby certify, that I, with my servants under my direction, have planted, on Captain John Hawkins's estate, called Flear, in the parish of East Allington, near Kingsbridge, in the county of Devon, between the first day of October 1818, and the first day of April 1819, 4,235 young oaks, 3,260 elms, 2,400 ash, 1,185 beech, 700 sycamore, 330 sweet-chesnut, 12 horse-chesnut, 160 walnut, 50 poplars, 40 limes, 20 planes, 17 birch, 30 pineasters, 70 silver firs, 40 Balm-of-Gilead firs, 130 spruce firs, 5 black-spruce firs, 10 Norway firs, 40 black American firs, 5 Weymouth pine firs, 30 of sorts firs, 23 deciduous seedlings of sorts, 12,850 larch, and 12,560 Scotch firs;—total, 38,207 trees, of from one to two-and-a-half feet high. The whole were planted to remain as timber-wood, but the Scotch firs were mostly planted so as to shelter the other trees exposed to the west and south-west winds. The young trees were planted with the intention of averaging about 2,750 per acre; but the land, in many places, was so full of rocks, stones, and other impediments, that it was impossible so to plant them with accuracy. The land planted by me is fifteen acres and a half: it had all been originally a brake of the common dwarf English furze; five acres and a half of which had been thoroughly cleared and ploughed a few years ago, and sown with oats, after a lime-manure; but the crop failed: four acres were cleared of the furze immediately previous to planting the young trees, by digging the furze up with mattocks, and thoroughly cleansing the land: and the remaining six acres were planted, by digging holes for the young trees among the furze-roots; the growing furze being previously cut off close to the ground with a hook, without any other preparation of the land whatever.

My agreement with Captain Hawkins was, to fill up all failures among the young trees during the two succeeding years after they were planted. I viewed the whole plantation this present Spring; and I do further certify, that I never experienced fewer failures, nor ever saw a more thriving plantation of young forest-trees (particularly in that part where the furze had been cut off with a hook) in the course of my life, although I have been a planter upwards of thirty years. Much of the success I attribute to Captain Hawkins's care and management of the young trees, after they had been planted by me.

Witness my hand, this 18th day of May 1822.

JOHN PONTEY.

LV.—MISCELLANEOUS.

Queries, On Painting upon Glass. By a CORRESPONDENT.

SIR, *Bury St. Edmund's, Suffolk, Jan.* 31, 1824.

NOT finding, in your Number of the Technical Repository for July last, among the receipts for staining glass, any mention of the *drawing-colours*; and as none of your Correspondents have taken up the subject; I have ventured to trouble you with the following Queries; hoping they may appear of sufficient importance to induce you to attend to them, in some future Number of your valuable Work:—

1. What is the composition of the *drawing-colours* generally used in painting upon glass?
2. With what vehicle are they laid on?
3. What degree of heat do they require to fix them?
4. Is it necessary that they should be hard enough to withstand the action of acids?

Some time ago I received instructions in painting glass; but the drawing-colours, as taught me, were not hard enough to resist even the action of the air; and in my subsequent experiments with harder colours, I have constantly found the glass fly after the burning; in many instances, after the lapse of several days. Any information upon this subject would be highly acceptable to me; and might, perhaps, prove useful to many of your Readers.

I remain, Sir, your obedient servant,

T. GILL, *Esq.* A CONSTANT READER.

Notice of an important Discovery in the Purification of the Pyroligneous Acid. By N. MILL, *Esq. of Camberwell.*

We are informed by Mr. Mill, that he has lately made a discovery of considerable importance in the *purification* of the *pyroligneous acid*, so that it may be made into vinegar.

There having been no known method of entirely getting rid of the tar generated in the distillation of wood, the vinegar prepared from the pyroligneous acid was always impure. It required *several distillations and rectifications to render it moderately pure:* still it would retain the flavour of the tar.

Mr. Mill states, that, by his improved process, *it is rendered so pure, in the first instance*, that, after being only once combined with a base, and re-distilled, it produces *excellent vinegar*.

Our Readers will find, in our First Volume, p. 405, the process employed in France for manufacturing the acetic from the pyroligneous acid.

LIST OF PATENTS FOR NEW INVENTIONS,

which have passed the Great Seal, since Jan. 24, 1824.

To Thomas Bewley, of Mount Rath, in Queen's County, Ireland, Cotton-manufacturer; for certain improvements in Wheeled Carriages. Dated Jan. 24, 1824.—To be specified in six months.

To John Heathcoat, of Tiverton, in the county of Devon, Lace-manufacturer; for certain improvements in the method of figuring or ornamenting various description or kinds of Goods manufactured from Silk, Cotton, or Flax. Dated Jan. 24, 1824.—In six months.

To John Jones, of Leeds, in the county of York, late of Gloucester, Brush-manufacturer; for certain improvements in Machinery and Instruments for dressing and cleansing Woollen, Cotton, Linen, Silk, and other Cloths or Fabrics; which improvements are also applicable to the dressing and cleansing of Machinery of various descriptions, and other articles or substances. Dated Jan. 27, 1824.—In six months.

To Sir William Congreve, of Cecil Street, Strand, in the county of Middlesex, Bart.; for an improved method of Stamping. Dated Feb. 7, 1824.—In six months.

To John Arrowsmith, of Air Street, Piccadilly, in the county of Middlesex, Esq.; who, in consequence of discoveries by himself, and communications made to him by certain Foreigners residing abroad, is in possession of an improved mode of publicly exhibiting Pictures, or Painted Scenery, of every description; and of distributing or directing the day-light upon or through them, so as to produce many beautiful effects of light and shade: and which he denominates "Diorama." Dated Feb. 11, 1824.—In six months.

To Robert Lloyd, of the Strand, in the county of Middlesex, Hatter; and James Rowbotham, of Great Surry Street, Blackfriars' Road, in the county of Surry, Hat-manufacturer; for a Hat, upon a new construction. Dated Feb. 19, 1824.—In six months.

To Henry Adcock, of Summer-Hill Terrace, in the parish of Birmingham, and county of Warwick, Gilt-Toy-manufacturer; for an improvement in making Waistbands; or Umbilical, Ventral, Lumbar, and Spinal Bandages or Supporters; to be attached to Coats, Waistcoats, Breeches, Pantaloons, and Trowsers; and to be either permanently fixed, or occasionally attached and supplied. Dated Feb. 19, 1824.—In six months.

To William Church, of Birmingham, in the county of Warwick, Esq.; for certain improvements in Machinery for Printing. Dated Feb. 19, 1824.—In six months.

To Augustus Applegath, of Duke Street, Stamford Street, Blackfriars, in the county of Surry, Printer; for certain improvements in Machines for Printing. Dated Feb. 19, 1824.—In six months.

To the Rev. Moses Isaacs, of Houndsditch, in the city of London; for certain improvements in the construction of Machinery, which, when kept in motion by any suitable power or weight, is applicable to obviate concussion, by means of preventing counteraction; and by which the friction is converted into an useful power for propelling Carriages on Land, Vessels on Water, and giving motion to other Machinery. Dated Feb. 19, 1824.—In six months.

To John Vallance, of Brighton, in the county of Sussex, Esq.; for a method of Communication, or means of Intercourse; by which Persons may be conveyed, Goods transported, or Intelligence communicated, from one place to another, with greater expedition than by means of Steam-Carriages, Steam or other Vessels, or Carriages drawn by Animals. Dated Feb. 19, 1824.—In six months.

THE
TECHNICAL REPOSITORY.

LVI. — *On the Austrian Mode of cultivating Asparagus. By Mr.* Jacob Baumann, *of Vienna, Corresponding Member of the London Horticultural Society**.

The seed of asparagus should be gathered from the finest stems of plants not less than seven years old. Seeds, from whatever country they may be procured, are generally good; though, what are produced by plants perfectly inured to the climate where they are sown, should always be preferred.

Towards the end of March, the seeds must be dibbled, in beds of good earth, in rows at nine inches apart, three inches between each seed, and one inch deep.

The proper treatment of the young plants consists, in keeping them clean, frequently stirring the soil, and in giving repeated waterings, according as they require moisture. In the following March, the roots, now a year old, must be taken up with all their fibres, and planted out, as may be predetermined.

Asparagus is sometimes raised for use in the spring and summer months, and sometimes for winter use. To obtain the first of these objects, the year-old plants should be planted out, in a piece of good somewhat-loose arable land, or in the ordinary soil of a kitchen-garden, or in artificial asparagus-beds; in which they are to remain permanently, as long as they continue productive. With a view to the second object, they should be transplanted into a good rich kitchen-garden soil, in order to be taken up again, a few years after, for ulterior treatment.

For open field culture of asparagus, trenches must be dug, late in autumn, at two feet asunder, as many in depth,

* From Vol. V. Part III. of the Society's Transactions.

and eighteen inches in width: the earth must be thrown up between the trenches, so that it may be exposed to the full influence of the atmosphere. In the spring, old decayed neat's-dung must be put into the trenches, to the depth of eight or ten inches, and moderately trodden down; and over this, about eight inches of mould: then, in the centre of these trenches, at full eighteen inches asunder, must be formed small conical heaps of earth, on which the roots are to be placed, with as many of their fibres as possible, in their naturally separated state; to be covered with about four inches of earth. The surface of the field is then to be so formed, as that each row of plants will present a shallow trench; for the purpose of conveying the rain, which may fall, to the roots of the plants.

The management of this asparagus-field (which will last, in full vigour, from eight to ten years, with moderate treatment) consists, in addition to its being kept clean, more especially in stirring the earth well in the trenches, late in every autumn, before the frost sets in; and then covering the trenches, to the height of two inches, with old neat's-dung; the coarser remains of which, in the following spring, must be cleared away, and the finer part mixed with the soil, by a careful digging. By this simple and cheap method, is raised the vast quantity of asparagus which is seen in the markets of Vienna, throughout the spring.

The planting of asparagus in the kitchen-garden is done in exactly the same way; except, that the place destined for it must be trenched at least two feet deep, plentifully manured; and, during the winter, watered in dry weather, as often as is needful.

In order to form artificial asparagus-beds, the following process is the most simple. In autumn, let the earth, in a part of the garden which lies fully exposed to the sun and sheltered from the north, be dug out, to the breadth of six feet, and in depth from five to six feet: this trench is then to be filled with decayed neat's-dung, and cleanly-sifted earth, in alternate layers of about six inches in thickness. In the following spring, the deficiency caused in the bed by sinking must be made up, with earth mixed with well-decayed dung; and the planting-out of the choicest year-old roots begun; setting the roots in quincunx order, at the distance of full two feet asunder; and covering them, to the depth of four inches, with good earth. In the autumn, after the stalks are cut down, and the earth stirred, the bed must be covered two inches deep, with old decayed neat's-dung; which, in the next spring, is to be worked under the surface, by careful digging. This is to be continued every successive spring, till the stratum of earth, which covers the heads of the roots, has reached the thickness of from six to eight inches: a mere surface dunging is then to be given; and this, after laying on through the winter, is, at the proper time in the following spring, to be cleared off. Managed in this way, the asparagus-plants last for fifteen years; and yield, according to the requisite strength they attain, unusually thick shoots.

If it be intended to plant asparagus for winter use, the one-year roots must then be put into a piece of good garden-ground, previously trenched two feet deep, and richly manured, in quincunx order, at eighteen inches asunder, and carefully attended to for four or five years: after which, they are to be taken up late in the autumn, and preserved for future use, in a trench, which must be protected from frost by a suitable covering.

For the purpose of forcing these roots; make, with fresh horse-dung, an ordinary hot-bed (with its glass, and other requisite coverings); upon which, at least eight or ten inches of manured earth must be laid, and the roots planted together therein, in tolerably close rows; the intervals between the rows being filled with the same kind of earth; and the crowns of the roots covered, to the depth of four inches.

The artificial asparagus-beds may be forced also to produce a crop in winter. When, however, this object is in view, the intervals between the rows must be made at least four feet broad, when the beds are formed. The beds usually selected to be thus forced, are such as, from the length of time they have been in use, cannot be expected to last much longer. On both sides, and at the ends of the bed destined to be forced, a trench, three feet broad, and four feet deep, must be dug, close to the outermost rows of plants. The bed should have been well stirred; and before the frost sets in, must be furnished with requisite coverings of glass, mats, &c. &c.; when the artificial heat produced by the fresh horse-dung in the trenches, and kept up in the usual way, will force the plants to produce shoots, until they are completely exhausted.

When an asparagus-field, or an artificial bed, not destined to forcing, becomes too much weakened by age, it may then be entirely cut down: to do which with most advantage, the shoots fit for use must be gathered, and the weakest suffered to remain standing, to keep alive the vegetative power as long as possible. By these means, we obtain in July, and even later, a few heads of asparagus, though of inferior size and quality.

To give to asparagus-shoots, growing in the open air, as much length and tenderness as possible, there is placed upon each stem intended to be gathered, as soon as it shoots above ground, a wooden tube or pipe, eighteen inches high, and one inch in diameter.

To the above description of the mode in use in Austria, for the culture of asparagus, the following practical observations may be added.

1. The plants must not be cut for use for five years, if we wish to have them in the fullest health and strength, and to obtain the strongest possible shoots.

2. Subsequently, too many shoots must not be cut from any root.

3. Not be too eager to gather the best; but leave, on each plant, two or three of the strongest shoots, to prevent its premature exhaustion, by the evolution of new shoots,

4. No other vegetable should be grown on asparagus-beds.

5. Every new plantation of asparagus must always be on new ground; or, at least, in ground which has been employed for several years in the culture of other vegetables, since it was used for asparagus.

Lastly, when a fresh plantation is intended for artificial beds, which generally occupy a place set apart for that purpose in the garden, the old earth must be cleared out to the requisite depth, and its place supplied with new.

Note, by the SECRETARY.

The following notes, relative to the cultivation of asparagus at Vienna were communicated to the Society by Dr. FORBES, shortly before Mr. BAUMANN'S Paper was received. As they appear to contain some additional information on the subject, they are now given.

"To raise a bed of asparagus, which should last from twenty to twenty-five years, and produce thick and white stalks fit for use, particular care should be taken to choose a warm situation, in order to have it sheltered against the north-east winds. The bed should be four feet in breadth, and the earth ought to be dug out four feet in depth. To fill up this cavity, the first layer ought to be one foot thick, consisting of dung, horn-chips, wood-chips, bones of cattle, ox-horns, and decayed and withered branches of shrubs or trees; the whole of which must be covered with a layer, of the same thickness, of the mould that had been dug out. Cover this, afterwards, with cow-dung, mixed with the mud of a river or pond: let this be half-a-foot thick: then, make another layer of mould, of the same thickness; and go on in this way, till the whole space is filled up.

"The bed ought to be made in the autumn, that the ground may have full time to settle. In the spring, before the seeds are sown, all the layers, except the ground-layer of horns, &c. must be turned over, and mixed together; then levelled with a rake; and the bed divided with a line, into three parts, of the same width: on these lines, the seed must be sown, in holes of a foot deep, at a distance of two-and-a-half feet apart; but not less than three grains be put in each hole; so that, if one or two should fail, there is still hope of the remainder taking.

"In order to preserve the whiteness of the asparagus-shoots, they should be covered with a wooden or earthen pipe, of twelve or fifteen inches' height, with a hole in the top of it."

LVII.—*On British White Herrings cured equal to the best Dutch Herrings.* *By* Mr. J. F. DENOVAN*.

(Continued from p. 166.)

SIR, *Aberdour, Fifeshire, Feb.* 12, 1820.

WHEN I had the honour, in Oct. 1818, of transmitting to the Society a half-barrel of herrings for their inspection, I promised, in making my next year's offering to His Royal Highness the Prince Regent (now His Majesty King George the Fourth), to send to the Society a specimen of the same herrings (of the early species); and which I anticipated, from the arrangements I had made, would be the first herrings taken on the coast of Great Britain. In conformity with that promise, I transmitted to my agents at Leith, to be forwarded to the Society, a sixteen-gallon barrel of these herrings, caught and cured by me, in the Frith of Clyde, on the 14th day of June 1819: and perceiving, from a printed copy of the Regulations, sent me in the spring of 1819, that the Society generously offered to extend the same premiums for another year, I have presumed again to become a candidate, and to submit to the consideration of the Society a narrative of my proceedings; *to the successful issue of which, I proudly and gratefully acknowledge, the Society have powerfully contributed.*

* From Vol. XXXVIII. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.—The Society voted the sum of Fifty Pounds to Mr. Denovan, as a bounty for his persevering and successful exertions, as shewn in this communication.

I am sorry however to find, from my Correspondent in London, that the specimen of herrings, owing to some accident or mistake, has been much longer in reaching its destination than I expected: and I have also to regret, that, just while I was about to sit down to address you, I was subpœnaed to give evidence in a civil trial by jury, in the West of Scotland, regarding the loss of a vessel; which has detained me until now. I can therefore only submit myself to the indulgence of the Society, for the delay that has unavoidably taken place.

In my former Letter *, I fully explained to the Society, that the object of my undertaking was, to obtain a preference for the British White-Herring fishery on the continent of Europe, by endeavouring to anticipate the Dutch, in importing into Hamburgh an article equal in every respect, if not superior, to what they had been in the habit of vending in Germany, for at least two centuries past: and having at the same time given, by affidavit, a full description of the process employed, I feel it unnecessary to swell the present communication, by a repetition of what is already in the possession of the Society: but every deviation from, or improvement on, the original process, shall be distinctly explained.

Early in June 1819, I freighted the sloop Mary Ann, of Glasgow, John Macfarlane, master; and having provided her with the necessary stores, I proceeded to the Frith of Clyde; where, after shifting about from bay to bay and head to head, I fell in with the first small shoal of herrings, on the morning of the 14th of that month, off Tarbet; and having made signals to the fishermen, had about three barrels on board in the course of the day. Of these I packed up the half-barrel for the Society, and the quarter-barrel for the Prince. From the pains I had taken, during the three years preceding, in instructing both the fishermen and their sons, in this neighbourhood, in the Dutch mode of gutting, assorting, laying, packing, re-packing, and pick-

* See our former Number, p. 154.

ling the herrings, I conceived I might safely try the experiment, without having recourse to foreign aid; and the result has fully justified my expectations. To satisfy the Society on this point, I have the honour to produce a Certificate from Messrs. M. and A. Mac Laren, fish-curers, in Glasgow, the proprietors of the Mary Ann, and from whom I freighted her; proving that this was the case; and also certifying the quantity of herrings cured by me, on board the vessel, for exportation to Hamburgh. Having, on the 24th of the same month, taken altogether about fourteen barrels, sea stock, which were repacked into eleven whole barrels for exportation, (exclusive of the half and quarter barrel, and a few kegs, for home consumption,) I proceeded to Glasgow, which I reached on the 26th; and forwarded my herrings to Leith, where they were shipped on board the smack, Courier, John Henry, master, for Hamburgh.

After landing my herrings at Glasgow, I returned again to the Frith of Clyde; and having taken, cured, and repacked for exportation, thirty-five and a half barrels more, I came back to Glasgow on the 10th of July following; pushed on to Leith, with what I had taken; and shipped thirty-four barrels to Hamburgh, by the smack Glasgow, Walter Paton, master; retaining one barrel and a half, for the supply of my friends in Edinburgh, in kegs.

It is singular, although the first herrings in the world are to be had in abundance on the coast of Scotland, that the natives had never been stimulated to profit by the advantages they possess; while this very herring-fishery became, as it were, an inexhaustible source of wealth to a foreign nation, who, to use their own words, founded their metropolis on herring-bones! But that the subjects of Great Britain should have tamely and supinely submitted to the disgrace of seeing a foreign nation take away these very herrings from their doors, to supply a foreign market, which it was their birth-right to have filled;—without once reflecting, that the Dutch had to fit out large deep-sea vessels, at a very great expense, to accomplish an object which a poor

Scotch fisherman might have effected with his little boat; and that every barrel of herrings drawn from the sea was so much real wealth acquired by the nation.

Remarkable as this may appear, it is nevertheless a fact, which will not admit of contradiction; and that, for upwards of two centuries past, *the Dutch have not only imported* (if I may be allowed the expression) *the first Scotch herrings to Hamburgh*, but have found means to maintain such a preference in the German market, that *British herrings*, although caught in the same water, never brought above *one-third* of the price at which Dutch herrings were sold; while, in consequence of the small profit earned by the exporter, QUANTITY, and *not quality*, was considered an object: and, if the curer, from the extent of his capital, could afford to send over 3 or 4,000 barrels, he was remunerated for his trouble, by receiving the 4*s.* per barrel of bounty paid by Government*, if he got no more; and contented himself with endeavouring to *undersell* the Dutch, by glutting the market with an inferior article. Yet, to imitate the Dutch, in their mode of cure, was, even with these very men, *considered to be nonsense:* they held up their herrings to be as well cured as the Dutch; while the idea of anticipating the Hollanders in the German market, was not only thought ridiculous, owing to their using busses; but even in June last, when I set out on the fishing, I was told, by two of the first-rate curers in the West of Scotland, who have *amassed fortunes by curing quantities*, that the thing was impossible; and that no herrings were to be found in our bays, *in condition for curing*, until the months of July or August.

I am proud however to say, that my favourite scheme has at length opened the eyes of my countrymen; and that my humble endeavours have at length been crowned with success. My first shipment, of eleven barrels, reached Hamburgh on the 4th, and they were exposed to sale on the 5th of July; before the Dutch, with a fleet of 269 deep-sea busses, had

* Now proposed to be taken off.

brought a herring to that market. It is customary in Hamburgh, as in Holland, to ring the bells in the steeples, on the arrival of the *first* or *new* herrings; but *this was the only occasion* on which the bells of that city had ever proclaimed the arrival of *British new herrings,* which were sold *at the enormous price of fifty dollars per barrel!*

Some gentlemen, I believe, from London, who were desirous of making a similar attempt, contracted with the curers in the neighbourhood of Lochfine, to cure for them a quantity of herrings for the Hamburgh market, on my plan: but these curers, bigotted, as it were, to their own system, induced these gentlemen to believe that their mode of cure was equally good; and prevailed on them to send out the herrings in that way, in the hope of obtaining as high a price: but the Certificate which I have now the honour of producing, under the hand of the *first* fishmonger in Hamburgh, and certified by the British Consul, will prove that both these fish-curers, and their employers, were widely mistaken in their ideas: and one of the former has since called upon me; and not only expressed a conviction of his error, but has made overtures to me to cure in conjunction with him next year, when he will be guided by my advice.

A great commercial house at Hamburgh having, the preceding year, purchased a part of my herrings in that city,—and calculating on the probable success of such an undertaking, and of the profit that might be expected to result from an importation of herrings cured in the same way,—sent over to Scotland a number of German herring-packers; who, being assisted by a British curer in the Frith of Clyde, cured, and sent to Hamburgh, a considerable parcel of herrings: but, owing to the injudicious manner in which the fish were gutted and packed, and the bad quality of the salt, a few barrels only sold at 60 marks; while the remainder were disposed of nearly at cost price.

After both these parcels had been sold, and after three cargoes of Dutch herrings had come to market, my second shipment, consisting of 34 barrels, reached Hamburgh. It must be allowed that they came then at a disadvantage, and had nothing but their quality to recommend them; yet, as is proved by the Certificate before mentioned, *they sold at from 90 to 120 marks per barrel;* which clearly established their superiority, in point of cure, to the shipments which had been previously made, both by the Dutch, and by those who had become my opponents.

Although it is highly gratifying to my feelings to reflect on the success I have had, and that I am the only *British subject* who has conquered the Dutch at their own weapons, in a branch of trade peculiarly our own, and which may be productive of great national advantage; yet it becomes a duty, on my part, to acknowledge, with gratitude, the protection and support I have experienced from the liberality and discernment of the Society. It would pain me to think that I offered only flattery, where sincerity was due. No doubt, many compliments are in this way paid to the Society, by individuals, like myself, who have experienced its bounty; but they should not be despised. To return thanks to his benefactor, is, but too often, all that a poor man can do: and I hope, in doing as others do, it may be believed that my offering is at least genuine.

When I first addressed the Society, I candidly explained to them the difficulties I had to combat with, and the loss I had sustained by the failure of a Hamburgh house to whom my herrings were consigned. When I embarked in my undertaking in May last, my finances were extremely slender; so much so, that I hardly knew how to manage; and therefore the Fifty Guineas voted to me by the Society operated, not only as a stimulus to exertion, but as a most seasonable assistance, in promoting the success of my undertaking. While thus I acknowledge, with gratitude, the liberality of the Society, I flatter myself they will not disdain to participate in the triumph of an individual, who owes, in a great degree, his success to their bounty.

Most men are anxious to conceal their poverty; but, situated as I am, I feel proud in avowing it. It has been generally believed, that a poor man had no chance of enriching himself by the White-Herring fishery; and that, for the reasons before stated, men only of capital could embark in it with success: but I flatter myself I have not only exposed the fallacy of an opinion which has been productive of the most pernicious effects, but demonstrated to the country at large, that every poor man may enrich himself by the fishery, if he will only be industrious and persevering. He must not, however, as too many have done, *depend on quantity*, and on the 4s. *bounty* to be received from Government. He must be attentive as to *quality* and *cure* for his remuneration; and instead of leaning on Government for support, he must, as I have done, seek for bounty in the markets of a foreign nation.

Having received immediate remittances for my two shipments from Hamburgh, I left the Frith of Clyde, and proceeded to Dunbar, where herrings were got in great plenty, and at a much lower price. I cured, *with British subjects, openly and publickly, on shore, so as every one might learn and profit by my example, one hundred and forty barrels* of excellent herrings, which were shipped for Hamburgh, by the smack Albion, Parker, master. These herrings, although the Hamburgh market was then very full of inferior British fish, would, I am convinced, have left a very handsome profit; but the vessel was unfortunately stranded on the island of Ameland, on the Dutch coast, and I was disappointed in my hopes of gain: having, however, effected an insurance on the parcel, and recovered from the Underwriters, I have suffered nothing from the disaster.

In proof of these facts, I have the honour to lay before the Society, a Certificate from Messrs. Kelly and Sawers, most extensive and respectable fish-curers at Dunbar; men who were formerly bigotted to their own system, but, from having paid great attention to my movements while at Dunbar, have publickly expressed their desire to imitate my example in future; and the Certificate now produced, distinctly explains their opinion, as to the superiority of the plan adopted by me.

I have also the honour of laying before the Society a Letter from the Right Hon. Sir Benjamin Bloomfield, bart.; written by desire of His Royal Highness the Prince Regent (now His Majesty, King George the Fourth), acknowledging the receipt of the quarter-barrel of herrings: and I am assured, from high authority, that my herrings have not only become of use, but are a standing-dish at the royal table.

I could have forwarded to the Society a much finer specimen of herrings than those contained in the half-barrel, had I waited until the season was further advanced, and the herrings had become more full and attained a greater size; but I promised that the Society should have a fair specimen of the *first-fruits* of my labour, and I have kept my promise. It is a very easy matter, in the middle of the season, to put up a barrel or half-a-barrel of superior herrings; but I have the honour of laying before the Society *a fair specimen of herrings actually caught and cured on the* 14*th of June*, nearly a month before the British curers commence their operations, and *ten days* before the Dutch statute permits a subject of that country to cast a herring-net into the sea, on the foolish and superstitious notion that herrings are not in a condition to be cured before the Eve of St. John. I pledge my honour, that the herrings, now sent, are a fair specimen of those forwarded to the Prince Regent; and of those shipped to Hamburgh, for which the price of fifty dollars per barrel was paid: and I flatter myself that no such specimen of *early herrings* can be produced by any Dutch or British curer whatsoever: and I pride myself the more in this, from the fact, which will be admitted by every one conversant with the curing of herrings, that, owing to the great quantity of fixed oil they contain, more care and attention is required in curing *one* barrel of early herrings than *twenty* of the later species, which are taken in September and October.

And I further pledge my honour, that the whole of the herrings cured by me last season, were done in the same manner as those in the half-barrel, without any difference in the process; saving and except the diminishing or increasing the quantity of salt, as the fatness or leanness of the fish required it.

These, my humble efforts, to improve the cure of and to obtain a preference for British herrings, I submit, with deference, to the consideration of the Society; and, grateful for the liberality I have already experieneed, fondly hope they may be honoured by their approbation.

I have the honour to be, with much respect, Sir, &c.

A. AIKIN, *Esq. Secretary, &c. &c.* J. FRED. DENOVAN.

CERTIFICATES.

Hamburgh, Dec. 15, 1819.

This is to certify, to all whom it may concern, that Mr. J. F. Denovan, of Aberdour, in Scotland, imported to this city, on the 5th of July last, (by the smack Courier, of Leith; Thomas Henry, master,) eleven barrels of early Lochfine herrings, cured in the Dutch manner; which herrings arrived in this port previous to the jagers of the Dutch Deep-sea fleet; and averaged the price of fifty dollars, Hamburgh currency, per barrel. And it is further certified, that no British subject had ever before outsailed the Dutch, or made such an early importation; neither has such a high price been before obtained for British herrings.

That, shortly after Mr. Denovan's were sold, several importations of Lochfine herrings were made to this port; and were sold, on an average, at from 32 to 34 marks per barrel; whilst a second importation of Mr. Denovan's, on the 23d of July, (by the smack Glasgow; W. Paton, master,) of thirty-four barrels of Lochfine herrings, cured by him, were sold at from 90 to 120 marks per barrel: and the superiority of Mr. Denovan's method of curing was proved more distinctly this season, when compared with an importation of about 70 barrels cured by Dutchmen, which reached our market about the same time; and out of which, only 20 barrels fetched from 48 to 60 marks; and the remainder from 32 to 36 marks per barrel. And there is little doubt, if Mr. Denovan is enabled to persevere, that his plan must ultimately have the effect of enhancing the price, and conducing to the establishment of an extensive market for the sale of British herrings on the Continent; by which means, the Dutch-herring trade might be successfully opposed; and, especially, provided that Mr. Denovan be supported in his undertaking by legal permits *to supply himself with the proper materials, the ensuing season, on a larger scale.*

J. LOUIS BERTHEAU; for JURGEN BONA MEYER, *Fish-Curer.*

Hamburgh, Dec. 16, 1819.

These are to certify, that this day personally appeared before me, at the British Consulate General in this city, Mr. J. Louis Bertheau, (having the full power of Mr. Jurgen Bona Meyer, fish-curer, of this city,) and made the above declaration; and that the above signature is his proper hand-writing.

J. C. MELLISH, *His Majesty's Consul General.*

Hamburgh, May 13, 1820.

I, the undersigned, Jurgen Bona Meyer, fish-monger in Hamburgh, (complying with the application made to me, to give some further information concerning Mr. J. F. Denovan's importation of early herrings, consigned to me last season,) do certify, and attest, that 11 barrels, shipped per the Courier, Thomas Henry, master, arrived on the 5th of July, before the Dutch jagers from the Deep-sea fleet had made their appearance. Five of these barrels were sold the same day to the inland dealers, at sixty dollars currency; and the remainder went off readily, in small parcels by retail, and also in small kegs, to the inland carriers; the receipts for the whole lot amounting to 1,142 marks banco.

That the barrels, in which these herrings were contained, were of the common size: they were, however, of oak, and hooped in the Dutch manner. Dutch and British herring-barrels are nearly of the same dimension; but the Dutch are made of well-seasoned oak; while those of the British are made from different woods, and some of them from fir, which not only injures the fish, but generally absorbs the pickle.

Mr. Denovan's second importation, of 34 barrels of Lochfine herrings, (per the Glasgow, Walter Paton, master,) were received on the the 23d of July: this shipment, however, had materially suffered from the voyage; several barrels had staves broken in, which rendered the contents of six barrels unmerchantable; and a similar accident had also happened to one barrel of the first importation. Ten barrels were sold to the inland dealers, at 40 and 30 dollars currency; and the remainder were partly sold by public sales, at 85 marks, and partly retailed in small kegs to the inland carriers; making the receipts of the whole shipment amount to 2,214 marks banco.

On the 12th of July, the Dutch jagers reached port; and, up to the 1st of August, were paid fifty dollars currency per barrel, although the herrings were not of the first quality: but this is not to be wondered at, considering the connexion and interest which the Dutch have in this port, and the deep-rooted prejudice entertained by the consumers against herrings imported from Great Britain. The first Prussian jager, of very fine fish, fetched only 70 marks currency per barrel; and, on the 14th of July, early Lochfine herrings were brought to public roup, by a Scotch gentleman; and only a single barrel went off at 53 marks: the sale was withdrawn, without leading to a more satisfactory result. While such is the nature and situation of the British trade in our market, Mr. Denovan's bold and well-managed attempt has, however, had the effect to open the eyes of many. Should he persevere steadily, and should his example be followed by his countrymen, with *due circumspection,* there is little doubt but a new mine of wealth will be opened to the industry of the British nation: and he and his countrymen are heartily welcome to my best exertions for their interest.

I embrace this oppportunity to refer every one interested in supporting Mr. Denovan's well-concerted projects, to Mr. Bertheau; who, from his experience and knowledge, I deem most competent to afford effective assistance towards the attainment of the object which the Honourable Board of Fishery contemplated, when it recommended the adoption of the Dutch method of cure; the expediency, as well as the importance of which, are proved to be most satisfactorily substantiated, by Mr. Denovan's patriotic endeavours. JURGEN BONA MEYER.

These are to certify, that the signature, Jurgen Bona Meyer, is the proper hand-writing of Mr. Jurgen Bona Meyer, a citizen and fish-monger of this city.

Witness my hand, and seal of office:

In the absence of the Consul-General,

C. WESSELHOEFT, *His Majesty's Vice-Consul.*

Dunbar, Jan. 20, 1820.

This is to certify, to all whom it may concern, that, in the month of September last, one hundred and forty barrels of white herrings were cured in our premises here, in the Dutch manner, under the direction of Mr. J. F. Denovan, of Aberdour, in Fifeshire; and that no Dutch fishermen were employed, either in taking, gutting, or packing the same; but that the whole operation was performed by natives of this place, under the orders and superintendance of Mr. Denovan, and a friend, who attended in his absence.

As professional men, we give it as our opinion, that Mr. Denovan's plan is very far superior to the general usage of this country. The scales are preserved more entire, the fish retains its fine natural shape and juices, and the flavour is entirely different; and there can be little doubt, were his system adopted at the different fishing-stations, that great advantages would be reaped by this country, in exporting herrings to the continent of Europe.

The herrings alluded to were intended for the German market, and were shipped on board the smack Albion, Parker, master, for Hamburgh; but the vessel was unfortunately stranded on the Dutch coast, and the cargo abandoned to the Underwriters. Although the German market was very much depressed by extensive exports from this Country, still we are assured, that, had these herrings reached their destination, they would have brought a much higher price than those cured in the common way, with which Hamburgh was then glutted.

KELLY & SAWERS, *Fish-Curers.*

[*To be continued.*]

LVIII.—*On a new Pyrometer, for the Higher Degrees of Heat. Invented by* NICHOLAS MILL, *Esq.**

WITH A PLATE.

THIS instrument is intended to *measure heat*; or, more philosophically speaking, *caloric*. It is greatly to be lamented, that no instrument susceptible of accuracy has hitherto been discovered; for we are quite at a loss to know what chemical changes take place, with different degrees of heat, above the boiling temperature of mercury. Mr. Children very justly observes, in a note to his excellent Translation of Thenard's Analysis, "We have no means of accurately measuring intense heats. The philosopher who should invent such an instrument, would confer an essential obligation on the science of chemistry in general, as well as on many of the arts and manufactures: at present, the eye of experience is the only pyrometer the operator can rely on."

The changes that take place in the composition of bodies, by the mere application of heat, are very well known; and it is because no means have hitherto existed, of measuring high temperatures, that compounds have been formed, which could never afterwards be reproduced.

* From the *Medico-Chirurgical Review, and Chemico-Philosophical Magazine*, No. 1. New Series.

A very familiar instance of the changes effected by a difference of temperature is to be found in fermentation.

If sugar and water be mixed together in certain proportions, and yeast be added, at the temperature of 50° of Fahrenheit, no change will ensue: if the temperature be gradually raised to 55°, and increased to 70°, spirit or alcohol will be generated: if the heat be still further increased, from 70° to 90°, acetic acid or vinegar will be produced; and again, if the temperature be increased to 150° of Fahrenheit, all fermentation will be destroyed, and no change whatever will be effected.

From analogy, it is but fair to suppose that similar changes may be effected, in different or even in the same body, by increments of heat, in the higher temperatures: therefore, the invention of an instrument susceptible of such accuracy as this carries upon the face of it, may be hailed, as an important improvement, in chemistry, the arts, and manufactures, where heat is used in the processes.

Sugar-refiners, distillers, oil-refiners, and metallurgists in general, will, doubtless, be much benefitted by its use.

Description of the Instrument.

The metallic bulb and stem, A, B, Plate VIII. is composed of Platinum, and is drawn down without any joint.

The bulb, A, is hollow; and its diameter is about half-an-inch internally, or less, according to the size of the instrument. The bore of the tube, B, is perfectly cylindrical; and about one-sixteenth of an inch internal diameter. At the further end of this tube is attached, by an air-tight joint, a glass tube, C; which is first bent in an angular form, and then into the inverted siphon C,D. At the upper extremity of this tube is a bulb of glass, D, of the same capacity as the platinum bulb, A, with a funnel-shaped mouth, for the insertion of the mercury; which is, afterwards, hermetically sealed. The scale, E, is attached to the perpendicular glass-stem, F; and is graduated, like a thermometer.

Heat, applied to the platinum bulb, expands the atmospheric air which it contains; and its pressure against the mercury forces it up the glass tube, F, to which the scale is attached. As the heat is increased, so does the air expand, and the scale indicates the degree of temperature.

The principle, upon which this instrument is constructted, is, that gases augment in volume, in a progressive ratio; their expansion, with increments of heat, being uniform. No other body known, possesses this quality so truly as gas; therefore this pyrometer is an instrument susceptible of very considerable accuracy.

In its use, some precaution is, however, necessary; because if the platinum bulb were plunged into the naked fire, it would be corroded, and destroyed. A crucible, of the form shewn at G, is therefore necessary, and is made of the most refractory clay: the platinum bulb, and part of the stem, is to be placed in it; and the empty space be filled up, either with powdered charcoal, or sand.

The extensive use to which this pyrometer may be applied, in the arts and manufactures, is, at one view, obvious. The degrees of heat, of any furnace, kiln, or boiler, may be read off, on the scale, at a single glance, during every and any part of the process; and thereby certainty, in the result, insured.

These instruments are made by Messrs. W. and T. Gilbert, Opticians, Leadenhall-street; and by Mr. Newman, Philosophical Instrument-maker, Lisle-street, Leicester-square.

LIX.—*On a new Drying Stove, heated by an Argand Lamp. Invented By* Mr. BAUP, *Chemist, of Vevey**.

WITH A PLATE.

WHENEVER we are engaged in analytical researches on organized substances, we cannot fail to see the necessity of employing a stove, by means of which we can completely desiccate them, and determine, in the most exact manner,

* From FERUSSAC's *Bulletin Universel des Sciences et de l'In du tri.*

without subjecting them to any other change, the proportion of water which they contain.

It was either by heating them with steam, or by means of M. D'Arcet's lamp, that we ordinarily obtained this end: but, with the first, we could never exceed the temperature of boiling water; and even with the second, we could not obtain a temperature sufficiently elevated.

M. D'Arcet's stove is described, in Professor Thenard's *Traité de Chimie*, as consisting of a gradrangular chest, made of very dry wood; but the temperature in it could never be raised above 100° of the centigrade thermometer, even at the end of many hours. M. Baup endeavoured to improve this stove, by constructing it of pasteboard in a cylindrical form, and thus avoiding that loss of heat which was occasioned by the useless spaces in the angles: he also made that part of it which was directly exposed to the heat of the lamp, double; and so contrived it, that he could observe the progress of the temperature within.

This apparatus completely answered the end proposed; as he could not only regulate the temperature at pleasure, but also raise it, by a little at a time, to 150° of the centigrade thermometer*, or even a little more. We have thought it our duty to give a description of this stove; and to recommend the use of it, to all chemists who are engaged in similar researches.

This new stove is composed of three principal parts, which are all cylindrical: each cylinder is formed by uniting two sheets of pasteboard together with strong glue, and in such a manner that the inner one should exceed the outer one a little in height, and that the edges which thus project should fit into corresponding recesses formed in the lower edges of the second and third cylinders, and thus serve to keep the three pieces steady, the one upon the other.

The lower part, which is the fire-place, has a circular hole made in the middle of a piece of pasteboard, which serves as a bottom to it, in order to introduce the glass chimney of an Argand-lamp: it is also surrounded, at the distance

* Equal to 312° of Fahrenheit.

of two or three centimetres*, with another cylindrical envelope, consisting of a single sheet of pasteboard. The space between the two cylinders is filled with carded cotton or wool; and the top is, lastly, closed by a circular band of pasteboard.

This first piece is surmounted by a second: and that by a third, performing the office of a cover. In the middle of the cover of this last piece, a circular opening is made—a little larger than that which, as above mentioned, was made in the bottom of the stove—to afford entrance to the glass chimney: this is intended to permit the humid air to escape, and to clear the interior of the stove; and a plate of glass is fixed on one side of it, in such a manner as, by turning it more or less, the opening may be diminished at pleasure.

In the first and second pieces, near their tops, a circle or ring of pasteboard is fixed; which serves to support iron-wire gratings, on which are to be placed the substances intended to be desiccated.

There is a circular iron plate, pierced with holes around its border; supported upon three iron wires placed in the lower part, or fire-place: its use being, like the mushroom in M. D'Arcet's stove, to prevent the heat of the lamp from acting upon one point only, and to distribute it equally.

Lastly, the lower part or fire-place of the stove is held within and supported by an iron frame, which can be fixed against a wooden plank or wall, by means of two screws or nails.

In order to use this stove, the glass chimney of the lamp must be introduced as high as possible, at the lower opening; and the space between the glass and this opening must be well closed, to prevent the entrance of cold air. When we wish to obtain the maximum of heat, the upper orifice must be closed, by means of the glass plate, as much as possible; permitting only as much air to escape as is necessary to prevent the lamp from smoking.

* We have given a Table of the New French Measures and Weights, reduced to the English standard, in Vol. III. p. 419: to which we beg to refer our readers.

From a stove constructed as above described, and of the following dimensions; viz.

	Metre.		Foot.
Height of the lower part, or fire-place, . .	0,3	or	1
Total ditto of the two upper pieces . . .	0,3	...	1
			Inches.
Interior diameter of the stove	0,2	...	8
Thickness of the space filled with carded cotton	0,02	...	2

we obtained the following results.—Before the envelope was added to the fire-place, the loss of heat was so great, that a centigrade thermometer, placed on the lower grating, was not elevated to more than 120°. With the pasteboard envelope, the space remaining empty, the thermometer mounted to 130°. The interval being filled with charcoal, it required a greater time even to arrive at the same degree of 130°; and beyond that it never reached. Lastly, having substituted, for charcoal, either feathers, wool, or carded cotton, the heat progressively increased to 150°, and even to 160°, although less rapidly; entirely owing to the fire-place being insulated by these bodies, which are bad conductors of heat.

In constructing this stove of larger dimensions, it is clear that we cannot produce a temperature so elevated, in a similar period of time; the flame of the lamp remaining the same.

REFERENCES TO PLATE IX.

Fig. 1. Elevation of the stove on its support.

Fig. 2. Vertical section of the stove. *a*, fire-place; *bb*, envelope; *c*, tripod; *d*, lower opening, to admit the glass chimney of the lamp; *ee*, rings of pasteboard, to support the gratings; *f*, a small glazed window; *gg*, gratings; *h*, a plate of glass fixed on the cover; *i*, the upper orifice.

3. Plan of the fire-place.

4. The tripod, shewn separately.

5. The support, with its two screws.

LX.—*On the Clarifying and Blanching of Syrup and Sugar. By* M. Pajot-des-Charmes.*

The blanching of syrups presents a problem, the solution of which is interesting to all sugar-bakers and refiners.—M. Pajot-des-Charmes has paid particular attention to the refining part; and has published the processes by which he has succeeded in it. This ingenious chemist has prefixed to the detail of his experiments, a summary review of the different processes for clarifying syrup generally employed by refiners, up to the present time. These consisted in dissolving, in a heat not exceeding 80° of Réaumur, any given quantity of sugar in about half its weight either of pure water, or water which has washed the skimmings of the sugar when boiling, or a mixture of common water and the above; and adding to this solution a given quantity of albumen, or the blood of oxen, and charcoal either vegetable or animal, or simply the latter; then skimming it, as the froth rises; and ultimately throwing it upon a filter, conveniently disposed. The liquor, when filtered, (termed, by French refiners, *clairce*,) ought to mark, by Beaumé's areometer for syrups, from 28° to 32°. It varies in colour, according to the kind of sugar which has been used in the solution; but it is clear and transparent. Evaporated by a brisk fire, so as to be kept boiling, it is raised to 43° of the same instrument; and then the syrup is poured out into receivers, and suffered to remain twenty-four hours, in order to crystallize. After the expiration of this time, the holes at the bottom of the receivers are opened, to let the uncrystallized syrup run off. The syrups thus made are always discoloured; and of deeper shades, in proportion to the number of times they have been boiled, to obtain the crystallized sugar. The mother-waters which remain after these operations become, at length, the black, glutinous, viscous, and uncrystallized substance, known by the name of *melasses*.

* From the *Journal de Phys., de Chim. et d'Hist. Nat.*

Having given a description of this manner of operating, the author proceeds to mention his refining materials; which are, charcoal, and the oxygenated muriatic acid (*chlorine*).

Use of Charcoal.—According to M. Pajot-des-Charmes, vegetable or animal charcoal may be used, or a mixture of both. He, however, mentions animal charcoal, as being preferable; and it was with this that he operated, and at various temperatures.

Experiments on blanching the syrup of raw sugar, by charcoal, with the assistance of heat.—In these experiments, he advises the separation, in the first place, by means of solution and filtration, of all the highly-coloured and insoluble substances, from the general mass, which sometimes will amount to six kilograms † in every metrical quintal: and then proceeds to the blanching of the syrup (having added to it an equal quantity either of pure or washings water), at a temperature of, from 50 to 60°.

The solution being filtered, five kilograms of animal charcoal, powdered as finely as possible, are to be added to it. This is introduced by stirring with a wooden spatula, so as to prevent the floating of any part of the charcoal. The liquor is then heated till it just simmers, and then filtered; after which it is put again into the same or any other boiler, and four kilograms more of animal charcoal are added, heating and stirring as before, and again filtering it. The liquor is then again put back into the boiler, and three kilograms more of the animal charcoal are added, and treated as before. The blanching process is still continued in the same manner, but only adding one kilogram of the charcoal; and the liquor is then, for the fifth time, filtered. The syrup now becomes as white as water, and stands at from 30 to 32° of the areometer.—This process consists, 1st, in separating from the sugar,

† The weight of the *kilogram* is equal to one thousand drachms.—For the scale of comparison between English and French Weights and Measures, see Vol. III. p. 419, of the Technical Repository.

by solution and filtration, all insoluble substances; 2dly, by five successive blanchings of the liquor; employing heat, and using 32 kilograms of animal charcoal, for each 100 kilograms of liquor.

Similar experiments made on clayed sugars (but which were only single-clayed) gave very profitable results. Three blanchings by the animal charcoal, employed in the proportion of 24 parts of it to 100 of sugar, (using for the first purification 5 kilograms, for the second 4, and for the last 3,) produced the same result.

The author remarks, that the number of blanchings must be more or less, in proportion to the quality of the sugar, whether it be raw or clayed.

Experiments, made in the cold, on syrup of raw sugar, of an inferior quality.—Fifty kilograms of raw sugar, of inferior quality, were dissolved in an equal weight of common water, at the temperature of the atmosphere: to this were put animal charcoal, well pulverized, equal to one-fifth of the weight of the sugar: the whole was stirred together for ten minutes, and then suffered to settle for about the same time. The stirring was then renewed in the same way, and for the same period; and when again settled, the liquor was thrown upon the filter. This operation was repeated five times; carefully changing the filtering-cloth each time, and employing the second time 7 kils. of charcoal, being the 7th part of the weight of the sugar; the third time 5 kils. the 10th of the weight of sugar; the fourth time the 10th (5 kils.); and the last time, the same quantity also (5 kils.). The syrup obtained after the fifth filtration became as clear as pure water.

This process, without fire, requires five applications of the charcoal; amounting, in the whole, to 32 kilograms; which is double the quantity used for blanching the same kind of sugar, when heat is employed.

The same experiment made on clayed sugar, and under the same circumstances, demonstrated, that for 50 kils. of this sugar it required only three applications of the charcoal, and 20 kils. for the whole operation: the first mixture being with 10 kils.; and the second and third, with 5 kils. each.

Another experiment, made by the same cold process, on raw sugar of a middling quality, has proved that 50 kils. of sugar have been completely blanched by three applications of charcoal: the first, of 10 kils.; and the second and third of 8 kils. each.

Another purification, by the same process, has demonstrated, that 50 kils. of a sugar that had been twice clayed required only two applications of charcoal; the first, of 10 kils.; and the second of 6 kils. The syrup resulting from this operation was also as transparent as pure water.

Of the Filters.—M. Pajot-des-Charmes having remarked, that, in the ordinary process of our sugar-houses, there remained, in the blanching substances, the filters and the different skimmings, about a fourth part of the sugar dissolved; that, by the method, by heat, above described, there remained a third; and one-half by the cold process;—and that, on the other hand, the many filtrations of the same syrup, by these methods, whether this operation was performed either by the hot or the cold process, occasioned a great loss of time, which it was essential to diminish;—he endeavoured to find a remedy for this double inconvenience, by a peculiar manner of placing the filters, one above the other, in the form of a column; which might also perform their functions with or without heat.

The filters placed in this manner have also the advantage of saving manual labour; as the sugar in solution, falling on the first charcoal-filter, passes successively to the rest, and is thus perfectly blanched; thereby requiring not more than six-eighths of the time employed, when the filters are placed as usual.

The strainers, when placed one above the other, also occasion a great saving of fuel; as once heating the stove will suffice for the whole operation; and the heat may be kept up in the column or casing which contains the filters, by means of a stove-pipe passing through it perpendicularly.

To save the expense of fuel altogether, and to do away the necessity of using heat in any way, the author had recourse to a method of producing the same effect, by introducing another ingredient in the filtering substance, to make it more permeable; namely, white sand (fine silex), well washed, and mixed with the charcoal, in the proportion of, from 2 to 3 times the weight of the latter;—the quantity of this material to be increased or diminished according to circumstances. It was found necessary, however, in operating without heat, to increase the quantity of charcoal.

The mixing of the charcoal and sand requiring a certain degree of care, particularly in the first and last filters, M. des Charmes recommends it to be done as follows: On the piece of linen, which covers the filtering-cloth, is laid the charcoal, mixed beforehand with two or three times its weight of the sand, after the sand has been washed and nearly dried. The sides of the filter should be well covered with the mixture, to the height of several inches, so as to form a kind of basin; on which is laid another linen-cloth, finer than that placed underneath. Into this latter cloth the syrup is to be poured, for filtering.

In the following filters, the sand was deposited immediately upon the filtering-cloth, and the charcoal upon the sand; then a linen-cloth was laid over the whole, intended to receive the syrup.

These two methods of placing the filtering materials are equally good. It is essential, however, that the layers be evenly distributed, and the ingredients raised round the sides of the filter.

It is to be remarked, 1. That the operation of destroying the viscous quality of the sugar being performed, in the first and second filters, on sugars of inferior quality, it is not necessary to use so much sand with the carbon, in the intermediary filters for sugars above the middling quality.

2. That the sand should not have more water added to it than what is necessary to wash it. It should be just sufficiently moist to adhere, and form a basin in the filtering-vessel, to receive the syrup. It is not necessary that the

sides of this basin be raised more than an inch thick, above the bottom of the filter.

3. That, by the disposing of the filters one above the other, the operation of blanching the syrup is easy; being done all at once.

4. That, by this economical method, the liquor produced by washing the skimmings, termed *clairce* by the French refiners, may be also reduced to a white syrup.

5. That, as to the last water, produced by washing the filters, it may used for other washings, and also for mixing with fresh sugar, to dissolve it.

6. That the small quantity of water used in washing the sand diminishes the effect of blanching, as the syrup passes through the filters; and it therefore becomes necessary to use the sand as dry as possible.

Pressing the charcoal and other materials, when taken out of the strainers.—In order to separate as much as possible the liquid matter contained in these materials, they should be put into a screw- or hydraulic-press. The liquor pressed out should then be filtered.

The author is particular in advising not to forget filtering the solution of sugar intended to be refined. He insists on the advantage of this filtration, to facilitate the operation of blanching. He says that all the syrups, and even the *melasses* itself, are benefitted by observing this advice.

The part of this memorial which treats of the blanching of sugar by charcoal, is terminated by considerations on the importance which the author attaches to the liquor, after blanching, marking from 28 to 30° of the areometer. He indicates the disadvantage of its being at a lower degree, as it will become coloured by the boiling being necessarily prolonged; but this inconvenience is not to be feared, when the blanching is effected by heat; although the quantity of water recommended, gives barely from 25 to 26° to the solution. This degree is found to be increased in the course of the operation.

The treatment in the cold not occasioning any augmentation of the syrup, we may begin by carrying it from 30 to 32°; as the mixture of the charcoal with the sand, by adding to the permeability of the syrup, assists also in destroying its viscous quality. Therefore, to attain 32° of concentration, the proportion of sugar to that of water ought to be about two parts of the latter, to three parts of raw sugar of a middling quality.

Use of Chlorine.—In a gaseous state, this article may be employed in two ways; either on the sugar in its natural or granular state, or in a liquid state. Both ways, the author observes, have their peculiar advantages.

This process is applied to liquid sugar, by conveying the chlorine, as fast as it is formed, into a filtered solution of sugar. The absorption of the gas is facilitated by means of an agitator, worked by hand. When the desired cast of colour is obtained, even to the clearness of water, attention must be paid to fixing it in this state, by filtering the liquor first through lime, to deprive it of the muriatic acid, and then through the animal charcoal. The syrup, after filtration, is to be boiled.

The advantages derived from this mode of operating consist in having the syrup constantly of the same specific gravity; in obtaining a gas possessing all the energetic properties required; in being enabled to apply it to the syrup in the quantity necessary for blanching it; and requiring only one straight-forward operation to complete the process.

The gaseous chlorine may be applied to sugar in the grain. To accomplish which, the sugar is spread on boards or strong pieces of hair-cloth, stretched tight, and arranged one above another, round a room, into which the mouths of the vessels enter, from which the chlorine is disengaged.

When the gas is in contact, care must be taken to renew the surfaces, by turning the sugar constantly with rakes, having handles adapted to the purpose. According to M. des Charmes, it is necessary that the layers of sugar should not be more than three or four lines thick, in order that the gas may act both under and above the hair-cloths. The sugar must then be treated with lime, to remove the excess of hydrochloric acid, as in the preceding experiments.

Liquid chlorine may be used in two ways: 1, by adding to the filtered syrup a fifth part, in volume, of the liquid chlorine, and shaking them well together in a barrel; then turning it out into a boiler with animal charcoal, filtering it, putting it back again into the barrel, and adding to it a sixth part more of the chlorine; 2. emptying it again into the filter, with a fresh portion of charcoal; and, having passed it through, mixing it again with a tenth part of its volume of the chlorine. This operation is repeated and the syrup again passed, with fresh charcoal, through the filter; when it becomes as clear and white as water.

Every kind of syrup may be blanched by these processes; and even *melasses* be brought to such a state of whiteness and clearness, as to be employed for purposes hitherto unthought of in commerce.

Some experiments made by M. Des Charmes have convinced him that vegetable charcoal may be used for the above purposes: but he remarks, that it does not mix well with the sugar, and that a part of it always floats on the syrup.

The author observes, that the animal charcoal which has been used in the sugar-refineries is an excellent manure for trees, at planting; and that great quantities are carried from Paris to the country, for that purpose.

M. Pajot-des-Charmes having tried if the charcoal which had been used might serve again after being fresh burnt, could not perceive any difference between that and fresh charcoal.

The memorial terminates with observations on the evaporation of syrups, by the action of the sun, and by the reflection of the heat of the furnaces. From these observations we learn that it may be effected by both; but the furnaces must be adapted to the purpose.

LXI.—*Experiments on ascertaining the Forces required to drive and extract Nails of various kinds from different species of Wood; and on the superior Adhesive Force of Screws.* By B. Bevan, *Esq. Civil Engineer.*

Sir, *Leighton-Bussard, March* 11, 1824.

Nails, of various kinds, have been used in almost every part of the world, for many centuries; and constitute one of the most general modes of fastening substances together. Every carpenter is familiar with the use of the nail; and possesses a practical knowledge, more or less accurate, of the force of adhesion of nails of various kinds and in different substances, so as to decide, without difficulty, what number, and of what length, may be sufficient to fasten together pieces of various shapes and subject to various strains. But, so far as my inquiries have been made, I have not been able to find any authentic experiments of the real force of adhesion of different nails, when driven into wood of different species; or to learn the actual weight, without impulse, necessary to force a nail a given depth into wood; and also, the force required to extract the same, when so driven.

With a view to obtain some useful knowledge upon a mechanical question so elementary, I had a machine constructed to measure the force of pressure and tension, with extensive powers; and applied it to the extraction of nails of different lengths, from one-fourth of an inch to two-and-a-half inches.

Theoretical investigation points out an equality of resistance to the entrance and extraction of a nail, supposing the thickness of it to be invariable; but, as nails generally taper towards their points, the resistance to entrance becomes, of necessity, greater than to that of extraction. In several of my experiments, I have found the ratio to be about as 6 to 5.

The following abstract will exhibit the relative adhesion of nails of various kinds, when forced into dry Christiania deal, at right-angles to the fibres:

	Number in the lb.	Inches long.	Inches forced into the wood.	*lb.* required to extract them.
Fine Sprigs	4560	0.44	0.40	22
Ditto	3200	0.53	0.44	37
Threepenny Brads .	618	1.25	0.50	58
Cast-iron Nails . . .	380	1.00	0.50	72
Fivepenny ditto . . .	139	2.00	1.50	320
Sixpenny ditto . . .	73	2.50	1.00	187
Ditto ditto . . .	73	2.50	1.50	327
Ditto ditto . . .	73	2.50	2.00	530

The last of the sixpenny nails was forced into the wood by the percussion of a cast-iron weight of 6.275 *lb.* falling 12 inches; 4 blows of which were necessary to force the nail 1½ inch into the wood.

It was found, that 400 *lb.* steady weight was required, to force the same nail to an equal depth.

A sixpenny nail driven one inch into *dry elm*, across the grain, required 327 *lb.* to draw it out, by direct force. The same nail driven one inch *endways*, into dry elm, or parallel to the grain, required 257 *lb.* to extract it. The same, driven two inches endways, into dry Christiania deal, was drawn out by the same force of 257 *lb.* To draw out one inch only, under like circumstances, required 87 *lb.*

The relative adhesion, therefore, in the same wood, driven transversely, to that when driven longitudinally, is as 100 to 78, or about 4 to 3 in dry elm; and as 100 to 46, or about 2 to 1, in dry Christiania deal. The relative adhesion, under like circumstances, of elm and deal, proves to be about 2 or 3 to 1.

The progressive depths of a sixpenny nail, driven into dry Christiania deal by simple pressure, were as follow:

¼ inch, by a pressure of	24 *lb.*
½ ditto	76
1 ditto	235
1½ ditto	400
2 inches	610

I may observe, that, in the above experiments, great care was taken to apply the weights steadily; and that, towards the conclusion, the additions did not exceed 10 *lb.*, with a moderate interval between each addition. In some instances, the weights were left 10 or 20 minutes, before the load was increased.

In other species of wood, I have found the force required to extract a nail to differ from the above. Thus, to extract a sixpenny nail from a depth of *one* inch, out of

Green sycamore, required	312 *lb.*
Dry oak	507
Dry beech	667

A common screw of 1-fifth of an inch in diameter has an adhesion about three times as great as that of a sixpenny nail.

From these experiments, I am able to infer that a common sixpenny nail, driven two inches into dry oak, would require more than *half-a-ton* to extract it, by steady pressure.

T. GILL, *Esq.* B. BEVAN.

LXII.—*On Preserving the Skins of Birds, Beasts, and other Animals; and the Bill of the Toucan.* By C. WATERTON, *Esq.*

IN our February Number, in replying to the Queries sent us in November last by our Correspondent, J. R. of Newark, we expressed a wish that Mr. Waterton would communicate his superior method of preserving subjects of Natural History. We are glad to learn, from the London Journal of Arts and Sciences, that on the 8th of January last he delivered a Lecture on this highly-interesting subject, before the Leeds Philosophical and Literary Society; some particulars of which are given in the above work. Finding, therefore, that Mr. Waterton had anticipated our wish, and had even communicated his process to a public Society, we feel ourselves justified in affording such particulars as have come to our knowledge, either from Mr. Waterton himself, or from a particular friend of his, or from other sources within our reach.—And first,

On Preserving Birds.

1. When the bird is shot, take it up by the legs; by which means the blood will not run through the feathers, but be detained by the reversed position of them: should, however, any run, scrape it off carefully with a penknife, when half clotted; then lay the bird in a cool place, to stiffen.

2. Wash the feathers clean with water, should any of them be dirty: observing to keep rubbing them downwards with the fingers, whilst drying, to prevent them from sticking together.

3. In skinning the bird, place it upon a towel laid on the knee. Be provided with a sharp penknife, having a lancet-shaped point; also several small needles or sharp wires; with thread; raw or *uncarded* cotton, for stuffing; wooden skewers, for clearing out; glovers' or surgeons' crooked needles, for closing the orifices; and, lastly, a mixture of a table-spoonful of corrosive sublimate (chloride of mercury) in a quart of rum or other proof spirit, which should be allowed to stand all night, and poured off from the undissolved part next morning. Then open the skin of the belly of the bird, from the breast-bone to the vent; carefully stopping every aperture with cotton, in order to absorb any fluids which may escape during the operation; and, particularly, observing first to stuff the beak and nostrils with cotton. Skin the bird, by blowing aside the feathers, and making an incision with the knife from the breast-bone to the vent: the skin may then be separated on each side with the knife; always filling up with fresh cotton, as before directed, until you reach the thighs: then sever the joints of the legs from the thighs; and either take out the thighs, or cut through the joints. Then separate or divide the back-bone from the rump; and proceed, by drawing out the body: cut the joints of the thigh-bones from the body, and also cut away the shoulder-bones from the breast.

Other particular Directions.

Make use of the knife, at the ears—only cut through the middle of the skin at the eyes, with the edge of the knife turned upwards. Leave the scalp and jaw-bones adhering to the skin. Rub the top of the scalp with the antiseptic mixture. Let cotton be introduced between the scalp and the skin on the top of the head, to loosen and separate it. Separate the body entirely from the skin. Clean the wing and thigh-bones; wrap them round with cotton, and touch them with the mixture. Take out the rump. Touch the inside with the mixture applied upon cotton, wrapped over and between a cleft stick which is stuck through the cork of the bottle. Sew up the body, and stuff it with cotton. Apply the mixture, by means of the cottoned skewer, inside the mouth, nostrils, &c. Clean the eyes and mouth. Fasten the upper and lower beak, with a needle and thread. If the thigh-bone is broken, unite it, by putting a needle, wire, or skewer, inside of it.

To shape the Bird.

Stick one end of a needle underneath and into the beak, and at the other end affix a cork: place the bird in a deep box or case containing cotton; so that the cork which supports the beak may rest on the ledge of the box, whilst the body, wings, tail, &c. may be supported and sustained in any required position, by packing the cotton accordingly beneath them. Whilst drying, the feathers may be displayed to the utmost advantage, from time to time, at pleasure; and the feet brought to shape, and punctures made in their solid parts, to which a little of the solution may be applied. The head may be stuffed into the natural shape, through the orifices of the eyes; and wires inserted into the feet, to attach the bird to a branch, &c.; but the wires are not required anywhere else. The bird will thus retain the shape given to it when dry.

To kill a bird, without injuring its feathers.

Raise the wings from behind, with the fingers and thumb of the left-hand; and, with those of the right-hand, press that part of the body close adjoining to and underneath the wings, as hard as possible: this pressure will exert an action upon the heart, and cause the death of the bird instantly.

To preserve the Bill of the Toucan in its natural brilliant colours.—The bill of the Toucan, immediately after death, loses all its beautiful colours, and becomes black. Hence we see, in Cabinets of Natural History, the bills of Toucans *painted*, as near as may be, of their natural colours, though, indeed, very far short of their native brilliancy.

Mr. Waterton found that this black appearance was owing to the bony or horny cellular parts within the beak becoming black; and *that the colours still remained in the beak itself, as perfect as ever.* He therefore drew out those black cellular parts; and coated the beak, withinside, with a mixture of whiting and gum-arabic in water; which caused the colours again to bear out. He then replaced the internal parts, and closed the joinings with wax.

The tongue of the Toucan, which is a very curious object, is also perfectly preserved by applying to it the antiseptic solution.

We have seen specimens of the Toucan, and other birds, in the Collection of his Grace the Duke of Northumberland, preserved in this manner by Mr. Waterton; which greatly exceeded in beauty any we ever saw before.

On preserving the Skins of Beasts.

Mr. Waterton preserved these subjects in South America (where, owing to the warmth of the climate, unless they are rapidly dried in the sun, or before or over a fire, they speedily putrefy), either by wetting them with the antiseptic solution, or dipping them into it, and then drying them. They were thus also effectually secured from the depredations of insects &c., without the least injury to their colours, or danger of the hair, fur, &c. coming off. Indeed, so little does the solution corrode animal matters, that woollen garments on which it had been accidentally dropped continued for years as perfectly sound as before. We have had in our possession, ever since the year 1816, a specimen of part of a leopard's skin, which had been preserved by Mr. Waterton in the above manner; it is yet perfectly pliable; the hair as firmly adhering to it, and of as beautiful colours, as when first received: and we have also seen the entire skin of a fox thus beautifully preserved by him.

On preserving the Skins of Snakes.

Mr. Waterton effects this, either by skinning the snake, sewing up the seam in the skin, and then stuffing it with cotton wetted with the solution diluted; or, otherwise, by extending it, wetting it with the solution, and allowing it to dry. By the latter method, he preserves the skin in a coiled-up state, like a riband; the beautiful colours of the scales being as perfect as ever. One of these last he shewed us, when last we had the pleasure of seeing him.

On preserving the Skins of Insects.

This is effected by taking out the entrails, and stuffing the skin, in its natural shape, with cotton moistened with the antiseptic solution.

LXIII.—*On clearing Feathers from their Animal Oil. By Mrs.* JANE RICHARDSON.*

SIR, *No.* 1, *York-place, Lambeth, Jan.* 16, 1806.

I HAVE sent forty pounds' weight of feathers, cleared from their animal oil, in claim of the Premium offered by the Society; and am, Sir, your obedient servant,

To C. TAYLOR, *Esq. Sec.* JANE RICHARDSON.

Process for clearing Feathers from their Animal Oil.

Take, for every gallon of clean water, one pound of quick-lime; mix them well together; and, when the undissolved lime is precipitated in fine powder, pour off the clear lime-water for use, at the time it is wanted.

Put the feathers to be cleaned into another tub; and add to them a quantity of the clear lime-water, sufficient to

* From Vol. XXIII. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.—The Society adjudged its Premium of Twenty Guineas to Mrs. Richardson, for this useful invention.

cover the feathers about three inches, when well immersed and stirred about therein.

The feathers, when thoroughly moistened, will sink down, and should remain in the lime-water three or four days; after which, the foul liquor should be separated from the feathers, by laying them on a sieve, to drain.

The feathers should be afterwards well washed in clean water, and dried upon nets; the meshes of which should be about the fineness of those of cabbage-nets.

The feathers must, from time to time, be shaken upon the nets: and, as they dry, they will fall through the meshes; and are to be collected, in order to be beaten, as usual, for use.

The admission of air will be serviceable in the drying; and the whole process will be completed in about three weeks.

Additional Particulars.

Mr. Jolly, poulterer, of Charing-Cross, attended a Committee appointed to inspect the feathers; and stated, that Mrs. Richardson had bought from him forty pounds' weight of feathers, in the state they were plucked from dead geese; and in such a condition, that, *if they had been kept in the bag only four days, without being cleaned, they would have been very offensive;* that the feathers exhibited by Mrs. Richardson appear to be the same he had sold her, but that *they were in a much cleaner state, and seemed to be perfectly cleared from their animal oil.*

The Committee, in order to authenticate more fully the merits of Mrs. Richardson's process, requested Mr. Grant, a considerable dealer in feathers, to furnish some specimens of different kinds, in an unclean state, to be cleaned by Mrs. Richardson: in consequence whereof, an application was made to Mr. Grant; and the following Letter was received from him.

SIR, *No. 226, Piccadilly.*

I send herewith, three samples of feathers, on which the experiments may be tried: but should the quantity not be sufficient, on being favoured with your commands I will with pleasure send any quantity necessary.

The bag No. 1, contains the commonest feathers we ever make use of: it is a Russian produce, of various wild-fowl. No. 2, grey Dantzick goose-feathers. No. 3, a superior kind of Dantzick goose-feathers.

The two first are in their raw state, just taken out of the bags in which they were imported: *the last have been stoved* the usual time (three days), but still retain their unpleasant smell.*

Should it not be considered as giving you too much trouble, I shall be extremely obliged by your favouring me with a line, when the experiment has been made; and I shall be happy in waiting upon you, to know the result.

I am, respectfully, Sir, your obedient humble servant,

C. TAYLOR, *Esq. Sec.* THOMAS GRANT.

After the feathers last mentioned were sent back by Mrs. Richardson, Mr. Grant attended to examine them; and declared *that they appeared to be perfectly well cleaned.*

Certificates, from Mr. Christopher Bushman, No. 10, Beaufort-row, Chelsea; and from Mr. W. Baily; also testified to the efficacy of Mrs. Richardson's process.

LXIV.—*On Reducing the Friction in Foot-Lathes. By Mr.* JOHN HOBBINS.

WE have been favoured by Mr. Hobbins of Walsall, (an account of whose Improved Tin-men's Stove was published in our present volume, p. 79,) with the following particulars of the improvements he has made in his foot-lathe, in order to lessen the friction; upon the principles laid down in our various Articles upon "Reducing Friction in Machinery."

These improvements consist in causing the cylindrical

* *Stoving* is the process usually employed; but it is evident that it does not remove the animal oil, the evil effects of which are continually experienced.—EDITOR.

necks, or pivots, at each end of the crank-axis, to turn in semi-cylindrical gaps, made in blocks of *lignum vitæ*, as recommended by Mr. Brunel; and also in placing other blocks of the same wood, with similar gaps in them, within the tops of the hooks, which connect the treadle with the two cranks, so as to act upon the necks of the cranks; and, by the occasional application of a little grease to the pivots, he finds that *this axis, which carries a heavy band-wheel, turns with very little friction indeed.*

He has also followed our advice, in making the ends of the hardened and tempered steel pivots *a little convex*, causing them to act against hard and *flat* steel surfaces, the one fixed, and the other made upon the end of a screw, to adjust the end-shake of the axis; and, we need hardly add, with complete success.

The advantages of this superior method will appear evident, when compared with the usual practice *of making a hole in each end of the crank-axis, and hanging it upon two cones; and thus, as it were, contriving to produce as much friction as possible, and greatly and unnecessarily to increase the labour of the numerous persons who are in the habit of using foot-lathes.*

We are truly glad to be informed of this instance of the application of the principles recommended by us: and hope it will be followed by communications from others, who may be induced, from this example, to place confidence in our suggestions.

LXV.—*On the successful Application of the Epicycloidal Curves to the Teeth of the Wheels and Pinions of Time-Pieces.* By Mr. WILLIAM HARDY.

WE were exceedingly gratified by Mr. Hardy's information, a few days since, that the teeth of the wheels and pinions of his Time-piece at the Royal Observatory at Greenwich were lately examined with magnifiers, by several of our most scientific men, and that *not the slightest appearance of rubbing could be perceived upon them, after thirteen years' wear!*

This is, indeed, a most satisfactory example of the value of the epicycloid, when applied with accuracy to the teeth of wheels and pinions. We gave an account of the method pursued by Mr. Hardy, in forming the cutters for shaping the teeth, in Vol. I. p. 451; and are promised to be favoured by him with other particulars. In the mean time, it may not be uninteresting to our readers to peruse the following Tables, of the rate of going of two of Mr. Hardy's clocks; namely, the one before mentioned, at the Royal Observatory, Greenwich; and the other at the Royal Military College, Sandhurst; from Vol. XXXIX. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce; which Society, as before mentioned, presented Mr. Hardy with its Gold Medal and Fifty Guineas, as a reward for his new escapement and other improvements in Time-pieces.

Royal Observatory.

1820		″	1820		″
Apr.	22, 25	1.4−	Aug.	26	1.4−
	29	0.9−		28	1.4−
May	4	1.1−	Sept.	2	0.9−
	9	1.1−		7	1.2−
	12	1.0−		12	1.3−
	15	1.0−		18	1.3−
	19	0.9−		29	1.0−
	23	1.3−	Oct.	3	1.0−
	27	0.9−		6	0.7−
June	12	0.9−		12	1.1−
	25	0.9−		17	0.8−
	27	0.9−		24	0.7−
July	1	1.3−		28	0.7−
	6	1.2−		30	0.7−
	11	1.0−	Nov.	2	0.9−
	17	0.9−		14	0.9−
	24	1.1−		17	0.8−
	30	1.2−	Dec.	7	0.9−
Aug.	4	1.1−		28	0.8−
	8	1.4−	1821		
	13	1.3−	Jan.	29	0.5−
	18	1.1−	March	15	0.5−
	22	0.9−	April	9	0.6−

Royal Military College, Sandhurst.

1820		"	1820.		"
Feb.	17	0.6+	June	23	0.
	28	0.8+	July	10	0.1−
March	1	1.0+		17	0.2−
	5	1.1+		23	0.
	8	0.9+		27	0.2−
	15	0.6+	Aug.	1	0.1+
	30	0.5+		10	0.2+
April	5	0.4+	Sept.	1	0.3+
	11	0.6+		21	0.7+
	20	0.3+	Oct.	3	0.7+
	28	0.		17	0.8+
May	5	0.2+		26	1.1+
	11	0.1+	Nov.	1	0.9+
	21	0.1+		4	1.1+
	29	0.2+		16	0.9+
June	7	0.1+		23	0.8+
	12	0.2+	Dec.	13	1.0+
	15	0.2+			

LXVI.—*Additional Improvements on Life-Beacons to be erected on dangerous Sands at Sea. By Mr.* George Holditch, *Keeper of the Buoys and Beacons of the Port of Lynn, Norfolk.**

In our Third Volume, p. 302, we gave an account of Mr. Holditch's Life-Beacon. We now add his following improvements, since made upon it.

Sir, *Lynn, Aug.* 4, 1823.

I beg leave to inform you, that I have erected a beacon similar to the one upon the Long Sand, of which you have a model, upon an island of sand called the Whiting Sand; the height, size, braces, and stones, of nearly the same dimensions; but with the following improvements; viz. Instead of the triangle, with seats upon the top, I have a round top, six feet diameter, and *railed round,* with a triangular vane of two feet each way, which shews that size from every point of the compass; and also a small seat

* From Vol. XLI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

under the top, to hold three persons occasionally. The beacon shews itself at three or four miles distant, like a sloop riding at anchor.

The Whiting Sand, where the beacon stands, is 12 miles from Hunstanton Cliff, seven miles from Terrington Steep (*i. e.*) the *nearest* land; and fourteen miles from Lynn town: and will preserve ten men, or more, if required.

I am, Sir, &c. &c. G. HOLDITCH.

To A. AIKIN, *Esq. Secretary, &c. &c.*

LXVII.—*Queries on the Fountain-Pen; and Short-Hand Writing. By a* CORRESPONDENT.—*With Editor's Remarks.*

SIR, *Lewes, Feb.* 23, 1824.

I SHOULD feel particularly obliged by your informing me, through the medium of the Technical Repository, if the Penographic Writing Instrument invented by Mr. Scheffer (and noticed in your last Article on his Life-Preservers, Vol. II. p. 213) is found to be practically useful? Does it answer all the purposes for which it is intended? Does not the small hole, through which the ink passes in supplying the pen, quickly become stuffed up by the ink? What is the expense? I have understood that the cost (I know not how correctly) is about 15*s.*; and not wishing to lay out such a sum, without ascertaining the utility of the article, I have thought proper to apply to you for information, previous to making the purchase.

Having found the Technical Repository to contain the most corrrect description of machinery; and having never found the processes recommended, fail, when pursued with proper care and attention; I have addressed myself to you, in preference.

I have one more request to trouble you with. It is a well-known fact, that, in pursuing a course of reading, on subjects which require close thought and attention, an epitome of the leading facts and arguments is found to be very serviceable, in fixing the subject in the mind. But to do this in common writing requires more time than persons in business can usually afford; and Stenography has been found to be of great assistance in economizing time. The many systems which have been brought forward, by Doddridge, Byrom, Gurney, Mavor, and others, require much time and attention to acquire. I saw, and perused with considerable pleasure, in the Philosophical Magazine for 1823, part of a series of articles on this subject, by a gentleman who had made himself acquainted with numerous systems, and extracted from them the characters which he considered as the best adapted for clearness, facility of writing, and brevity. I was prevented from perusing the whole of his communications, from the Magazine having been discontinued to be taken by a Subscription Library in this town, where works of fiction and imagination have long been preferred to those of *sterling value and utility*. Some excellent practical observations were prefixed to the system of Short-hand which he proposed.

If some notices on these subjects could appear in your work, I think they would prove highly useful to a numerous class of your readers, who, like myself, have but little time to spare for literary and scientific pursuits.

Wishing you that success which the practical utility of your Technical Repository so well merits, I am, Sir, yours very respectfully,

Mr. T. Gill. H. Browne.

Remarks by the Editor.

There are two Patent Fountain-pens now before the public; Scheffer's and Lewis's. Both possess merit; but *the union of the two forms a complete fountain-pen*; and it would indeed be highly advantageous were the patentees to combine their interests, both for themselves and for the public. Under present circumstances, the purchase of the two pens, whereby to form one good one, is too expensive: for Lewis's wants the cock appertaining to Scheffer's; and

Scheffer's is greatly improved by divesting the quill, which is employed by him, of its membranous coverings, as well as of the silver-tube in which it is enclosed, and using it, as Lewis does, without them. Mr. Brockedon (whose Painter's-Rest we described in our last Number) has effected this union, in a pen which he has now used for nearly two years, with great convenience.

It is to be hoped that Mr. Upington will soon complete his System of Short-Hand: as yet, it is far too incomplete for use, particularly in wanting the characters for the vowels; although he certainly has taken the proper measures to obtain the desired results. We must however confess, that, after witnessing the astonishing performances of some of Mr. Gurney's pupils (who, in public Courts, will actually take down every sentence as fast as it is uttered, even without looking at what they write, while watching the movements of the speaker's mouth), we conceive that there cannot be much more required in this useful art; the exercise of which must, however, be continually kept up, in order to preserve facility.

Mr. John Moon, of the Custom-House, Dover, has lately published a system remarkable for its simplicity, which unites many points of excellence. We intend to notice this work in a future Number, and give specimens.

Short-hand, however, except in the hands of professors, on account of the omission of vowels, the contractions in spelling, &c. and consequently the various readings which it will admit of, is hardly to be trusted, further than for making extracts or memorandums; and even these, if they are intended to be referred to in future, should, as early as possible afterwards, be copied into ordinary writing.

LXVIII.—*On an English Substitute for Leghorn Plait for Huts and Bonnets. By the late Mr.* William Corston.

We published, in our Second Volume, p. 1, an extract from Chateauvieux's Letters from Italy, on the material and manufacture of the Italian Bonnets; stating it to be the straw of a wheat—a variety of the summer and winter beardless wheat of the Arno, "harvested before it is quite ripe, and whose vegetation is whitened by the *sterility* of the soil. This soil is selected among the *calcareous* hills: it is never manured; and the seed is sown very thick." Again, in our Third Volume, p. 183, we gave an Article from the Transactions of the Society of Arts &c. on Mrs. Sophia Wells's successful substitute of an American Grass, in place of it. Also, another from Mr. John Parry, on Platting; with additional information collected by the Society, on manufacturing it. And, in our last Number, we gave an Article from the same Work, on Mr. William Cobbett's application of various British Grasses to the same purpose. We now find, however, from Mr. Cobbett's Weekly Register for February 28th last, that, although he had, during the week, seen several very beautiful bonnets in a finished state, made from the straw of English grass in Oxfordshire, and knew that many others were making in different parts of the kingdom,—suspecting even that the dealers were now buying English plait, and selling it for Leghorn,—yet, that the straw of spring-wheat, sown very thick upon a poor soil, is the thing which bonnets will be eventually made of.

This being the case, we think it is but justice to the late Mr. Corston, to republish this Article, from the Transactions of the Society for the Encouragement of Arts &c. Moreover, to afford what further information it is in our power to give on this most interesting subject, we shall add to it other particulars which we obtained from Mr. Corston; with some valuable information obtained from Mr. Parry (whose experience in the manufacture of straw-plait is equalled but by few), on the soil proper for raising straw for plait.

In the year 1805, Mr. Corston had the Gold Medal of the Society of Arts voted to him, for his application of *rye-straw* to the manufacture of a substitute for Leghorn Plait; specimens of which are deposited in the Society's Repository.

The following are the communications from Mr. Corston on the subject.

GENTLEMEN, *Ludgate Hill, Dec.* 17, 1804.

I beg leave to lay before your Society, two specimens of a manufacture which was never before made in this country, and for the purchase of which a very considerable sum is annually remitted to Italy, Germany, &c. It is called Leghorn Plait, and is made use of for ladies' and gentlemen's hats.

The annual importation, as entered at the Custom-House for the last ten years, would furnish employment for five thousand female children and young women; and give cultivation to two thousand acres, annually, of very poor land, to raise the straw, unfit for other culture. The two specimens sent, were plaited at a school I have at Fincham in Norfolk; and the straw is part of the produce of five acres sowed last year in that county. I should feel happy to communicate every information respecting it, that your Society may require; and if you, Gentlemen, should, on investigation, deem it entitled to an honorary reward, such a mark of your distinction I should feel proud to receive. I have been three years in bringing it to its present state of perfection; and I now trust it will not only prove of public advantage to this country, by preventing many thousand pounds a year being sent abroad, but will also be the means of diffusing private happiness to some hundreds of poor families, by the healthy and productive employment it will afford their children.

I remain, respectfully, Gentlemen,

Your humble Servant,

To the Society of Arts, &c. WILLIAM CORSTON.

An Account of the Quantity of Straw Hats imported into Great-Britain in the last ten years; distinguishing each year, and the Countries from whence imported.

	Denmark.		Germany.		Flanders.		France.		Gibraltar.		Italy.	
	Doz.	No.	Doz.	No.	Doz.	No.	Doz.	No.	Doz.	No.	Doz.	No.
1794	—	—	—	—	360	0	—	—	—	—	3702	2
1795	—	—	1165	0	—	—	—	—	—	—	3696	0
1796	—	—	1455	0	—	—	—	—	314	8	1010	6
1797	—	—	3128	0	—	—	1	4	—	—	240	0
1798	—	—	4409	2	—	—	—	—	—	—	—	—
1799	—	—	6615	6	—	—	—	—	—	—	400	6
1800	—	—	9718	6	—	—	—	—	—	—	1602	1
1801	—	—	3129	8	—	—	—	—	—	—	235	10
1802	—	—	2955	6	—	—	—	—	—	—	6831	10
1803	1514	11	320	0	—	—	—	—	—	—	12237	7
Total	1514	11	32986	4	360	0	1	4	314	8	29956	6

Total Number, 65,133 dozen and 9.

Plait for Hats.

1800	Nil.
1801	779 *lb.*
1802	2396 *lb.*
1803	2106 *lb.*
	5281 *lb.*

Inspector-General's Office, Custom-House, London,
July 7, 1804. W. IRVING, Inspector-General.

At five hats to a pound, 5281 *lb.* will make 26,405 Hats.
Add the dozens above mentioned . . 781,605
808,010

GENTLEMEN, *Ladgate Hill, January* 22, 1805.

Presuming on a hope that the particulars of my experiment, and a slight view of the advantages which this new branch of industry opens to this country, may meet with attention from those who alone can patronize and forward its establishment, allow me to subjoin the result of an experiment, upon part of five acres of rye, sown last year in Norfolk, upon a poor and sandy soil, with two bushels of seed per acre: it was the third year of my attempting to produce the Leghorn-plait, from the growth of the seed of this country. I feel happy that I can now (after much trouble and expense) lay before you, for inspection, specimens, made up in hats, both knitted and sewed; accompanied by the signatures of many respectable tradesmen in London, who have dealt in that article, some of them ten, twenty and thirty years, and could not discover the difference from the Italian Leghorn: and, if it be honoured with your approbation, it will strengthen my hope, of seeing the waste land of this country rendered subservient to the industry of its poor, as well as to the national prosperity, by distributing at home the large sum which is at present annually remitted to a foreign market.

I selected two square yards from the thickest part of the crop, and likewise two from the thinnest: it was all pulled up by the roots. I tied them together, and again repeated the same. I manufactured one bundle, at my school at Fincham, in Norfolk; the other, at my house in Ludgate-street; and, averaging both experiments, the produce was as follows, from four square yards:—The bundle measured ten inches in circumference, and weighed one pound, with the seed: the straw was of four different sizes; the finest, not measuring more that fifteen inches in length; the coarsest, only twenty-four, including the root and ear. The part used in plaiting, produced ten yards of Leghorn, of four different qualities; and the weight was one ounce. The grain, or seed, measured one-third of a pint, and weighed five ounces; the refuse straw, eight ounces: the waste was two ounces in the four yards. By this calculation, one acre will produce forty pieces of Leghorn, of fifty-five yards in length; and employ, for one week, thirteen children to sort the straw, and eighty to plait it: and, allowing them four shillings each, the acre will furnish 18*l.* 12*s.* in amount of labour bestowed on the produce.

The Right Hon. George Rose has obligingly favoured me with the annual Account of Imports for the last ten years, up to Christmas 1803: they amount to 83 cases per annum: but the last year, there were 180 cases imported. 83 cases contain 79,680 Leghorn-hats, to manufacture; which quantity, in this country, would require the cultivation of 2000 acres of waste land; and furnish employment, for nine months in the year, for 5000 female children from seven to fifteen years of age: their industry, averaged at 4*s.* per week, would amount to 36,000*l.* I have not noticed the number of hands that will be required to make up the hats, nor those employed in the cultivation of the land.

I am indebted to the Hon. Mrs. Harcourt, for having procured me three acres of Bagshot Heath. The General's steward has sown it for me, with rye-seed that grew on the five acres alluded to in Norfolk: and he has no doubt but it will answer the purpose.

I remain, Gentlemen, your humble Servant

To the Society of Arts, &c. WILLIAM CORSTON.

CERTIFICATE.

We hereby certify, that Mr. William Corston, of Ludgate Hill, has exhibited to us a specimen of plaited straw, manufactured by him in this country, similar to that imported from various parts of Europe, under the denomination of Leghorn. We have examined this specimen, and the hat made of the same article; and candidly confess, we thought it Leghorn, until informed to the contrary.

J. J. Valloton, *Jermyn-street.*
Joseph Robson, *Coventry-street.*
Davies and Wain, *Sackville-street.*
G. and R. Thompson, *Cockspur-street.*
Harding, Shorland, and Co. *Pall-Mall.*
Samuel Barlow, *Jermyn-street.*
Walter Gladhill, *Jermyn-street.*
Richard Cotton, *Duke-street.*
Welchman and Masters, *Ditto.*
H. Wheettal, *Ditto.*
James Senier, *Bruton-street.*
Thomas Smith, *New Bond-street.*
Beamon and Abbott, *Bond-street.*
W. Absalom, *Green-street.*
Guidon and Hughes, *Golden-square.*
George Sneath, *Duke-street, St. James's.*
Morice and Penny, *Ludgate-hill.*
Wells, Gilgrest, and Neville, *Fleet-street.*
Middleton and Innes, *Ditto.*
Richard Fisher and Son, *Ditto.*

GENTLEMEN, *Ludgate Hill, Dec.* 2, 1805.

Since I had the honour, last Spring, of Communicating to you my ideas on the benefits to be derived from the encouragement of the growth of rye-straw, for the purpose of making British hats, resembling Leghorn, I have been enabled to prove the result of my experiment on Bagshot Heath. The Hon. General Harcourt has now the first hat made from the rye-straw grown on that barren waste, which is well calculated to produce it.

I cannot help expressing a wish, that Government would set the example, by causing 1000 acres of the Heath to be cultivated: and, when it is considered that the consumption is equal to the annual cultivation of 2000 acres, and the employment of 5000 poor children, I should humbly conceive it deserves the experiment.

I am, Gentlemen, your obedient servant,

To the Society of Arts, &c. WILLIAM CORSTON.

Additional Particulars, obtained from Mr. Corston by the EDITOR *of the Technical Repository.*

Mr. Corston stated, that the part of the stem underneath the *spatha,* or sheath, was the only part of it which was fit for making the *undyed* Leghorn plait; that part being of a *lighter colour* than those which are exposed to the open air. For the dyed plait, it is of no consequence; and, therefore, more of the upper joint of the stem may be used, than for the undyed plait. The rye was suffered to stand until it was quite ripe, before it was pulled; as, otherwise, the straw would have been of a *greenish* hue, and not of the fine *yellow* colour required. The top joints only were broken off for use, close to the knots; and being tied together in little bundles, just below their heads, the lighter-coloured parts were broken off for plaiting. They were flattened, previous to plaiting them, in sevens or thirteens. A child, under fifteen years of age, could plait enough for four hats in one day. He cultivated, in the year 1804, forty-five acres of poor land in Norfolk, for this purpose: the grain produced did not exceed the quantity sown, but there was plenty of straw for manure. He gave *eighteen* shillings each, for foreign Leghorn-hats, which he himself could manufacture for *ten* shillings. He bleached the hats, in the same manner as those made from split-straw; namely, by *exposing them to the fumes of burning sulphur.*

LXIX.—*Mr.* JOHN PARRY'S *information to the* EDITOR, *on the Soil proper for raising Straw for Plait.*

MR. PARRY'S information furnishes a curious instance of the remarkable differences in similar plants, when grown in various kinds of soil.

He says, that the straw of grain which is sown in soil of a *clayey* nature is very liable to be *discoloured* or *spotted*, owing to the *iron* in the clay. That which is grown in *sandy* soils is very apt to be *harsh* and *brittle*, and unfit to plait, on account of the *silex* which it has taken up. And that, alone, which is grown in a *calcareous* or *chalky* soil, such as abounds in the neighbourhood of Dunstable, for instance, possesses the necessary *pliancy* and *toughness* so desirable in the manufacture of straw-plait, as well as that *brilliancy of colour* which is also required.

We conceive that it is of the utmost importance to attend to this proper choice of soil, if we would rival the Italian bonnets in their admirable qualities.

LXX.—*On an Early Variety of Horse-Bean, introduced into this Country from the Continent. By* WILLIAM PYLE TAUNTON. *Esq.**

GENTLEMEN, 3, *Pump-Court, Temple.*

PERCEIVING that you have offered a premium for the cultivation of any species of beans which shall be cleared off the ground, ripe, before the middle of August, I take the liberty to submit to your consideration my humble pretensions as a claimant of that premium, in respect of the cultivation

* From Vol. XLI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.—The Society voted its Premium of the Large Gold Medal to Mr. Taunton, for this useful Communication.

of the winter-bean; a variety which I have not met with in England, in the hands of any other agriculturist; nor can I inform you of what country it is a native. I derive my stock from so small a quantity as a pint, communicated to me by a friend on the Continent, about six years back; from which small beginning I have gradually extended my stock, until I could make this variety the subject of field culture. Its properties are, that it is a small, firm, plump, and heavy seed; that the plant is very productive and very hardy; that it ought to be sown in autumn; and that it admits a very considerable latitude in the time of sowing; inasmuch as I have had the finest of produce from the ripened seed which has shed itself in July, and have also had it succeed well though sown late in November: but the time of sowing to which I should give the preference, is the month of October; that if the land be properly relieved from stagnant water, the young plant bids defiance to all the frosts of winter, even in the coldest and wettest clays; and that if, as I have sometimes seen it happen, after the bean has renewed its growth in Spring, and made considerable progress in fresh vegetation, a severe honeycomb frost, attended with alternate thaws, cuts its tender shoots, the plant indemnifies the farmer, by tillering-out with increased vigour from the roots, which I have never known to be affected by the vicissitudes of the weather. Indeed, in all circumstances, this variety tillers out very freely; insomuch that, in 1821, where I had drilled only 7 gallons of seed on 5 roods of ground (which is only after the rate of 5¼ gallons to the acre), at intervals of eighteen inches between the drills, I found that the plants were thicker than was consistent with a full crop of grain. They are very prolific; and I have always had abundant reason to be satisfied with their produce, until the present year: but the extraordinary mildness of the last winter having caused all the beans which I had sown in September to blossom in March and the beginning of April, some cold weather, which subsequently ensued, prevented the earlier blossoms from setting, and caused a considerable degree of blight, which I had never before experienced; and a small quantity of ground, not exceeding 31 rods, which I sowed during the month of November, proved much more productive than any of those which I had sown earlier. I have, in every instance hitherto, in the climate of Surrey, where alone I have tried these beans, had them all harvested before the last day of July; and the seed has always then been hard, dry, and bright.

A bean possessing these qualities appears to promise the following important advantages to the cultivator. In a season when beans are scarce, it may be thrown into the market in the end of July, or beginning of August; and inasmuch as it greatly resembles an old bean in its hardness and dryness, it may reasonably be expected to obtain a price nearly approaching to the price of old beans. No competition can at that time be apprehended from new beans of the varieties usually sown; for they are at that time still growing, and in an unripe state. Next, the winter-bean being ripened in the heat of summer, yields to the flail as soon as it is carried from the field; whereas the latter varieties, coming to maturity only under the weaker and more uncertain suns of autumn, require to be kept longer in the stack or barn to dry, before they will readily thresh. The farmer, therefore, can convert the produce of this variety into money, on an average, three months earlier in the year than he can the produce of the ordinary sorts. Next, the weight, plumpness, and hardness of the sample, will at all times recommend it, and ensure a superior price. But the greatest advantage which it offers to the agriculturist, above all, in those rich soils which permit the long-continued alternation of wheat and beans, such as the Vale of Pewsey, the Vale of Evesham, and other highly-favoured districts, is this, that after this bean-crop is harvested, there still remains enough of the heat of summer, to give to the land, which has borne it, a very effective fallow before the season requires the succeeding crop of wheat to be sown. If, in 1818, or in 1822, the plough had been put into the foulest and wettest ground, on the 20th of July, at which time my beans were cleared, or even within a month after that time, there was sufficient subsequent heat and drought to have roasted and killed every weed, and to have so completely dried and contracted the toughest clay, that upon the first succeeding rains it should all have shivered into the finest tilth, perfectly clean, and ready to receive wheat, or any other seed: whereas, in the ordinary course of bean-culture, the beans often are scarcely got off in time to plough for wheat; and the land is then frequently so foul, as to be unfit for any crop at all, without an intervening fallow.

I have found this crop well adapted for sowing therewith the seeds of perennial-grasses for permanent meadow. I feel called upon to make a remark on the quantity of land which I have this year sown with these beans, and which I humbly conceive ought to be considered as amounting to the extent (five acres) which the Society has required. The largest of the fields, called Claypond Field (10 acres, 1 rood, and 20 perches), which was actually sown with them, at intervals of 12 feet between drill and drill, will not, probably, be considered by the Society as a space of 10 acres fairly cropped with beans; but it may with propriety be considered, that an interval of three feet between the rows is a proper and husbandlike distance for the cultivation of beans, especially since the crop sown at 18 inches was found to be too closely sown: and if this be allowed, then the same number of rows of beans which were spread over 10 acres, 1 rood, 20 perches, at 12-feet interval, will, at an interval of 3 feet, cover 2 acres, 2 roods, 15 perches.

	a.	*r.*	*p.*
Let Claypond Field, therefore, be considered as .	2	2	15
In West-London-lane Field the beans were . . .	1	1	26
In Ruffett Field the beans were	1	1	0
In Peach's Close I had of these beans	0	0	31
And the total area of the beans will be	5	1	32

thus exceeding the quantity which the Society requires.

I have the honour to be, Gentlemen, &c. &c.

W. PYLE TAUNTON.

SIR,

Your favour of 30th April was mis-sent to Staines, or it should have received my earlier attention.

With respect to the expense of the culture of the winter-beans, my answer must, to a certain degree, be hypothetical; because, in the year in which the crop grew whereof I have sent you a sample, the beans were not my primary object; but my primary object was, the reducing of a stiff, sour, clay land to permanent meadow (a subject to which I have given many years attention, with the most satisfactory results); and I only combined the beans with that object, because I wished to increase and propagate the beans, and had no other ground ready to take them. The course of crops in Claypond Field (where the beans stood at 12-feet interval between the rows), for the several preceding years since I first occupied the land, was—

Harvest 1819.—Wheat; dunged for

Harvest 1820.—Tares, fed off with sheep, intended to be sown to grass in August, but the showery weather prevented my getting the land fine enough for grass that year; wherefore, I again sowed for

Harvest 1821.—Tares, fed off with sheep; and in September, 1821, sowed it with grass and beans at 12-feet interval, thinking to steal from the grass a crop of beans, which, at this wide interval, would not hurt the grass. I am of opinion that the excess of manure in this field, which would have been beneficial to the grass, assisted to force the growth of the beans prematurely, and also to prevent their maturing their seed, and to render them more obnoxious to the blight. As I had high narrow ridges of old arable to level in this as well as in all my fields, before I could bring them into a fit state for a meadow, I ploughed, in the summer of 1820, six or seven times, to level the ridges; and in summer 1821, I ploughed about three or four times; viz. half the ground three times, half four times, besides many harrowings; my object being to produce for the grass as fine a tilth as possible (which is indispensable for the purpose of creating meadows in the best manner): but for the beans only, had they been my principal object, I would not have given more than a single ploughing, and much less manure. The Committee will observe, that the beans in Ruffett Field were the very worst of my whole crop.

The piece of land in West-London-lane Field, which bore beans, was thus cropped:—

Summer 1819.—An imperfect summer fallow, I not having time to spare to it from other objects.

Spring 1820.—Kales; viz. *chou cavalier, chou caulet de Flandres, chou moëllier,* and *chou mille-têtes,* mixed, in drills, at 2 feet 4 inches: dunged for

Harvest 1821.—The same (after being cut for sheep in the spring, and carted to a distant meadow) stood for seed, and produced a crop.

1822.—The same (having been once or twice ploughed between the drills in the autumn and winter) were fed off by sheep in the spring; their gnawing of the bark of the stalks killed many plants; the others stood and perfected a second crop of seed in summer 1822; after which, about three or four ploughings were given to level the ridges, with a view of sowing grass thereon; and cocksfoot (*dactylis glomerata*) was accordingly sown in September 1822, as soon as the beans had been sown and harrowed in. It will be observed, that no manure was applied to this, except the original dunging for the cabbages in spring 1820, and the droppings of the sheep in April 1822, which may be conceived to be nearly counterbalanced by the scourge of a crop of cabbage carted off, and 2 crops of cabbage-seed; so that no particular indulgence in point of manure can be said to have been shewn to this crop: and this crop, the Society will be pleased to remember, was better than that in Ruffett-Field, but still was a bad crop, being too early, and thereby blighted, and also being a good deal shaded by hedge-row timber. Had it been my object to sow beans only, I certainly should have given only one ploughing for them.

The land in Ruffett Field was thus managed:—

Harvest 1819.—An imperfect summer fallow.

Harvest 1820.—Scarlet-robe potatoes, with dung.

Harvest 1821.—The ridges ploughed down, and levelled by three ploughings and five harrowings, and sown in September with beans and cocksfoot-grass.

This cocksfoot proved an excellent plant, and is now as good a piece of perfectly clean cocksfoot as any within fifty miles of London, the ground having been sufficiently fine when it was sowed.

The Committee will perceive, that the circumstance of sowing grass with the beans entirely precluded hoeing in all of these instances; and that the produce might have been reasonably expected to be more advantageous, if hoeing had been performed.

The beans which grew in the turnip-loam soil, called Peach's Close, grew on land dug by the spade, under the following circumstances:—Peach's Close is my experiment-ground, in which I have under cultivation between two and three hundred different species of plants, with a view to the improvement of agriculture; and many of them, particularly the gramina, are disposed in square beds of a rod each, with an alley of the width of three feet in every direction between bed and bed, which serves as a path. The whole of the ground on which these beds are situate, in the autumn of 1819, was sown, part with winter-peas, part with Canada-tares, succeeded by stubble-turnips, which were poor: after which crops, in the autumn of 1820, I ploughed the land deeply, and repeatedly, say three or four times, dunged it well, and laid it out in beds; and in September, 1820, sowed it with sundry grasses. Not to waste the space of the alleys, in the first year, while the grasses in the intermediate beds were in their infancy, I sowed some part of the alleys, in autumn 1820, with various annuals, and, among others, with winter-beans. In autumn 1821, I sowed nearly the whole of the same alleys, and also some of the square rod-beds where the grasses had failed, with winter-beans; and these were the beans which I harvested there in 1822, as mentioned in my memorial: upon which I have to observe, that I perceived, in many instances, that dropped beans from the perceding harvest fell upon pathways and corners, and on beds which had never been dug at all in that year, and came up, and grew quite as well, and bore as well, as the crop on the ground which had been prepared by digging: part of the beans in the alleys and beds I hoed in March, part was neglected and never hoed at all, and they had to contend with a numerous and luxuriant host of annual weeds. The beans in Peach's Close were the best I had in that year, as I have before observed. My digging in that field was done at the rate of 3*d.* for some, and 4*d.* for others, per square rod, varying according to the degree of drought and hardness of the ground; and the beans were dibbled in by a boy, who fed my pigs at his vacant hours: his day-work cost me 6*s.* per week; and I suppose he wasted 3 or 4 days in dibbling these beans, which might have been done in one. The alleys between the beds, being more trodden and hard, I paid, in some weather, 3 farthings, and in other 1*d.* per rod, run, for digging them, or 4*d.* and 5½*d.* respectively per rod square, which was rather too much; but the finishing the work, so as not to entrench on the boundary of the bed on both sides, required more time and care than straight-forward digging does.

In the present year, I observe that the scattered beans dropped in the last harvest on the surface are come up, and look as hardy, healthy, and forward, as they need to do; whence, as well as from the other premises, I draw the conclusion, that these, like other hardy small horse-beans, require not an expensive tillage; that one ploughing, and two or three turns or tines of the harrow, to cover them, would be quite sufficient to ensure a crop. And I would make the following estimate of their culture, according to the practice I should pursue; looking to the bean crop only, and not looking to the future melioration of the soil, for the purpose of bearing grass or wheat:—

	£.	s.	d.
In stiff clay land, one ploughing, per acre . . .	0	17	0
Drilling beans, per acre, with Smyth's drill, four horses, drill-man, and driver, at 4*s.* per acre,	0	4	0
Three tines of the drag, or harrows, at 8*d.* . . .	0	2	0
Water-furrowing, say per acre	0	1	0
Bird-scaring 3 weeks, say per acre	0	0	9
2 hoeings in spring, *i. e.* end of March, and end of May, the two, per acre	0	8	0
	£. 1	12	9

On my lighter land, the ploughing would cost me 5*s.* per acre less, one tine of harrowing less, and no water-furrowing; thus reducing the cost of culture from 1*l.* 12*s.* 9*d.* to 1*l.* 6*s.* 1*d.* per acre.

If I were to make either a complete summer fallow, or a partial summer fallow, previous to my sowing the beans, I should be induced to debit in my ledger the succeeding crop with a part of the expense of such fallow, which the row-culture of the beans would enable me to keep clean during the succeeding summer, so as to leave the ground in a very good state of preparation for wheat, or other autumn-sown crops.

If the Committee should not think that my division of the expenses between this crop and the succeeding crops is to be adopted, I must then submit to them the actual cost of the tillage on which they were sown, which, I conceive, stands as follows:—

	s.	d.
In Peach's Close, digging per rod	0	4
Dibbling per rod (through the boy's idleness)	0	2
Hoeing per rod (where performed)	0	1
	0	7

The amount of spade culture, at this rate, would be per acre 4*l.* 14*s.* 8*d.* This small parcel was not watched to preserve them from the birds, therefore no cost thereof is charged here.

	£.	*s.*	*d.*
For that which I sowed in the fields; Ruffett,			
3 ploughings, one at 17*s.*, two at 13*s.*	2	3	0
5 draggings and harrowings, at 8*d.*	0	3	4
Water-furrowing	0	1	0
(Bird-searing was omitted, this piece being small.)			
Drilling beans, per acre	0	4	0
Harrowing in the same, two tines only, per acre .	0	1	4
Rolling three times with heavy stone-roller (this operation was performed purely for the sake of the grass), at 9*d.* per acre	0	2	3
Hand-weeding in Spring, per acre	0	2	0
	2	16	11
For the beans in Clay-pond Field, must be added hereto, upon all the field, the further cost of bird-scaring	0	0	9
To which, add the preceeding charge	2	16	11
	2	17	8
And on one half of the field, one more ploughing,	0	13	0
Total . . .	3	10	8

And in East-London-lane Field the charge differs from the estimate in Ruffett Field in this respect; viz.

Charge on Ruffett Field	2	16	11
Deduct 2 rollings, this having been rolled only once, at 9*d.* per acre	0	1	6
Total cost per acre	2	15	5

But I beg leave to repeat, that I should have incurred, and did incur, the whole of these expenses at the same seasons, for the sole purpose of sowing my meadow-grasses, even if I had sown no beans, the combination of which was an after-thought, and, for me, not a very happy one; for in two instances out of the three, namely, in Clay-pond Field and West-London-lane Field, where their growth was most exuberant, they injured the grass; in Ruffett Field, where the land was less full of manure, grass succeeded most perfectly under these beans: and as the autumnal sowing of grass is certainly the most advisable, I think I may venture to say, that, with due precaution not to sow the beans too early, or too thick, they may form a useful means of lessening the expense of laying down perennial pastures or meadows in the best manner.

I have to regret that I was not aware that the Society wished for an estimate of the expense, or I would sooner have submitted it to them; and I hope the above statement will be found satisfactory.

In the pursuit of agricultural improvement, my researches have made me acquainted with several plants, which I cannot but esteem to be valuable acquisitions to our national stores. Among the *Cerealia*, the winter-pea, St. John's-rye, spring-rye, and Georgian-oat, above all the others; among the *Diadelphous* plants, the *hedysarum onobrychis biferum*, or double-crop saintfoin; the *trifolium incarnatum*; the bullock-clover; *trifolium macrorhizum; medicago maculata*; and several others which promise valuable results, the qualities of which I have no time now to enlarge on: nor do I perceive any premiums held out by your Society which particularly call for the exhibition of them; but all of which, as well as the collection of about 200 various species of grass, I shall be happy to render subservient to the good of the community, in any way I can most effectually do it.

I am, Sir, &c. &c. &c.

A. Aikin, Esq. Secretary, &c. &c. W. P. TAUNTON.

CERTIFICATES of a most satisfactory nature follow the above statement.

SIR, *Cheam, April* 4, 1822.

I have the honour to inform you, that I have this day, according to your request, weighed with accuracy a bushel of the winter-beans, and that the weight of them is $63\frac{1}{2}$lbs. avoirdupois. I ought to add, that these are some of the beans which were last threshed, and which grew on the acre in Ruffett Field, a crop which was less blighted than those I had the honour to send to the Committee; the latter having been taken from those I first threshed, and which grew in Claypond Field and West-London-lane Field. I suspect that the sample I exhibited to the Society would not weigh quite so much.

With respect to the produce per acre, it has, in this last year, in consequence of the blight, been very unequal and less satisfactory than in any former year. As I did not keep the produce of the several fields distinct, I cannot take upon myself to speak to the produce per acre with perfect accuracy; but, to the best of my judgment, the one acre and a quarter in Ruffett Field (which was sown the latest) produced to me 21 or 22 bushels; the few rods in Peach's Close, on a drier soil, produced to me after the rate of about thirty bushels an acre. The produce of West-London-lane Field and Clay-pond Field suffered so much by the blight as to be very inferior, and did not, I think, much exceed a sack to an acre.

I have the satisfaction of stating, that after the late winter (which, as the thermometer was several times many degrees below zero, must be thought a strong test for growing beans), I see the bean-plants now about three or four inches high, bearing no other mark of the severity of the winter than their having a brown and scorched edge round some of their lowermost leaves; and some which had lain in the ground during the winter, being sown in mid November, are, since the frost, come up perfectly healthy and vigorous.

I am, Sir, &c. &c. &c.

A. Aiken, Esq. Secretary, &c. &c. W. P. TAUNTON.

LXXI.—TABLES OF CANDLE-LIGHT; for Mean Time.

By B. BEVAN, *Esq.**

DAY.	APRIL. End Morning.	APRIL. Begin Evening.	MAY. End Morning.	MAY. Begin Evening.	JUNE. End Morning.	JUNE. Begin Evening.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	5 .. 6	7 .. 2	3 .. 58	7 .. 56	3 .. 7	8 .. 47
2	5 .. 4	7 .. 4	3 .. 57	7 .. 57	3 .. 6	8 .. 48
3	5 .. 1	7 .. 5	3 .. 55	7 .. 59	3 .. 6	8 .. 50
4	4 .. 59	7 .. 7	3 .. 52	8 .. 2	3 .. 6	8 .. 50
5	4 .. 57	7 .. 9	3 .. 50	8 .. 3	3 .. 5	8 .. 51
6	4 .. 54	7 .. 11	3 .. 48	8 .. 4	3 .. 3	8 .. 53
7	4 .. 51	7 .. 13	3 .. 46	8 .. 6	3 .. 2	8 .. 54
8	4 .. 49	7 .. 15	3 .. 44	8 .. 8	3 .. 2	8 .. 55
9	4 .. 48	7 .. 16	3 .. 42	8 .. 10	3 .. 2	8 .. 56
10	4 .. 45	7 .. 17	3 .. 40	8 .. 12	3 .. 1	8 .. 57
11	4 .. 43	7 .. 19	3 .. 39	8 .. 13	3 .. 1	8 .. 57
12	4 .. 41	7 .. 21	3 .. 37	8 .. 15	3 .. 0	8 .. 58
13	4 .. 39	7 .. 23	3 .. 36	8 .. 16	2 .. 59	8 .. 59
14	4 .. 36	7 .. 24	3 .. 34	8 .. 18	2 .. 59	9 .. 1
15	4 .. 34	7 .. 26	3 .. 33	8 .. 19	2 .. 59	9 .. 1
16	4 .. 31	7 .. 29	3 .. 30	8 .. 22	2 .. 59	9 .. 2
17	4 .. 29	7 .. 31	3 .. 29	8 .. 23	2 .. 59	9 .. 2
18	4 .. 26	7 .. 32	3 .. 27	8 .. 25	2 .. 58	9 .. 3
19	4 .. 24	7 .. 34	3 .. 25	8 .. 26	2 .. 58	9 .. 4
20	4 .. 22	7 .. 36	3 .. 24	8 .. 28	2 .. 58	9 .. 4
21	4 .. 21	7 .. 37	3 .. 23	8 .. 29	2 .. 58	9 .. 4
22	4 .. 18	7 .. 38	3 .. 20	8 .. 31	2 .. 58	9 .. 4
23	4 .. 15	7 .. 41	3 .. 19	8 .. 33	3 .. 0	9 .. 4
24	4 .. 13	7 .. 43	3 .. 18	8 .. 34	3 .. 0	9 .. 4
25	4 .. 11	7 .. 45	3 .. 16	8 .. 36	3 .. 0	9 .. 4
26	4 .. 9	7 .. 47	3 .. 15	8 .. 38	3 .. 0	9 .. 4
27	4 .. 7	7 .. 48	3 .. 14	8 .. 39	3 .. 1	9 .. 4
28	4 .. 4	7 .. 50	3 .. 12	8 .. 42	3 .. 2	9 .. 4
29	4 .. 2	7 .. 52	3 .. 11	8 .. 43	3 .. 2	9 .. 4
30	4 .. 0	7 .. 54	3 .. 9	8 .. 45	3 .. 3	9 .. 3
31			3 .. 8	8 .. 46		

* Continued from p. 68.

LXXII.—*On Accidents occasioned by the bursting of the Air-magazines of Air-Guns.*

We are favoured with the following particulars of one of these accidents, by Mr. Berresford of Sheffield, the possessor of an air-gun; which we think it our duty to lay before our readers, in order to put such of them as may happen to possess these dangerous weapons upon their guard against overcharging the air-magazine.

On leaving Sheffield for London, in July last, Mr. Berresford took the precaution to remove the lock from his gun; thinking it not unlikely that, otherwise, it might be improperly used in his absence. Nevertheless, a party of his friends from Rotherham would see the gun; and, not able to employ it in shooting, from the lock being wanting, they determined to amuse themselves in charging the air-reservoir; and accordingly proceeded to do so, until the valve would no longer readily open: it then became a contest amongst them, which had the greatest power to force more air into it; frequently applying oil to the piston of the injecting-pump, which became very warm from the friction; and continued their exertions, by turns, until, at length, the globe suddenly burst asunder; and the upper hemisphere of it struck the person, who was charging it, in the belly, with such violence, that the continued application of one hundred leeches to the affected part became necessary, in order to keep down the inflammation. It was a long time, indeed, before the sufferer recovered from the effects of the accident.

The globe was four-and-a-half inches in diameter; composed of two iron hemispheres, each the eighth of an inch in thickness, the edges of which were accurately fitted together; and, before soldering them with brass, a circular band of iron, an inch broad, and the sixteenth of an inch in thickness, was placed within the joint, as an additional security. Notwithstanding this precaution, on the explosion, the globe parted at the joint, tearing the band of iron asunder down its middle, and leaving half an inch, in breadth, adhering to each hemisphere!

We have also seen the stout oaken lid of a case which contained an air-gun completely perforated by the bursting asunder of the globe belonging to it; and, indeed, *there can be no limits assigned to the power of the air, when so strongly compressed.* It therefore becomes highly necessary, for those persons who have air-guns, to be exceedingly careful in avoiding this dangerous excess, by limiting the charge of the globe to a certain number of injections of air, and such as experience has shewn to be within the limits of safety; and to satisfy themselves with the powerful effects to be obtained in the use of this instrument, without hazarding the dangerous consequences of overcharging; of which we have but too many examples.

It even appears that no reliance whatever can be placed in the safety of air-guns; if we may judge from the bursting of the globe, after the gun had been deposited in its wooden-case, as above mentioned: and it may deserve inquiry, as to the cause of the separation of the soldered parts, at a period subsequent to its being so laid aside. It was a copper globe, soldered with speltar-solder; and possibly the solder might have become decomposed, which allowed the disruption to take place.

At any rate, we cannot be too cautious, in the making, using, and securing of air-guns; so as to prevent the possibility of accident.

LIST OF PATENTS FOR NEW INVENTIONS,

which have passed the Great Seal since Feb. 28, 1824.

To Abraham Henry Chambers, of New Bond Street, in the county of Middlesex, Esq.; for improvements in preparing and paving Horse- and Carriage-Ways. Dated Feb. 28, 1824.—To be specified in six months.

To Richard Evans, of Bread Street, Cheapside, in the city of London, wholesale Coffee-dealer; for a method or process of Roasting or preparing Coffee and other vegetable substances, with improvements in the machinery employed; such process and machinery being likewise applicable to the drying, distillation, and decomposition of other mineral, vegetable, and animal substances; together with a method of examining and regulating the process, whilst such substances are exposed to the operations before mentioned. Dated Feb. 28, 1824.—In six months.

To John Gunby, of New Kent Road, in the county of Surrey, Sword- and Gun-Manufacturer; for a process, by which a certain material is prepared, and rendered a suitable Substitute for Leather. Dated Feb. 28, 1824.—In six months.

To John Christie, of Mark Lane, in the city of London, Merchant; and Thomas Harper, of Tamworth, in the county of Stafford, merchant; for an improved method of combining and applying certain kinds of Fuel. Dated Feb. 28, 1824.—In six months.

To William Yetts, of Great Yarmouth, in the county of Norfolk, Merchant and Ship-owner; for a certain Apparatus to be applied to a Windlass. Dated Feb. 28, 1824.—In two months.

To James Wright Richards, of Caroline Street, Birmingham, in the county of Warwick, Metallic Hot-house Maker; for an improved Metallic Frame and Lap, applicable to all Hot-houses, Green-houses, Horticultural Frames, and Glasses, Sky-lights, and other inclined Lights and Glasses. Dated Feb. 28, 1824.—In six months.

To William Greaves, of Sheffield, in the county of York, merchant; for a certain improvement on, or additions to Harness, principally applicable to Carriages drawn by one horse. Dated Feb. 28, 1824.—In two months.

To William James, of the city of Westminster, Land-agent and Engineer; for a certain improvement in the construction of Rail- and Tram-Roads or Ways; which Rail- or Tram-Ways or Roads are applicable to other useful purposes. Dated Feb. 28, 1824.—In six months.

To Maurice De Jough, of Warrington, in the county Palatine of Lancaster, Cotton-spinner; for a mode of constructing and placing a Coke-Oven under or contiguous to Steam or other Boilers; so as to make the heat, arising from making coal or other intense combustion in the said oven, subservient to the use of the boiler, instead of fuel used in the common way; and to exclude such heat from the boiler, when required, without detriment to the operations of the oven. Dated Feb. 28, 1824.—In two months.

To Charles Bagenell Fleetwood, of Parliament Street, Dublin, in that part of the United Kingdom called Ireland, Gentleman; for a Liquid and Composition for making Leather, and other articles, Water-proof. Dated Feb. 28, 1824.—In six months.

To Joel Spiller, of Chelsea, in the county of Middlesex, Engineer; for an improvement or improvements in the Machinery to be employed in the Working of Pumps. Dated March 6, 1824.—In four months.

To John Heathcoat, of Tiverton, in the county of Devon, Lace-manufacturer; for a new method of manufacturing certain parts of Machines used in the manufacture of Lace, commonly called Bobbin-Net. Dated March 9, 1824.—In six months.

To John Heathcoat, of Tiverton, in the county of Devon, Lace-manufacturer; for certain improvements in Machines now in use for the Manufacture of Lace, commonly called Bobbin-Net; and a new method of manufacturing certain parts of such machines. Dated March 9, 1824.—In six months.

To John Heathcoat, of Tiverton, in the county of Devon, Lace-manufacturer; for an improved economical method of combining Machinery used in the Manufacture of Lace, in Weaving, and in Spinning, worked by power. Dated March 9, 1824.—In six months.

To Wiliam Darker Mosley, of the parish of Radford, in the county of Nottingham, Lace-manufacturer; for certain improvements in the making and working of Machines used in the Manufacture of Lace, commonly called Bobbin-Net. Dated March 10, 1824.—In six months.

To William Morley, of Nottingham, Lace-manufacturer; for various improvements in Machines, or Machinery, now in use for the making Lace or Net, commonly known by the name of Bobbin-Net. Dated March 15, 1824.—In six months.

To Rupert Kirk, of Osborne Place, Whitechapel, Dyer; for a new method of preparing or manufacturing a certain Vegetable Substance, growing in parts abroad beyond the seas, and imported to and used in these kingdoms, as a Dye, or Red-Colouring Matter, for the use of Dyers, called Safflower (*Carthamus*); so as more effectually to preserve its colouring principle from decay or deterioration in its passage, from the places of its growth, to England and other parts of Europe. Dated March 20, 1824.—In two months.

To Jean Henry Petelpierre, of Chalton Street, Somer's Town, in the parish of St. Pancras, in the county of Middlesex, Engineer; for an Engine or Machine for making the following articles from One Piece of Leather, without any Seam or Sewing whatever; that is to say, all kinds of Shoes and Slippers, Gloves, Caps and Hats, Cartouche-boxes, Scabbards and Sheaths for Swords, Bayonets, and Knives. Dated March 20, 1824.—In two months.

To James Rogers, of Marlborough, in the county of Wilts, Surveyor; for an improved method, or an improved Instrument or Instruments, for determining or ascertaining the Cubic Contents of Standing Timber. Dated March 20, 1824.—In six months.

To John Lingford, of the town and county of the town of Nottingham, Lace-Machine Manufacturer; for certain improvements upon the Machines or Machinery now in use for the purpose of making that kind of Lace commonly known or distinguished by the name or names of Bobbin-Net, or Buckinghamshire Lace-Net. Dated March 20, 1824.—In six months.

To John Heathcoat, of Tiverton, in the County of Devon, Lace-manufacturer; for improvements in certain parts of the Machinery used in Spinning Cotton Wool or Silk. Dated March 20, 1824.—In six months.

To Henry Berry, of Abchurch-lane, in the city of London, Merchant; for certain improvements on a Machine or Apparatus for more readily producing Light. Dated March 20, 1824.—In six months.

To Jean Jacques Stainmare, of Belmont Distillery, Wandsworth Road, Vauxhall, in the parish of St. Mary, Lambeth, in the county of Surrey, Distiller; who, in consequence of communications made to him by certain

Foreigners residing abroad, and discoveries by himself, is in possession of an Invention of improvements in the Process of and Apparatus for Distilling. Dated March 20, 1824.—In six months.

TECHNICAL REPOSITORY.

LXXIV.—*On the Chinese Paak-Tong, or White-Copper.* By JOHN BARKER, *Esq.*

SIR, *Dumfries, April* 6, 1824.

IN the Article on *Chinese White-Copper*, in the Second Volume of the Technical Repository, the analysis has evidently been made of the *Tutenag*, or "Mixed Metal;" and not of the *White-Copper*, or what the Chinese call "Paak-Tong, or White-Metal." The white-copper is produced from ore, as the Chinese say, and cast into small round cakes, of about 6 inches diameter, and 1½ inch thick at the circumference and centre, with a hollow between.*

I beg leave to send you a small piece of the copper; and shall be obliged by your getting it analysed by some of your chemical friends; and by inserting the analysis in your Repository, where I shall see it.

I have made a good many experiments with it formerly: but not having much practice in analysing, and now little time to attend to it, I cannot make out the result to my satisfaction; but think it is an alloy of copper and nickel. The copper does not appear to be the same as ours.

My father, who was long Agent for the Lead-Mines at Leadhills, and the late Mr. Samuel More, Secretary of the Society for Encouragement of Arts &c. made a number of trials, upwards of thirty years ago, to make the *tutenag*, which is an alloy of white-copper and zinc; and of which various articles were made, such as candlesticks,† &c. They succeeded completely, by using some of the cake

* See Plate XI. Fig. 9.

† Four of these candlesticks, of a pale-yellow colour, are in the possession of the Society of Arts.—EDITOR.

(a part of which is now sent you), with different proportions of zinc. A friend of my father procured for him the proportions used by the Chinese for making the *tutenag;* of which they, as usual, make a great mystery; which is also the case with the ore which produces the white-copper. The copper, they say, is a metal *sui generis;* the exportation of which, and the ore, are strictly prohibited.

I am, Sir, your most obedient Servant,

T. Gill, *Esq.* John Barker.

Remarks by the Editor.

We shall, agreeably to Mr. Barker's request, place some of the white-copper in the hands of able assayers, for analysis, and shall not fail to inform our readers of the result. It appears that the Chinese are in the habit of forming various alloys with it. We have been told lately of an assay made of Chinese *tutenag,* in which *ten per cent. of silver* was found. A *kupfer-nickel* is now found in Germany which is employed by the French in various ways in the arts; and, indeed, *nickel* is getting into that extensive use to which its valuable properties seem fully to entitle it. The specimen sent us is of a reddish-white colour; and very soon tarnishes, on exposure to the open air.

LXXV.—*On the proposed Plan of erecting a Patent Wrought-Iron Bridge of Suspension, over the Thames, near Iron-Gate, and Horslydown. With Observations on the Strength of British Bolt- and Bar-Iron. By Captain* Samuel Brown, *Royal Navy.**

There is not in this, or in any other country, such an extent of fertile and valuable districts, with such a numerous population, separated by an unfordable and navigable river without any means of communication, except by

* Communicated by the Author.

boats, as the counties on both sides of the Thames, in the eastern parts of the metropolis.

Nothing can more clearly manifest the paramount importance of the commercial and maritime interests of Great Britain, which will not admit of the least impediment or injury to the navigation, even to attain such immense public and local advantages as must result from the erection of a bridge at the spot proposed in the present design.

I need not, therefore, have recourse to argument, in order to prove, that if such advantages can be obtained, without prejudice to the great desideratum—a free passage to sea-going ships and vessels, as heretofore, it would be a highly important acquisition to the city of London, and to the country at large.

My object is now to shew, that the measure is not only in itself practicable, but that it is a task of much less difficulty than its apparent extent and magnitude would seem to indicate.

It will not at all lessen the importance of the present proposal, if it be admitted that bridges of suspension have long existed in other countries; and it cannot be pretended, by any man, that a new principle has been discovered. The properties of the catenarian curve are obvious in the Indian bridge of suspension formed of ropes or bamboo-canes, and in those constructed of common chain, as well as in a variety of objects which must be familiar to every person of common observation. But those simple contrivances, which have been noticed by some writers, have no more resemblance in their construction to the bridges or piers of suspension which have been erected in Great Britain, than the rude bridges of remote ages, which consisted of logs supported on props, are to be compared to the architecture of modern times.

The first Bridge of Suspension that we hear of in this country, is the one thrown across the River Tees, in the county of Durham; the span of which does not, I think, exceed 80 feet. It is formed of two common chains, stretched over the river, from abrupt banks, with battens laid across, and boarded; the gangway partaking of the curve of the chains.

Such an arrangement is evidently a bad one; inasmuch as we must ascend to the points of suspension, then descend, and rise according to the curve of the chain, which, in that I have usually adopted, would be a pull of one foot in seven. This is hardly practicable; and my earliest attention was employed to remedy the evil. In 1814, I erected a bridge, with the road or platform perfectly horizontal, on my premises at Mill Wall, where it still remains. This is effected by introducing perpendicular rods through the joints of the main suspending-bars, and adjusting their length to the curve above, so that they form a series of straps for the reception of a row of bars on each side, placed edgeways, and extending the whole length of the bridge, parallel to the entrance. The beams being laid across these bars, the platform or road becomes quite horizontal; or an ascent may be given from the sides to the middle, in the same plane as with the roads leading to the bridge. The span is 105 feet, and the iron-work only weighs 38 cwt. It was inspected by the late Mr. Rennie and Mr. Telford, who drove their carriages over it; and it has been considered, by men eminent for their skill in mechanics, as a remarkable combination of strength and lightness.

The advance to improvement in this new era of bridge-building may be traced to the invention of iron-cables, which necessarily introduced the powerful proving-machine. A knowledge of the strength of bolt- and bar-iron of large dimensions was thereby obtained, which formerly was deduced from trivial experiments, leading to most erroneous calculation; and as the importance of this new branch of naval equipment developed itself, the principal iron-manufacturers of England vied with each other in its improvement; and British iron is now brought to a state of perfection, that will, for general purposes, entirely supersede the use of foreign. There is also a uniformity in the strength of the improved British iron, beyond that of any other country; so that by adopting straight bolts or bars united end to end in the direction of their length, by coupling plates and pins of proportionate strength instead of chains, we have an increase of strength, with less weight; the risk of bad workmanship is almost entirely obviated; and the subsequent proof, to which every part of the work is subjected, reduces the calculation of its strength to a certainty.

The consideration of the plans at present submitted will be much assisted by an examination of the model of the bridge which was erected about four years ago over the river Tweed, near Berwick. It is called the Union Bridge, from one of the towers standing in England, and the other in Scotland. Although it consists of but one span, the principle and plan of construction are precisely the same. The foundations of the towers were laid on the 19th of July 1819; and it was completed and opened to the public on the 19th of July 1820, by a procession of two rows of loaded carts and carriages, after which there were admitted about two thousand people. It has been in constant use for waggons and loaded carriages, and all the usual traffic of the country, without any regard to weight or number, the same as any bridge of arches. The span is 437 feet, only 133 feet less than the present design; the width 18 feet, which admits of two carriages passing in opposite directions; and a narrow path on each side, protected by cast-iron brackets, for foot-passengers.

The road is constructed of beams, 5 feet asunder, laid across the lower bars, covered with 3-inch planks; and the carriage-road in the centre is defended by cross-bars of wrought-iron, which afford a firm foot-hold for the horses. The bridge is supported by perpendicular bolts, resting on saddles, on 12 main lines of suspension, which consist of eye-bolts 15 feet long and 2 inches diameter, united as before mentioned: they pass over the towers, and rest on cast-iron saddles built into the masonry; and are extended on an angle of about 35 degrees; the extremities, bolted behind strong cast-iron plates, fixed about 40 feet under the road. The backstay-bars, on the English side, are secured in the solid rock.

I have ascertained the degree of tension which is created under every deflexion of the catenarian curve, by numerous experiments.

The versed sine of the main suspending-bolts of the Union Bridge is, as near as may be, one-fourteenth of its chord: in this position the bolts will only bear about three-sevenths the weight which would be required to tear them asunder in a vertical position, or when uniformly supported and stretched horizontally.

I have found that a 2-inch bolt, 12 feet long, and 2 inches diameter, was torn asunder horizontally by my machine, which is on the lever principle, like the weigh-bridges in the Royal Dock-yards, with a strain of 82 tons: it began to stretch with 47 tons; and lengthened, during the experiment, 2 feet 9 inches; and was reduced, at the point of rupture, to $1\frac{5}{8}$-inch diameter.

But, according to the power indicated by the hydraulic engine used for the same purpose by Mr. Brunton of the Commercial Road, it requires a strain from 95 to 100, sometimes 103 tons, to break a bolt of the same dimensions and quality.

Mr. Barlow, Mathematical Professor of the Royal Military Academy at Woolwich, has published, in his Treatise on the Strength and Stress of Materials, an account of experiments on my proving-machine, made in presence of himself, as well as others made by Mr. Brunton; and he ascribes the difference to the peculiar nature of the action of the two engines—Mr. Brunton's over-rating; while mine registers less than its full power: and he considers 27 tons as the measure of strength of an inch square.

Taking the mean results, therefore, of the above trials, 91 tons are the measure of strength, corresponding nearly with Mr. Barlow's datum: therefore, as three-sevenths of the weight which will tear a 2-inch bolt in the position before mentioned will produce the same strain when equally divided on a catenarian curve whose versed sine is one-fourteenth of its chord, 39 tons is the least weight that would break down one of the main lines of suspension of the Union Bridge, and 468 to break the whole; and the area of the bridge could not contain half that weight in any shape.

It is also to be observed, that even admitting the possibility of the bolts in a bridge of suspension being overstrained, or strained to stretching, it is very evident, from the wonderful ductility remarked in the experiments before mentioned, that the very effect of their lengthening reduces the strain; because, as the curve becomes relaxed, the tension is diminished. It is quite different from a sustaining power, whose inertia is continually exerted.

It is interesting and important to note the changes that the iron undergoes, in proving bolts or bars. It seems perfectly rigid and unaffected by any force less than five-ninths of its measure of strength, when a change is indicated by small exfoliations, or scales, from its surface. This is the consequence of the bolt stretching, and necessarily lessening in diameter; and a certain proof of its yielding, is the phænomenon of its becoming sensibly warm: the heat increases in the ratio of the strain; and when the rupture takes place, which is generally near the middle, it is almost too hot to hold.

It cannot but afford additional satisfaction, in the consideration of this subject, to know, that, in the evidence given before the House of Commons respecting the Menai Bridge, which is now constructing under the direction of Mr. Telford, the most eminent men, both engineers and mathematicians, were not only unanimous in their opinion of the practicability of that measure, but, also, that both theory and experiment confirmed the possibility of extending it far beyond the limits of the present design.

Having made these preliminary observations, I shall proceed with a brief explanation of the plan itself, the eligibility of the situation, and the facility of forming approaches contiguous to the great roads and principal streets on both sides.

The designs are projected by James Walker, Esq. F.R.S.E. Civil Engineer, and myself.

There are 3 spans of 600 feet each, and 2 side spans, supported by the back-stay bars, of 300 feet each. The total extent of the Suspended Bridge, including the width of the towers, is 2400 feet.

The embanked approaches, which form an integral part of the plan, are, together, 900 feet; the whole extent being 3300 feet, or little more than half-a-mile.

The road on the North side takes its rise on Little Tower-Hill, near the bottom of the Minories; that on the South side near Dock-Head, in Bermondsey, which forms a central point to the streets leading to the great Kent and Surrey Roads.

The rise, from its commencement on each side, is formed by an easy acclivity of 1 foot perpendicular in 20 feet horizontal.

The carriage-road of the bridge will be 21 feet wide; the footpaths on each side, 8 feet wide.

The bridges will be constructed of strong beams of Baltic timber, covered with 3-inch plank. The centre, or carriage-road, will be defended with wrought-iron bars of different thicknesses laid across, forming ribs, which will afford a secure foot-hold for horses.

The height of the bridge above high-water-mark is 70 feet in the front of the towers, rising gradually to 75 feet in the centre. The height will allow ships of 200 tons to pass under without striking their top-gallant masts; and ships of 300 or 400 tons to pass with main-top-gallant masts down.

The towers will be constructed either of granite, or some other stone of equally good quality, and the best rubble-work in the interior.

The bridges will be supported by 64 principal bars or bolts of suspension, 2½ inches diameter.

The bolts will be 20 feet long, joined by side-plates and pins of proportional strength. They will be extended, from their respective points, over the towers, in four rows over each other, one foot apart; each row to consist of four lines of bolts, parallel with each other. Those principal lines of suspension may now be denominated chains, although differing from the *common* form and *usual acceptation* of the word. The joints being exactly opposite to each other, the saddles which support the perpendicular bolts rest on them, and bear equally on all. The principal suspenders are so arranged, that the beams are alternately supported by a different row of chains, so that an equal strain is produced; as, for instance, the first joint from the towers is 5 feet long, and supports the first beam; the second joint is 10 feet long, and supports the second; the third is 15 feet long, which supports the third; and the fourth is 20 feet long, and supports the fourth beam. The others are all 20 feet long. Having thus set off with different lengths, this alternate system extends over the whole; and the perpendicular bolts are all 5 feet apart, corresponding with the distance of the beams.

The foregoing plan renders the united strength of the principal suspenders certain; and we may now proceed to apply a calculation of strength, from the known principles of the catenarian curve, and the strength of iron, as found by so many accurate experiments.

It may here be briefly noticed, that as the strain is somewhat greater at the points of suspension, the main bolts might be, in a small degree, gradually diminished to the centre; and in erecting the Trinity Pier in the Frith of Forth, I adopted this rule; but the expense and trouble attending it exceeds any advantage to be derived from a closer approach to mechanical precision.

The least force that will break a $2\frac{1}{2}$-inch bolt, when strained vertically, or supported uniformly in a horizontal direction, is 142 tons; and the least force that will stretch it, under similar circumstances, is five-ninths of the above, or 79; but when extended in the catenarian curve, whose versed sine is one-fourteenth of its chord, three-sevenths of the 142, or about 61 tons, equally divided, will produce the same degree of tension, or the breaking strain; and the same rule will obtain as to the stretching point, viz. five-ninths of 61 tons, or 34 tons, will produce the same effect on the curve: but no force less than this will cause any change.

Then, the least force that would break down the whole of the main suspending-chains, in any one span, is 3904 tons; and the least force that would strain them to stretching is 2170 tons.

The weight of the bridge, the main suspending-chains, and every thing within the points of suspension, will be 750 tons.

The centre division of any span of the bridge would contain 20 waggons, with 8 horses; which, taken at 12 tons, including the weight of the horses, is 240 tons:—a promiscuous collection of carts and waggons would perhaps be nearly the same. There could not be room for many other vehicles; but, allowing 60 tons for horses and droves of of cattle, say 300 tons. The side-paths are to be solely appropriated for foot-passengers; and it is just possible to place (allowing 2 feet in breadth, and 15 inches in width for each) 3648 persons on both sides; which, at 11 stone, is 250 tons. The total weight which it is possible to load on the area of any one division is therefore 550 tons; so that, in this extreme case, there would be 2604 tons less weight than would break down the main chain, and 870 tons less than the weight that would stretch them.

This calculation of a single span applies to the others. If the whole area were filled, it would contain 14,592 people, or 1003 tons; and there would be a burden of 1200 tons in waggons and carriages: those, together with the weight of the bridge, make the whole strain 5200 tons. But then we have the strength of all the main-chains in the respective spans, viz. 15,616 tons, to support this, or 10,416 less than would break down the bridge, and 3480 less than would stretch them.

This I consider to be a surplus of strength, that will be deemed quite sufficient, even with the most cautious mind: but in a bridge of suspension, we are not at all limited to strength, more than in any other structure. I can increase either the number of the chains, or the diameter of the bolts: a due regard to economy, and mechanical proportion, however, should always prevail, and guide us in rejecting whatever is not absolutely useful and necessary.

The towers will not be affected by any strain or drag from the main suspending-chains, being only subject to vertical pressure. The area, or base of the last iron framings on which the principal chains rest, will be about 500 feet; and computing the cohesion of the masonry under them, which is the weakest substance, it would require, at the moderate calculation of $1\frac{1}{2}$ ton to a cubic inch, upwards of 100,000 tons to crush one of the towers.

With respect to the probable durability of the bridge, I do consider, that, with the exception of the timber, it may be deemed an imperishable structure.

If it was to be totally neglected, the time would arrive, but that at a very remote date, when oxidation would waste the bolts, and a diminution of strength in the ratio of its loss of weight would ensue: but even in this case (which is so improbable to occur, that it seems like courting an objection to notice it), we have the fact before us, that every part of the bridge can be taken out, and renewed in detail, without either endangering its strength, or disturbing the passage.

The iron-work will, in the first place, receive several coats of the anticorrosion paint, which will be cleaned off, and renewed, every year: and there is no part of the work that will not be accessible; even the chains under ground will be extended within covered-ways, or barrel-arches, like the Brighton Pier; and there can be no question, that, with common attention, the whole may be kept in a state of constant preservation: indeed, were it considered necessary or desirable, all the principal chains might be covered close round with thin sheet-lead, which would not only be impervious to water, but the joint, or seam, which would be *under* the chains, might be soldered, and prevent the action of the atmosphere altogether.

The platform, or road of the bridge, being defended with plates of iron, will not be subject to wear; but it will require occasionally partial repairs, owing to the decay of the timber, which in about 40 years may amount to a total renewal: yet this need not at any time stop the passage of the bridge: a beam can be taken out, and another introduced, by wedging up the planks from below: the planks, being longitudinal, may be lifted and replaced, without much trouble or inconvenience at any time.

The cheapness of the material, and the simplicity of the construction, are strong recommendations for its adoption. It is quite practicable, and consistent with the design, to build the road entirely of cast-iron, with wrought-iron plates rivetted across, to afford a sure foot-hold for the horses: but, in that case, the main suspending-chains would require to be stronger, to support the additional weight; and the expense would be so much greater, that the difference of interest would not render it desirable in an economical point of view.

The space occupied by the columns in the river, on each side, will not be greater than the length and breadth of two small sloops or brigs. Speaking as a seaman, I should say, that they would rather be an advantage than a hindrance, because the spread of the yards of two vessels would be more likely to impede the passage of other vessels than the towers will be.

It is necessary to state most unequivocally, that no hindrance whatever will be created, either in the river or the adjoining streets, during the erection of the bridge. When the towers are finished, chains of sufficient strength to carry a temporary gangway will be stretched across, which can be hove up in half-an-hour: the principal bolts will be hoisted up to the temporary bridge, and the whole put together aloft.

LXXVI.—*An Account of the Overflowing Well, in the Garden of the Horticultural Society, at Chiswick. By* JOSEPH SABINE, *Esq. Secretary to the Society.**

Turnham Green, Nov. 27, 1823.

IN consequence of the success which had attended the operations of several persons in the vicinity of Chiswick in boring for water, it was determined, by the Council of the Horticultural Society, that an attempt to procure an overflowing-well should be made in the Society's Garden, for the purpose of obtaining a supply of water for various purposes; but, more particularly, to form an ornamental canal in the *Arboretum*, for the growth of hardy aquatic plants.

After the necessary inquiries had been made, it was determined that Mr. John Worsencroft, a person who had previously succeeded in making an overflowing-well for Messrs. Bird of Hammersmith, should be employed to execute the experiment. He commenced his operations upon the first of September last; and, after boring for five weeks without material interruption, tapped the spring on the 18th of October, and finally completed his task on the following day. The depth from which the water first rose was 317 feet; and the whole depth of the well, when completed, was 329 feet; the additional 12 feet of boring having been made in order to gain a perfect opening into the bed of the spring, which flowed, when first tapped, less copiously than after the final depth was obtained. The chalk, from which the water immediately comes, is soft; but the bottom of the well is in hard chalk. The

* From the Quarterly Journal of Science, Literature, and the Arts, No. XXXIII.

water in all the neighbouring wells appears to have been obtained at about the same depth; and the strata, through which the perforations were made, are nearly similar to those met with in the present instance.

The tackle, and the instruments used, were very simple. A scaffolding was raised, 20 feet above the proposed orifice of the well; on which a platform was fixed, to support a windlass, by which the rods used in boring were lowered into, and raised from, the well. These rods were of tough iron, about an inch and a half square, and ten feet long; the ends of each screwing on to, or unscrewing from, the top of the next, as they were lowered into, or raised from, the hole. The instruments—fixed, as occasion required, to the lowest extremity of the series of rods, when in action—were, augers of various dimensions, for boring; steel-chisels, for punching; and a hollow iron cylinder (called a shell), fitted with a valve at its lower end, for bringing up soft mud. The rods, when an auger was attached to them, were turned round by means of moveable arms or dogs, which were made to lay hold of the part of the uppermost rod, at the top of the hole: the auger, being thus forced through the stratum of clay or sand, was drawn up, as soon as its cavity was filled with the substance it had loosened. The chisels were employed for punching through stones, hard chalk, or other hard substances: the rods, when these were attached, were moved by means of a powerful beam, acting as a lever, and worked by four men.

The water is discharged, at the surface of the ground, after the rate of six gallons per minute; and is capable of being carried 20 feet above the ground-level; and even then supplies a copious stream. The well is lined, for the first 186 feet, with cast-iron pipes with a three-inch bore, jointed, by means of wrought-iron collars, which are rivetted into the pipes: the succeeding 77 feet 6 inches are lined with copper-pipes of 2½ inches bore, soldered into a single length, and resting in the chalk, through which the remainder of the hole is bored, and in which no pipes were used. The whole series of pipes was introduced at once; the hole having been prepared for them as soon as it was ascertained that the augers had reached the chalk stratum. The land-springs in the gravel, above the blue clay, were kept out, in the first instance, by extra iron-pipes. The spring which was found in the sand below the blue clay, and above the chalk, rose to within a few feet of the surface, but did not overflow. The whole of the water of this spring is, however, excluded from the well, by the pipes with which it is lined.

The cost of the well, including that of the pipes, boring, and every other expense whatever, did not exceed 130*l.*; and the manner in which it was executed was in every respect satisfactory. Indeed, it is impossible to speak too highly of the care, attention, and dexterity of Mr. Worsencroft, and the workmen whom he employed.

The various strata bored through were as follow:

Feet.

19 Gravel.

162 Blue clay.

30 Coloured clay; varying from brick-red, mixed with blue and yellow, to many shades of dull purple.

22 Clay, with nearly an uniform colour of yellow ochre, occasionally mixed irregularly with grey. This was more sandy than the previous stratum. Among this, water rose in some quantity.

28.6 Soft soil, apparently composed of clay and sand. It varied very much in colour; being sometimes bright green, otherwise yellow intermixed with green, or sometimes beautifully veined with dark-red and yellow.

67.6 Chalk, among which many flints were scattered. Of these, one was one foot in thickness; and so unusually hard, as to occupy the workmen three days in punching, before they could force a way through it.

The water was found, as before mentioned, at the depth of 317 feet, in a bed of soft chalk, mixed with small flints: the hole was bored 12 feet among the water:—so that the total depth of the well is 329 feet; and it is supposed, by the workmen, that the last piece of chalk that was brought up, sticking to their punch, was from the upper surface of a new layer of chalk, in which there is no water.

The principal impurity discovered in this water, by the action of re-agents, is common salt, of which it contains about four grains and a half in the pint. When evaporated to dryness, the residue contains a sufficient quantity of carbonate of soda, to render it very manifestly alkaline: this is also the case with the waters of the other deep wells in and about London.

LXXVII.—*On the Melting of Gold, and the Preparation of Gold-Leaf. By the late* WILLIAM LEWIS, M.D.*

ON FINE GOLD.

FINE gold is a soft metal; easily chiselled, cut, or graved; very flexible; and so tough, that when at length made to break by repeated bendings backwards and forwards, the fracture, on each of the pieces, appears drawn out in the middle, like a wedge. It takes impressions from dyes in great perfection; but does not file freely, but sticks in the file-teeth; has little elasticity or sonorousness; receives great splendour from the steel-burnisher, but does not appear so bright from the polishing-stone. It yields freely to the hammer, both when hot and cold; and admits of being stretched to a vast extent.

The great value which has at all times been fixed on gold, its beautiful colour, incorruptibility, and compactness, render its ductility an object of primary importance: on this depend sundry arts and manufactures, in which we see it extended to an amazing tenuity, and variously applied on the surfaces of other bodies, both for their ornament and preservation.

* From his *Commercium Philosophico-Technicum.*

OF THE MELTING OF GOLD.

Gold melts in a low white heat, and when in fusion appears, on the surface, of a luminous bluish-green colour. Though its expansion, by small degrees of heat, as from freezing to boiling water, is less than that of most other metals, yet in fusion it seems to expand more than any of the others; rising up with a more convex or elevated surface as it becomes fluid, and growing more concave or depressed as it sets again, or returns to solidity. From this property it follows, that gold is less fit for receiving sharp and perfect figures, when cast into moulds, than silver, copper, lead, or tin, which do not shrink so much, and far less so than iron or bismuth, which expand in their passage from a fluid to a solid state.

The workmen, for the melting of gold, choose generally a black-lead crucible, on account of its being smoother than the Hessian or other common sorts, and, consequently, less apt to retain any particles of the costly metal: it is likewise much less liable to crack, may be used for several fusions, and does not require the precautions necessary to be observed where the others are employed.

When the gold is divided into small parts, as filings, though all the particles be brought to perfect fluidity, they do not easily reunite into one mass; many of them continuing frequently in distinct drops. This repugnance is judged to proceed from small atoms of dust, or other extraneous matters, adhering to the surfaces of the particles, and preventing their close contact. The addition of certain fusible saline substances, which dissolve and vitrify earthy bodies in the fire, is found to remove the impediment, and to collect and unite the gold, however divided. The use of fluxes is absolutely necessary in these circumstances; and, from their apparent utility here, it has been thought that they were needful in other cases; and hence they are often employed where they seem to be little wanted.

Borax, one of the most powerful dissolvents of earthy matter, is, in this respect, one of the best fluxes for gold; but the gold melted with it, however fine, is commonly observed to have its colour made somewhat paler. From what cause this slight diminution of the colour proceeds, I have not been able to discover: nor do the workmen find the diminution considerable enough to prevent their using borax more generally than any other kind of flux. Nitre, added to the borax, prevents this effect; and gold, previously made pale by borax, has its colour restored by melting it with an addition of nitre: hence this salt is usefully employed where the gold is designed for the high-coloured sort of leaf, for gilding, or other purposes where the high colour of the metal is a principal object. When gold is alloyed with copper, and the full proportion of the copper is to be preserved, nitre is never to be used, the base metals being scorified or destroyed by it: in this case it will be adviseable to add to the borax a little charcoal in fine powder, which will preserve the copper from being scorified by the heat.

There is another material point, in melting gold; viz. the preservation of its malleability; which is very liable to be injured, either from an excess, or deficiency, or too sudden an abatement of, the heat, occasioning an undue arrangement of its parts at the time of its becoming solid. When gold is made excessively hot, and the mould, into which it is to be poured, is warmed but a little, or not at all, the metal almost always contracts a degree of hardness and rigidity; whereas, by duly proportioning the heat of the mould to that of the metal, its softness and toughness may generally be secured. The gold-beaters, to whom these qualities are of more importance than in any other art, heat the iron ingot-mould, till the tallow, which it is rubbed with, runs and smokes without taking flame, and pour out the gold as soon as its surface appears of a bright-green colour: the clearness of the colour serves them as a mark, both of the gold being of a proper degree of heat, and of its being fine. Those who work in alloyed gold judge also from the appearance of the surface whether the metal is of such a heat, or such a disposition, as to prove tough or eager when cold; and are taught, by use, that which cannot easily be described. It is supposed by some, that gently shaking or striking the crucible, so as to communicate a kind of undulatory motion to the fluid metal, just before it is poured out, contributes to its toughness.

It is a general opinion among metallurgic writers, that fine gold, in fusion, is made brittle by the contact of vegetable coals not thoroughly burnt, or by their fume; and, what is pretty singular, that gold alloyed with copper is not so subject to receive this injury. But it is probable that the brittleness, ascribed to this cause, depends rather upon others: for the gold-beaters, who have their crucible open, do not find that the toughness of the gold is at all diminished, either by the vapour of the charcoal, or by a coal in substance falling in; though, if any such diminution happened, it could not be supposed to escape their notice. There appears to be little danger to the malleability of gold to be apprehended from any kind of fumes but metallic ones.

When gold is made brittle by a small admixture of base metals, or by their fumes, its malleability may be restored by melting it with a little nitre, which scorifies and dissolves all the other metals, except silver and platina. The nitre should be thrown upon the gold just as it is going to melt; and the metal be poured out as soon as it flows thin. A long continuance of the fusion is apt to destroy the effect of the nitre, and render the gold as brittle as it was before: for so much of the nitre as has acted upon the base admixtures of the gold is changed by that action into an alkaline salt; and the slightest access of any inflammable matter is sufficient to revive the scorified metallic particles from the alkali, and render them again miscible with the gold. Corrosive mercury-sublimate, thrown, by a little at a time, upon gold in fusion, with care to avoid its noxious fumes, answers the same end as nitre, and is commonly preferred to it by the workmen.

THE PREPARATION OF GOLD-LEAF.

The iron ingot-mould, into which the gold, melted in a wind-furnace to perfect fusion, is run, as above mentioned, is six or eight inches long, and three-quarters of an inch wide. The bar of gold is made red-hot, to burn off the tallow; and forged, upon an anvil, into a long plate; which is further extended, by being passed repeatedly between polished steel-rollers, till it becomes a ribbon, as thin as paper. Formerly, the whole of this extension was procured by means of the hammer, and some of the French workmen are still said to follow the same practice: but the use of the flatting-mill both abridges the operation and renders the plate of a more uniform thickness. The ribbon is divided by compasses, and cut with shears, into equal pieces, which, consequently, are of equal weights: these are forged upon an anvil till they are an inch square; and afterwards well annealed, to correct the rigidity which the metal has contracted in the hammering and flattening. Two ounces of gold, or 960 grains, the quantity which the workmen usually melt at a time, make a hundred and fifty of these squares; whence, each of them weighs six grains and two fifths; and, as 4902 grains of gold make one cubic inch, the thickness of the square plates is about the 766th part of an inch.

In order to the further extension of these pieces into fine leaves, it is necessary to interpose some smooth body between them and the hammer, for softening its blow, and defending them from the rudeness of its immediate action; as also to place between every two of the pieces some proper medium; which, while it prevents their uniting together, or injuring one another, may suffer them freely to extend. Both these ends are answered by certain animal membranes.

The gold-beaters use three kinds of membranes;—for the outside cover, common parchment, made of sheep-skin; for interlaying with the gold, first, the smoothest and closest vellum, made of calves-skin; and, afterwards, the much finer skins of ox-gut, stripped off from the large straight-gut, slit open, curiously prepared on purpose for this use, and hence called *gold-beater's skin.* The preparation of these last is a distinct business, practised by only two or three persons in the kingdom, some of the particulars of which I have not satisfactorily learned. The general process is said to consist in applying them one upon another, by the smooth sides, in a moist and semi-glutinous state, when they readily cohere and unite inseparably; stretching them on a frame, and carefully scraping off the fat and rough matter, so as to leave only the fine exterior membrane of the gut; beating them between double leaves of paper, to force out what unctuosity may remain in them; moistening them once or twice, with an infusion of warm spices; and, lastly, drying and pressing them. It is said, that some calcined gypsum, or plaster of Paris, is rubbed, with a hare's-foot, both on the vellum and on the ox-gut skins, which fills up such minute holes as may happen to be in them, and prevents the gold from sticking, as it would otherwise do, to the simple animal membrane. It is observable, that, notwithstanding the vast extent to which the gold is beaten between these skins, and the great tenuity of the skins themselves, they sustain continual repetitions of the process, for several months, without extending, or growing thinner. Our workmen find, that after seventy or eighty repetitions, the skins, though they contract no flaw, will no longer permit the gold to extend between them; but that they may be again rendered fit for use, by impregnating them with the virtue which they have lost; and that even holes in them may be repaired by the dexterous application of fresh pieces of skin. A microscopical examination of some skins, that had been long used, plainly shewed these repairs.

The method of restoring their virtue is said, in the *Encyclopédie*, to be, by interlaying them with leaves of paper moistened with vinegar or white wine, beating them for a whole day, and afterwards rubbing them over, as at first, with plaster of Paris. The gold is said to extend between them more easily after they have been used a little, than when they are new.*

The beating of the gold is performed on a smooth block of black marble, weighing from two hundred to six hundred pounds—the heavier the better—about nine inches square on the upper surface, and sometimes less, fitted into the middle of a wooden frame about two feet square, so that the surface of the marble and the frame form one continuous plane. Three of the sides are furnished with a high ledge; and the front, which is open, has a leather flap fastened to it, which the gold-beater takes before him, as an apron, for preserving the fragments of gold that fall off. Three hammers are employed, all of them with two round and somewhat convex faces, though commonly the workman uses only one of the faces: the first, called the *cutch-hammer*, is about four inches in diameter, and weighs fifteen or sixteen pounds, and sometimes twenty; though few workmen are found who can manage those of this last size: the second, called the *shodering-hammer*, weighs about twelve pounds, and is about the same diameter as the first: the third, called the *gold-hammer*, or *finishing-hammer*, weighs ten or eleven pounds, and is nearly of the same width as the two others. The French use four hammers, differing, both in size and shape, from those of our workmen: they have only one face, being, in figure, truncated cones: the first has very little convexity, is near five inches in diameter, and weighs fourteen or fifteen pounds: the second is more convex than the first, about an inch narrower, and scarcely half its weight: the third, still more convex, is only about

* We shall give other particulars of the preparation of gold-beater's skin, in a succeeding Article.—EDITOR.

two inches wide, and four or five pounds in weight: the fourth, or finishing-hammer, is nearly as heavy as the first, but narrower by an inch, and the most convex of all. As these hammers differ so remarkably from ours, I thought proper to insert a description of them; leaving the workmen to judge what advantage one set may have over the other.

A hundred and fifty of the pieces of gold are interlaid with leaves of vellum, three or four inches square; one vellum leaf being placed between every two of the pieces, and about twenty more of the vellum leaves on the outsides: over these is drawn a parchment-case, open at both ends; and over this, another, in a contrary direction; so that the assemblage of gold and vellum leaves is kept tight and close on all sides. The whole is beaten with the heaviest hammer; and every now and then turned upside-down, till the gold is stretched to the extent of the vellum; the case being opened from time to time, for discovering how the extension goes on; and the packet, at times, bent and rolled, as it were, between the hands, for procuring sufficient freedom to the gold; or, as the workmen say, to make the gold work. The pieces, taken out from between the vellum leaves, are cut in four, with a steel knife; and the six hundred divisions, hence resulting, are interlaid, in the same manner, with pieces of the ox-gut skins, five inches square. The beating being repeated, with a lighter hammer, till the golden plates have again acquired the extent of the skins, they are a second time divided in four: the instrument used for this division is a piece of cane, cut to an edge; the leaves being now so light, that the moisture of the air or breath condensing on a metalline knife would occasion them to stick to it. These last divisions being so numerous, that the skins necessary for interposing between them would make the packet too thick to be beaten at once, they are parted into three parcels, which are beaten separately, with the smallest hammer, till they are stretched, for the third time, to the size of the skins: they are now found to be reduced to the greatest thinness they will admit of; and, indeed, many of them, before this period, break or fail. The French workmen, according to the minute detail of the process given in the *Encyclopédie,* repeat the division and the beating once more; but, as the squares of gold, taken for the first operation, have four times the area of those used among us, the number of leaves from an equal area is the same in both methods; to wit, sixteen from a square inch. In the beating, however simple the process appears to be, a good deal of address is requisite, for applying the hammer so as to extend the metal uniformly from the middle to the sides: one improper blow is apt, not only to break the gold leaves, but to cut the skins.

After the last beating, the leaves are taken up by means of a cane-instrument or forceps, and, being blown flat on a leather cushion, are cut to size, one by one, with a square adjustable frame of wood, edged with two parallel slips of cane made of a proper sharpness: they are then fitted into books of twenty-five leaves each, the paper of which is well smoothed, and rubbed with red bole, to prevent their sticking to it. The French, in sizing the leaves, use only the cane-knife; cutting them first straight on one side, fitting them into the book by the straight side, and then paring off the superfluous parts of the gold about the edges of the book. The size of the French gold-leaves is from somewhat less than three inches to three inches and three-quarters square; that of ours, from three inches to three inches and three-eighths.

The process of gold-beating is considerably influenced by the weather. In wet weather, the skins grow somewhat damp, and in this state make the extension of the gold more tedious: the French are said to dry and press them at every time of using; with care not to over-dry them, which would render them unfit for further service. Our workmen complain more of frost, which appears to affect the metalline leaves themselves: in frost, a gold-leaf cannot easily be blown flat; but breaks, wrinkles, or runs together.

Gold-leaf ought to be prepared from the finest gold; as the admixture of other metals, though in too small a proportion to affect sensibly the colour of the leaf, would dispose it to lose its beauty in the air. And, indeed, there is little temptation to the workmen to use any other; the greater hardness of alloyed gold occasioning as much to be lost, in the points of time and labour, and in the greater number of leaves that break, as can be gained by any quantity of alloy, that would not be discovered, at once, by the eye. All metals render gold harder and more difficult of extension: even silver, which, in this respect, seems to alter its quality less than any other metal, produces with gold a mixture sensibly harder than either of them separately; and this hardness is not more felt, in any art, than in the gold-beater's. The French are said to prepare what is called green gold-leaf, from a composition of one part of copper and two of silver, with eighty of gold; but this is probably a mistake; for such an admixture gives no greenness to gold; and I have been informed by our workmen, that this kind of leaf is made from the same fine gold as the highest gold-coloured sort; the greenish hue being only a superficial tint, induced upon the gold in some part of the process: this greenish leaf is little otherwise used than for the gilding of certain books.

But, though the gold-beater cannot advantageously diminish the quantity of gold in the leaf by the admixture of any other substance with the gold, yet means have been contrived, for some particular purposes, of saving the precious metal, by producing a kind of leaf, called party-gold, whose basis is silver, and which has only a superficial coat of gold upon one side of it. A thick leaf of silver, and a thinner one of gold, laid flat on one another, and heated and pressed together, unite, and cohere; and, being then beaten into fine leaves, as in the foregoing process, the gold, though its quantity is only about one-fourth of that of the silver, continues everywhere to cover it; the extension of the former keeping pace with that of the latter.

LXXVIII.—*On an improved Manufacture of Wooden Bushels, and other Measures, in France.**

WITH A PLATE.

It will be necessary to describe the manner of making the bushel as it was formerly practised, in order to shew the improvements which have taken place in this art, since the Law has enforced the introduction of new measures.

The bushel-makers formerly bought the bodies of their bushels ready made, which they procured from Champaigne; these were made either of oak, beech, or walnut-tree. The wood was first sawn into thin planks, and shaped with the plane; then boiled in water, and, whilst hot, was bent with a machine made on purpose.

The bodies being thus prepared, the workman made the edges even with a shave, such as coopers use. This done, he nailed the ends together inside and outside, in such a way that it might make that part of a double thickness. He then grooved the body of the bushel interiorly and circularly at the part where the bottom was to be placed. This was done with a tool made on purpose, the blade of which could be shortened or lengthened as occasion might require.

In order to form the bottom, the workman traced on a plank of wood a circle, whereof the diameter is equal to the groove made in the interior of the bushel. He then cut off the parts beyond the circle, and rounded the edges of the bottom with his plane; he placed the bottom thus prepared within the body, forced it into the groove, and fastened it with nails below the groove; and around the outside of the measure he placed a hoop of oak. He

* From the *Dictionnaire Technologique.*

afterwards cut bands of sheet-iron, which he nailed across the bottom at right-angles to each other, and placed an iron hoop round the rim, and another round the bottom, and between them he nailed slips of sheet-iron in a zig-zag form; and the bushel was complete.

As the new measures of capacity in France must be made absolutely cylindrical, with circular bases,—which was not the case with those formerly used, as the two extremities of the rim overlapped one another considerably, forming a kind of spiral of three millimetres in thickness, extending withinside,—we may now easily conceive that the cylindrical form of the measure was changed, and that we could not be sure of its exactness in measuring it with the grain; the Law now expressly forbidding it, as not affording the means of verification. These measures must therefore be perfect cylinders, the diameters of which are exactly equal to their height, when intended for measuring dry substances. Now, if the form be not exactly circular, how can we be sure that the exact proportion exists between their height and diameter?

In order to obviate these inconveniences, I have endeavoured to improve the process, so as to fulfil rigorously the intention of the Law. The *modus operandi*, which I propose, is the same for all measures of capacity. I shall therefore take, as an example, the forming of a litre for dry measure; and it may easily be applied to all others.

I cut a plank of wood, 4 millimetres thick; I give it 128 millimetres 3 centimetres in breath, viz. 2 centimetres more than the interior height of the litre; and $340^{m}. 7^{c}.$ in length, viz. a length equal to the circumference, the diameter of which is 108.3, the dimension of the litre, *plus* 6 centimetres, which the small plank ought to contain; in all, 400^{m}. I suffer it to remain 4^{m}. thick in the middle, diminishing insensibly to 3^{m}. at the extremities.

Whilst the wood is still flat, I hollow out the groove, for the reception of the bottom, with a plane made for the purpose; as it is then much more conveniently and expeditiously performed than when the wood is bent into the circular form. I make the groove at the height of 17^{m}.; and prepare the bottom, which must be 3^{m}. thick, so that the groove and the bottom being 20^{m}. thick, the height of the measure will be 108^{m}. 3^{c}., as required.

The whole being thus prepared, and the wood having been soaked long enough in hot water to bend easily, I fix it at one end upon a cylinder A of my machine (Pl. XI. fig. 1), and I then turn the handle gently, in order that the wood may be forced, by the power of the other cylinder B, to apply itself perfectly upon the surface of the cylinder first described. When I have arrived at the other extremity of the wood, I fix the two ends, the one upon the other, then draw from off the cylinder the hoop of wood which is to form the measure; first, however, removing the iron bar O, by which it was fixed to the cylinder at one end; and, retaining it in shape by means of a wooden clamp A D E (fig. 2), I then firmly secure the moveable cylinder B, and preserve the circular form of the hoop by means of two false bottoms (fig. 4), each being exactly of the diameter prescribed: I leave the wood to dry in this situation; and replace the piece of iron, O, in the cylinder A, ready to commence the same operation for another measure.

When the hoop is sufficiently dry, I place it on a mould, which is a cylinder of hard wood of 108^{m}. 3^{c}. in height and diameter (fig. 5). This mould has at its foot a base, whose diameter is four centimetres larger; and it is a decimetre less in height than the measure, for the purpose of moving it with more facility. I adjust it upon the mould, so that the lower edge of the hoop and the base of the mould perfectly touch each other. I then firmly secure the hoop upon the cylinder, by means of two, three, or four jointed iron hoops (fig. 7), having previously fixed the bottom into the groove made to receive it; and which rests upon the top of the mould, whilst the other edge of the hoop is in perfect contact with the upper surface of the base. All being thus arranged, I place upon the joint, the piece of thin wood (fig. 8), bent to the form of the cylinder, and drive nails or points into the hoop from the convex surface of the measure, in order to prevent the two ends of it from separating. Two grooves, EF, GH, (fig. 5) are made in the mould, to receive the points of these nails, and to facilitate the removal of the hoop. I then fix wooden hoops upon the measure, raise it from off the mould, and rivet the points of the nails inside: it is then finished, and presents the most regular and exact form. To all these advantages is added that of expedition in the execution of the work. The calibres and heights being once exactly fixed, I have no need to take any further dimensions; I cut the wood mechanically, bend it, fasten it, and am certain of obtaining the required success.

In order to afford more solidity to the measure, the top and bottom are encircled by hoops of beech-wood; that at the top is 4 millimetres thick, and 4 centimetres wide; the bottom one is 2 centimetres wider, and greatly contributes to strengthen the part around the groove near the bottom. The two hoops are placed on the outside; and it is of no consequence, in this case, whether the two ends of them lie the one over the other, and form a double thickness; provided, that the exactness of the interior of the measure be not injured thereby.

It only remains now, to strengthen the measure with iron, if necessary. In this case, the superfluous wood is removed, and replaced by bands of iron, which are nailed to the wood.

Explanation of Figures 1, 2, 3, 4, 5, 6, 7, *and* 8, *of Plate* XI.

Fig. 1. A front view of a machine to bend the wood uniformly. The cylinder A can be changed, as it must be of exactly the diameter required for each measure: it is then evident, that as many of these cylinders are required as there are different sizes of measures to be made. The second cylinder, B, is never changed. The two cylinders, A and B, are supported on the solid base DCEFGH; but it

must be observed, that each cylinder is mounted upon a separate frame. The frame E G D C is intended to support the cylinder A only. The second frame, F H, supports the cylinder B. The second frame slides within the pedestal D C. At M is seen an opening or mortice, N, for the purpose of placing the cylinder B farther from or nearer to the centre of the cylinder A, according as the latter may be larger or smaller. The cylinder, B, is retained in its place, by means of double wedges, placed in the mortice N. The same arrangement is also provided on the opposite side. The pivots of the cylinders are supported in brasses, with covers, L K, placed in the tops of the uprights, E F.

The handle, I, is fixed on the extremity of the axis of the cylinder A, which is placed on an immoveable frame, for greater solidity. The piece of iron, O, is rounded exteriorly, and extends the whole length of the cylinder. It is armed with a number of points along it, for the purpose of holding the end of the plank of wood securely, which is intended for the measure. The wood, P Q R, is strongly compressed between the two cylinders, so that it may be continually applied upon the cylinder A.

After having turned the handle I, the end R of the plank covers, by several centimetres, the part P: near to S, for example, the two ends of the plank are secured by three or four nails, driven in rows opposite to each other, the points of which enter into the small groove S, made in the cylinder, parallel to its axis, to prevent the nails from entering the cylinder, which would prevent the hoop from being taken off from it. This done, the cylinder A is removed from its supports; the piece of iron, O, is taken out, and with it the measure, which I call a *tambour*, as the bottom is not yet fixed in it: the *tambour* is then detached from the points, in the piece of iron, O.

Fig. 2. represents a wooden clamp, made either of oak or walnut-tree. It is composed of the two legs, D E, and a small intermediate piece, to keep the two former at a

distance, equal to the double thickness of the plank; and of an iron ring, A, to render the whole firm. C represents a section of this clamp, taken at the line *a b*. The two ends, D E, of the clamp, enter within the ring, B, to prevent its opening; and it thus secures the *tambour*.

Fig. 3. represents the *tambour* separated from the cylinder, and retained in its circular shape by the clamp, fig. 2.

Fig. 4. represents a false bottom, made either of oak or walnut-tree, two centimetres thick: one of these is to be placed at each end of the *tambour* (fig. 3). These false bottoms are made of exactly the same diameter as the measure, so that the wood should not lose its form by drying. A represents a groove, made for the entrance of the clamp (fig. 2). These false bottoms are left in their places, till the *tambour* is perfectly dry. It is therefore necessary to have a great number of these false bottoms, as two are required for each *tambour*.

Fig. 5. The cylinder A B C D, which is used as a mould for the measure; its height A B, and its diameter B C, are equal, agreeable to the legal instructions. I K, is a solid base; and E F, G H, are grooves to receive the points of the nails.

Fig. 6. When the wood is dry, the *tambour* is accurately shaped; and the two ends of it which just met, or overlapped each other, in first securing them together upon the cylinder A, with the nails, are made to close, and are strongly bound upon the mould, by iron hoops furnished with hinges and screws (fig. 7). In this figure (6) are also represented the two grooves in the mould, *ef*, *gh*, by dotted lines, to indicate their position when the measure is on the mould. When the measure is accurately placed upon the mould, as before mentioned, and fixed by two screwed hoops, it must be placed in an inverted position; the upper part of it must be fitted completely to the circular base of the mould; and the groove made to receive

the bottom of the measure will appear, all round, above the top of the mould, as represented at F G.

Fig. 7. An iron hoop, hinged at B. One of the branches, C, has a round hole made in it, which receives the body of the screw, and allows it to turn freely whilst a female screw is made in the other branch, A. The screw D E is also represented in its place. As it sometimes happens that the two ends of the *tambour*, although nearly adjusted, form an angle, they are made to receive their circular form in the following manner: the small wooden plank (fig. 8) is placed on the joint, but without being nailed; it is then compressed by two or three other iron hoops, which are placed between the two that are already fixed at each end of the cylinder; but care is always taken that the hinges of these latter hoops are on the same side with the screws of the first hoops: the plank or *tambour* is then securely nailed very near to these latter hoops, which are made to slide along successively, in order to drive more nails, till the *tambour* is entirely nailed. Before this is done, however, the *tambour* must have been opened, and the bottom placed in the groove made for it, so as to rest on the top of the mould: the wooden hoop is then to be adjusted, which is placed in the interior, and below the groove at the bottom of the measure, which fastens all together: the iron hoops are removed from the outside, and the measure is then taken off the mould; the nails are next rivetted inside; and the whole is finished. If the measure is to be bound with iron, the wood has only to be removed, and the iron substituted in place of it. L.

LXXIX.—*On rendering Leather, Canvass, Linen, &c. Water-proof.* By MM. FARRIMANN *and* THILLY.*

To 100*lb.* of the best linseed oil are added 1½*lb.* of acetate of lead, 1½*lb.* of calcined umber, 1½*lb.* of white-lead,

* From the *Bulletin de la Soc. d'Encouragement*, &c.

and $1\frac{1}{2}$*lb*. of very finely-powdered pumice-stone. These solid substances, well ground and mixed together, must be boiled in the oil for ten hours, over a moderate fire, to prevent the oil from burning. This varnish should be of such a consistence, that, when mixed with a third part of its weight of pipe-clay, it should be as thick as treacle. It is left to settle eight days, and is then to be passed through a lawn sieve. They then grind, in a solution of strong and clear glue, as much pipe-clay as amounts in weight to the tenth part of the oil employed, and mix to the consistence of ointment; adding the varnish by degrees, and stirring it well with a wooden spatula. This varnish must be repeatedly stirred, till it becomes perfectly fluid; and then the desired tint is given by adding a fourth part of the colour, ground in oil.

The linen must be stretched upon a wooden frame; and the composition applied upon it, with a large spatula 3 inches broad and 9 inches long. The frame is then inverted, and the operation repeated upon the other side of the cloth: it is then left to dry for a week, and separated from the frame for use.

This cloth may be used for riding-hoods, covers for carriages, &c. &c.

For leather and skins the same composition is used; but to give the surface a smooth and brilliant appearance, the following varnish is employed; viz. 5*lb*. of the oil varnish, and an equal weight of well-clarified resin, are boiled together until the resin is dissolved; they then add 2*lb*. of oil of turpentine, having the colour to be given to the varnish ground with it, and passed through a lawn sieve: this is to be applied with a brush. When the varnish is thoroughly dry, it must be rubbed even with a pumice-stone and water, and be then washed clean. Two or three coats of varnish being then applied, and each coat suffered to dry for two or three days, is sufficient to produce a brilliancy equal to that of the Japan lacker.

LXXX.—*On an Improvement in the Process of Manufacturing Brandy from Potatoes.* By M. Siemens, *Bailli, à Pyrmont.*

This process has been adopted in many parts of Germany; and, in the North of Europe, has received the approbation of two most scientific men; viz. M. Berzelius in Sweden, and M. Œrsted in Denmark; who have each recommended their Governments to encourage the introduction of it. Essays made at Copenhagen have proved, that the inventor has not exaggerated in saying, that by his method he could obtain one third more of brandy than by the usual processes; and that it was of a good quality.

From the report made on this subject, by M. Œrsted, we learn in what consists the chief importance of this discovery. The potatoes are put into a close wooden vessel, and exposed to the action of steam, which communicates to them a degree of heat greater than that of boiling water. Thus heated, the potatoes can be reduced to the state of the finest paste, with extraordinary facility: all that is required being, to stir them with an iron instrument armed with cross-pieces, and turned in a wooden vessel a few times; they then add boiling water to this paste, and afterwards a little potash, rendered caustic by quick-lime. This latter addition is intended to dissolve the vegetable albumen, which opposed the entire conversion of the potato-starch into a fluid. This fluid being filtered, is susceptible of being chemically treated. M. Œrsted has also employed himself in freeing the potato-brandy from the flavour which is peculiar to it: this he has effected by means of the chlorate of lime, which renders it equal to the best brandy made from wine.

LXXXI.—*On an Extract of Mimosa Bark, for the use of Tanners; imported from New South-Wales, by Mr.* T. Kent.*

In April last, the Society received a Letter from R. Wilmot Horton, Esq. Under-Secretary of State for the Colonies, requesting them to take into consideration the probable value, with reference to the manufactures and commerce of the country, of a new material for tanning, recently imported from New South-Wales, by Mr. T. Kent.

A Committee of Colonies and Trade was accordingly appointed to investigate the subject.

It appears, that, in consequence of the great extension of the British trade with South America, the importation of hides (that being the article in which a considerable proportion of the returns are made) has of late years greatly increased.

The excellence of British leather is fully acknowledged on the Continent; and therefore it might be expected that the South-American hides imported would be all tanned here, and re-exported in the state of leather. This, however, is far from being the case: many thousand hides are sent from London and other British ports to the continent of Europe in a raw state, after having remained for a longer or shorter time in the merchant's warehouses, producing no profit, and incessantly exposed to damage from weevils and other vermin.

There are two causes (according to the testimony of the tanners who attended the Committee) which occasion this unsatisfactory state of things: first, the regulations of the Excise, which forbid an union in the same persons of the businesses of tanning and currying; and, secondly, a deficiency of tanning-materials. Bark, being a very bulky article, will not bear the expense of freight from distant foreign countries; and the oak being a tree of slow growth,

* From Vol. XLI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce, for 1823.

it has not been possible to increase our domestic supply of this article in proportion to the demand, although its high price has, in many instances, tempted landholders to sacrifice the future value of flourishing plantations to the present profit arising from the bark. By this improvident anticipation, however, the supply of oak-timber for naval and other purposes is continually diminishing; and the most effectual defence of the country may, in the next generation, experience insuperable difficulties on this account.

During the last year or two, establishments have been formed in Dalmatia, and in other parts of the European continent that abound in forests of oak, for the purpose of condensing into the form of a soft or solid extract the active principles of oak-bark, and thus, by materially diminishing the cost of freight, to enlarge the range of supply. With the same object in view, Mr. Kent, at that time a resident in the colony of New South-Wales, was employing himself in experiments to prepare an extract from the bark of two species of Mimosa, natives of that country; which bark is in common use at Sydney, and other places, as a material for tanning.

Specimens of this extract were given by Mr. Kent to Mr. Bigge, the Commissioner for inquiring into the state of the colony; and, soon after, Mr. Kent himself returned to England, bringing with him above two tons of the extract prepared by him. This extract it was which formed the subject of inquiry.

It appears, from evidence before the Committee, not only that all the oak-bark grown in this country is purchased by the tanners, but that considerable importations of foreign oak-bark take place, to the amount of about 10,000 tons per annum. Of this, nearly the whole is used by the tanners who live in London and other places on the coast; and of the whole quantity of bark employed in London and its immediate vicinity, nearly four-fifths are foreign bark, exported from the opposite coast of France and Flanders, and selling at the price of about 14*l.* per ton.

The quality of leather is estimated, in a considerable degree, from its colour: the paler that is, the better price it bears in the market. The importance, however, of this character has been greatly over-rated; for, although it be true, that bark which is old, and has been injured by fermentation, will produce a brown leather, brittle, and of bad quality, yet it by no means necessarily follows, that dark-coloured leather is therefore inferior in any of those properties in which the real value of this substance consists.

The bark of the alder and of the larch* are each of them capable of converting skin into excellent leather; but, on account of the reddish-brown colour of such leather, it is very difficult of sale. A similar objection applies, in a greater or less degree, to leather prepared by the extract either of oak-bark or of Mimosa-bark; but as, from the testimony of professional persons, and from an examination of the specimens produced before the Committee, the colour appears, in these cases, to be no indication whatever of inferiority, there is good reason to expect that this prejudice, as far at least as it is prejudice, may in time be overcome.

From experiments made by Mr. Brewin, of Bermondsey, and by other tanners, it appears, that a given weight of the extract of Mimosa will produce as much leather as from four to five times its weight of oak-bark of fair average quality. It is, therefore, not quite equal in strength to the extract of oak-bark. The comparative price, however, of the two more than counterbalances this inferiority; for, notwithstanding the cost of freight from so distant a country as New South-Wales, the expense of bringing it to market must, upon the whole, continue to be very moderate, as long as the Mimosa-trees shall be cut down,

* See a valuable Article, On the application of Larch-Bark to Tanning Leather, by Thomas White, Esq., in Vol. IV. p. 342 of this work.

for the purpose of clearing for cultivation the land on which they spontaneously grow.

NOTE.—The Society has lately awarded its Gold Isis Medal to Mr. Kent, for the introduction of this useful tanning material to this country.

LXXXII.—*On Combinations of a Hydro-pneumatic Blow-pipe, and a Pneumatic Trough and Tray, in one Apparatus; and of a Gas-holder, and Pneumatic Trough, in another. By Mr.* JOHN CUTHBERT, *Optician, and Philosophical-Instrument Maker.**

WITH A PLATE.

SIR, *London, April* 13, 1819.

I BEG leave to offer to the Society for the Encouragement of Arts, Manufactures, and Commerce, a combination of the Blow-pipe and Pneumatic Trough, invented by me: the utility and simple arrangement of which, I hope, will meet with their approbation.

It is well known, that, in chemical analysis, the blow-pipe is indispensably necessary; and the almost constant application of the pneumatic-trough need not be enlarged upon. The apparatus I now lay before the Society combines these two instruments in one; and, when required for either purpose, can at once, without any trouble, be applied to their separate uses.

To a public Lecturer, who often, at the time of exhibiting the effects of gas, may have occasion for a blow-pipe, this combination will be of infinite advantage, by reason of the facility with which oxygen-gas from a bladder may be introduced, and passed through the platina jet, which cannot be fused by the heat required.

When the apparatus is used as a pneumatic-trough, it is only necessary to remove the mouth-piece and cover;

* Now residing at No. 22, Bishop's Walk, Lambeth.—From Vol. XXXVII. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.—The Society voted its Silver Medal to Mr. Cuthbert for these inventions.

which latter, when taken off, becomes a useful tray for transferring the receivers from the pneumatic-trough; the ledge or rim of the cover being sufficiently deep to contain water for that purpose.

The water from the bottom vessel may be occasionally forced up by blowing with the mouth, in case of a deficiency, when many receivers are in use; and it is kept up to the height required by means of a sliding-pipe within the large tube; and if the contrary effect is necessary, by depressing the sliding-pipe any quantity of the water may be let off at once into the lower vessel. By this means, a ready increase or diminution of the water is always in the operator's power, without delay, or the assistance of a second person.

I am, Sir, &c. &c. &c.

A. AIKIN, *Esq. Sec.* JOHN CUTHBERT.

References to Plate XII.

Fig 1. is a view of the apparatus when used as a blow-pipe, with the air-vessel, *b*, laid open to shew the tubes within it. Through the tube, *dd*, which descends within a quarter of an inch of the bottom of the air-vessel, the air is blown from the mouth. The tube *ee* is to convey the air from the vessel *b*, through the jet, to the flame of the lamp: this latter tube contains another tube, which slides into it air-tight, and is shewn at fig. 6; to the extremity of this, a transverse tube is connected, and into this the moveable tube, fig. 7, slides. To the part *g*, of this moveable tube, the jet, *k*, is attached, by a screw at *i*; and, by turning it in the opposite direction to that required when in use, it becomes a stop-cock; and is capable of shutting off the passage of the air, by means of the hole, *h*, in the tube, through which the air passes to the lamp, being turned to the contrary side of the transverse tube, fig. 6.

The large tube, *f*, which reaches within half an inch of the bottom, serves to let the water flow down from the broad or enlarged part of the pneumatic-trough, so as to force the air from the air-vessel, *b*, through the central tube *ee*.

The bent upper part of the tube, *dd*, is capable of being removed occasionally, in order to admit the pipe of a bladder to fit air-tight within it; by which means, oxygen-gas may be forced into the air-vessel (the common air, however, being previously displaced), which will render the flame particularly effective, where a great heat may be required.

The lamp, and its tray, *l*, are placed on the cover of the blow-pipe, so as to allow the wick to stand immediately before the jet. The jet-tube, *e*, can be raised or lowered, for the purposes of elevating or depressing the flame, as occasion may require. *m* shews, by dotted lines, the form of a circular shade affixed upon the tube *dd*, to keep the light of the lamp from reaching the eyes of the operator, as well as to prevent his breath from agitating the flame: it can be turned back at pleasure.

Fig. 2. is a section of the instrument in use, through the front of the trough and air-vessel, and through the tubes *d*, *e*, and *f*; shewing the water descending from the upper part of it, through the large tube, *f*, into the lower vessel, *b*; and forcing the air above its surface, through the central tube, *e*, to the flame of the lamp.

Fig. 3. is the apparatus, when employed as a pneumatic-trough, for collecting gas. The short sliding tube, shewn in fig. 8, which fits into the large tube, *f*, of fig. 2, is furnished with a cap, *n*, to prevent the water from being thrown over the upper edge of the trough when forced up from the air-vessel, by blowing through the tube *d*.

Fig. 9. is a plan of the cap, *n*, of fig. 8.

One of the advantages of this construction is, that, in filling a large receiver with water from the trough, the deficiency can be immediately supplied by raising it from the lower vessel, by blowing with the mouth; and it is retained in the upper compartment of the trough, at any height, by the sliding-tube, *n*, being drawn up even with the intended surface of the fluid.

When the water in the receiver is displaced by the gas, the redundancy is let off into the lower vessel by the same tube.

By this contrivance, the necessity of pouring water into the trough, or emptying it out, by means of another vessel, is obviated; and the operator is relieved from that inconvenience.

The broad expanded surface of the upper part of the pneumatic-trough, when the apparatus is used as a blow-pipe, is peculiarly adapted to keep the pressure of the water nearly equal at all times upon the air, and thus to produce an uniform flame; the altitude of the water being but little varied: it also presents the most convenient form for pneumatic operations.

Fig. 4. shews the cover of the apparatus inverted, when it becomes a tray, into which the receivers may be transferred, when filled with gas. The two short tubes, *o* and *p*, are intended to prevent the water, which is put into the tray to keep the receivers air-tight, from passing through the holes made in it, to permit the tubes, *d* and *e*, to pass through.

Fig. 10. is a plan, and fig. 11. a side view, of the lamp, on a moveable shelf. This shelf, when it is necessary to employ the lamp at the same time that the cover of the apparatus is used as a tray, hangs within the well of the pneumatic-trough, near its top; and it has a bent plate affixed to it at right-angles, with notches or gaps made in it, as shewn in fig. 10; which notches admit the tubes *d* and *e* within them; and thus securely retain the shelf, and the lamp upon it, in their places.

Fig. 12. is a gas-holder, open below, which fits into the well of the pneumatic-trough, and has a stop-cock, *t*, attached to it.

Fig. 13. is a section of the same vessel, shewn as inverted; the stop-cock, *t*, being also removed, and the

aperture made water-tight by the screw, *s*. It becomes a small pneumatic-trough, by the addition of a moveable shelf, with a hemispherical chamber, *r*, connected to its under side, which serves to insure the gas from a retort, &c. passing only through the hole in the shelf; and also to prevent the neck of the retort from slipping out of its position.

LXXXIII.—*On the Preparation of Gold-Beater's Skin, Lathe-Bands, Catgut, Strings for Harps, Violins and other Musical Instruments, &c.**

These various arts all require the previous freeing of the *muscular tunic* from the other membranes which constitute the gut. Anatomists distinguish in it, three membranes; viz. the external one, termed the *peritoneal*; the middle one, or *muscular* membrane; and the internal, or *mucous* membrane. Formerly, the guts were subjected to the putrid fermentation, in order to separate the peritoneal and mucous membranes from the muscular one; and this process was accompanied with such a fœtid effluvia, that the authorities obliged the manufacturers to establish their works at a distance from all other habitations. In 1820, the Prefect of Police, of Paris, proposed to the *Société d'Encouragement*, to offer a prize for a process, either chemical or mechanical, of effecting this object without submitting the guts to the putrid fermentation. The writer had the happiness to fulfil this object, and to merit the premium offered.

After the guts have been freed from all greasiness, by the usual methods, and turned inside-out, they are to be put into a tub, capable of containing as many as are produced from 50 oxen; and two buckets of water, each containing a pound and a half of the *eau-de-Javelle*† (marking from 12 to 13 degrees of the *Pèse-liqueur*, or areometer for alkaline solutions), are to be poured upon them. If they should

* From the *Dictionnaire Technologique*.

† This article is an alkaline liquid, manufactured in the vicinity of Paris, and sold at a cheap rate, for the use of laundresses, &c.—Editor.

not be sufficiently wetted, throw over them another bucket-full of well or river water; they are then to be well stirred up, and left to steep all night. At the end of this time, the mucous membrane may be removed with as much facility as it could be after many days of putrid fermentation*. At the moment of contact with the *eau-de-Javelle*, all fetidity totally disappears.

The other operations may be afterwards performed in the usual manner.

ON THE PREPARATION OF GOLD-BEATER'S SKIN.

When the workman has stripped off that part of the peritoneal membrane which surrounds the *cæcum*, he takes from 2 to 2½ feet in length of it, and inverts it, or turns it inside-out; he then leaves it to dry: when dry, it resembles a pack-thread. In this state it is sold to the manufacturer of gold-beater's skin; who takes the dried membranes, and soaks them in a very weak solution of potash. When sufficiently soaked, so as to have become gelatinous, he places them on a wooden plank, to scrape them clean, and cut them open with a knife. When the pellicles are well cleansed, and sufficiently freed from the water, they are extended on wooden frames, three or four feet long, and about ten inches wide; these are formed of two uprights, joined by two cross-pieces; the cross-pieces have grooves of three or four lines wide made in them.

In order to extend the membrane, the workman takes it in his hands, and affixes one end of it, by its glutinous quality, to the top of the frame, taking care that that part of the intestine which formed the outside of it be placed next to the frame; he then extends it every way, and causes it to adhere to the other end of the frame: this effected, he takes another membrane, and applies it upon that which is already extended, taking care that the muscular membranes should be in contact with each other: in

* For more ample details, consult *L'Art du Boyaudier;* printed by Madame Huzard, December 1822.

this way, they become so perfectly glued together, as to form one solid body.

The two membranes soon become dry, except at their extremities, which are glued to the cross-bars of the frame. When the whole is well dried, the workman cuts the pellicles across at each end with a good knife, and separates them from the frame. The dried and stretched membranes are then delivered to another workman, to give them what is termed *le fond*, being the last preparation; and to cut them into convenient sizes.

In order to finish the pellicles, the workman takes each band separately, and glues it on a similar frame to that which we have before described, but without a groove: he applies the glue upon the edges of the frame, and places on it the band of pellicle. When quite dry, it is washed over with a solution of one ounce of alum, dissolved in two wine-quarts of water, and again allowed to dry; it is then coated, by means of a sponge, with a concentrated solution of isinglass in white wine, in which acrid and aromatic substances have been steeped, such as cloves, musk, ginger, camphor, &c: these last substances are added, to prevent insects from attacking the pellicle. When sufficiently coated with this composition, or, as the workmen call it, *grounded*, they, lastly, cover it with a layer of whites of eggs. The pellicle is then cut into pieces of about five inches square; submitted to the action of a press, to flatten them; and then formed into small packets or books for sale to the gold-beaters. This last process very much resembles that used in preparing the English Court-Plaister, or *le taffetas d'Angleterre*.

ON THE PREPARATION OF LATHE-BANDS.

Before we make known the preparation of the intestines of sheep, for the manufacture of various kinds of cords, we shall mention that of those made of the horse, mule, or ass, called *Lorrains*, for lathe-bands. These intestines receive exactly the same preparatory treatment as those of the ox.

Grinders, polishers, and various other mechanics, use bands, or cords, manufactured from the intestines of the horse, &c. freed from the mucous membrane. The gut is taken hold of by one end; into which is thrust a wooden ball, fastened on the end of a stake, fixed in a block: below this ball are four cutting-blades; or, to render the explanation more clear, it is a cutter formed of four blades and surmounted by a wooden ball: they draw down the intestine equally over these blades, with both hands, so as to cut it into four equal strips. They take four, six, or eight of these strips, accordingly as they wish the cord to be thicker or thinner; then tie these strips by a particular kind of knot at one end, with large twine, made on purpose, which they call a lace; and pass the end of it over a peg secured in a hole made in a post strongly fixed: at the distance of about 80 feet, is placed another post with pegs, on one of which they pass these strips: near to the first post, the strips are all tied together with a new lace, which they fasten to the peg whereof we have just spoken: the workmen call this first operation the "warping." They cut these strips, and fasten them as above described, if they are long enough (which is generally the case), being careful that the ends are always taken in with the thread, having cut them previously across, so that the seam shall not form any unequal thickness. If they are long enough, they make a second length, till the gut is all taken in, or the pegs entirely filled.

When the weft is finished, the workman places his wheel conveniently, and passes over the hook of the emerillon the thread which holds the weft-cord: he puts on a second lace, if the wheel be strong enough to bear it; gives several turns to the wheel by means of a handle; and places the already-twisted cord over a hook. He acts the same with every woven cord; passing his hand carefully along the cord from the wheel, and cutting with his knife all those fibres or threads which will not form one body with the cord. This never shortens in drying, provided it is always gathered together at the same dimension over the pegs. Some hours having elapsed, they replace the cords upon the wheel, and twist them afresh: 12 or 15 hours afterwards they take them one after the other, and fasten the lace to a peg which they turn with the hand; the wheel seldom being strong enough. This twisting being effected, they rub it with a horse-hair cord dipped in water, which they form into a bundle, and hold between their hands. This operation is called "stretching." Another twisting is made 3 hours afterwards; and they stretch it as forcibly as possible, after again fixing the cords over the pegs, and to the posts.

If the cord, when sufficiently dry and twisted, is not exactly even, they polish it with a piece of dog-fish-skin; but if the horse-hair cord has been passed enough over it, that becomes unnecessary. When the cord is dried and stretched, it is not generally sulphured. When perfectly dry, they cut the two ends near to the lace, and coil it into a ring for sale.

The instant that the workman who makes these cords receives the intestines, he is obliged to wash them; to turn them inside-out; and to steep them in a barrel, containing two pails of water, mixed with a pound of *eau-de-Javelle*, of the strength we have before noticed. This quantity will serve for 15 or 20 intestines, and only increases the expense to the manufacturer, for this number, about ten centimes. On the morrow, he separates the mucous membrane, by the ordinary means; washes the guts in a large tub of water; cuts them into strips; puts the laces round them during the day, and gives them the first twist: the next day, he finishes them.

If the cords be not sufficiently dry by the next day, he is obliged, for the sake of salubrity, to repeat the operations. After this, the fœtid odour is no longer perceptible, and he may finish the cords at leisure.

(*To be continued.*)

LXXXIV.—*On British White Herrings, cured equal to the best Dutch Herrings.* By *Mr.* JAMES FREDERIC DENOVAN.*

[Continued from p. 234.]

IN the Society's premium list for the session 1821 and 1822, the gold medal, or fifty guineas, is offered for the best sample of white herrings, cured in Great Britain or Ireland. For this premium, Mr. Denovan, who had been rewarded in the two preceding years, for an improved method of curing herrings, and for his successful competition with the Dutch in the Hamburgh market, became a competitor. His Letter on the subject, dated the 18th of December 1821, was duly received, as well as a 16-gallon cask of herrings. From the tenor of his Letter, it did not clearly appear whether he was a candidate for the premium for curing, or for that for exporting, cured herrings; and a Letter, requesting explanation on this head, was sent him by the Secretary, on the 21st of the following month. Before the arrival, however, of this Letter, Mr. Denovan was gone to prosecute the fishing on the West coast of Scotland, and it did not reach him till the month of May. On the 15th of that month, he answered the Secretary's Letter, and forwarded a Certificate from Messrs. Cordes and Grönemeyer of Hamburgh, attesting the excellent quality of the herrings forwarded by him to them, for sale in that city. Together with these documents, he also sent an Essay on the Natural History of the Herring, and on the Herring Fishery.

These papers, however, did not arrive in time to be taken into consideration, and to be reported to the Society, before the commencement of the vacation. The

* From Vol. XLI. of the Transactions of the Society for the Encouragement of Arts, Manufactures and Commerce.—The Society voted the sum of Fifty Guineas to Mr. Denovan, for the continued zeal and success with which he has entered into competition with the Dutch, in the early supply of the Hamburgh Market with Pickled Herrings of very superior quality; thus demonstrating, that *this very important branch of commerce is completely accessible to British enterprise.*

cask of herrings, sent as a sample, was therefore not opened; but was placed in the Society's Repository, with directions that it should be rolled over from time to time. Notice of this being sent to Mr. Denovan, a Letter was received from him on the 28th of the following December, containing a general account of his proceedings during the last fishery, and announcing that he had sent a cask of the present season's (1822) herrings, to replace that formerly sent, *which, from its having been kept a year longer than was intended, would probably be found in a bad state.*

This second barrel duly arrived; and on the 28th of February, 1823, the Committee proceeded to examine the contents of the two barrels.

The fish last sent greatly resembled those for which Mr. Denovan was rewarded two years ago. Their scales were quite bright, the flesh was white, perfectly well preserved, but somewhat hard, and with but little flavour. *Those which were received the year before, and which, from their having been kept on the ground-floor of the Society's house during a very hot summer, were expected to be tainted,* presented the following appearance: their scales were not so bright as of the preceding, nor was their flesh so white, it having become of a pale yellowish brown; at the same time, it was found to be soft and mellow, without being in the least degree flabby, *and the flavour was unanimously considered as far superior to that of the recently-pickled fish!* Thus, the accident which prevented the investigation of this claim at the regular time *has had the beneficial consequence of shewing, that Mr. Denovan's herrings may be kept through the second year, under circumstances in several respects not very favourable, not only without injury, but with a manifest improvement; especially in those characters which constitute the peculiar excellence of the Dutch herrings.*

Sir,

Having been favoured, by a friend, with a copy of the printed list (of premiums), about the middle of December last, and observing that the Society had again offered their gold medal, or fifty guineas, for the best sample of white herrings, I forwarded a sixteen-gallon barrel, containing a fair specimen of about one hundred and fifty barrels, cured by me on the west coast of Scotland; one hundred and forty-two of which were exported to Hamburgh, in June and July 1821: but it being impossible to procure certificates from Hamburgh, in time to be delivered in by the first Tuesday in January following, I resolved to abandon any claim I might otherwise have had to the premium; and to draw up at leisure, and to present to the Society, such a communication on the state of the British Herring Fishery, as might, I conceived, be worthy their attention and approval.

I had previously determined to write and publish a treatise on the British Herring Fishery; which, from the experience I have had, the pains I have taken, and the information I have collected, I felt justified in thinking would throw more light on the subject than any thing of the kind which had gone before it: but I have deviated from my original plan, and endeavoured to compress the whole into a less shape; which I now offer, with much deference, to the Society.

My former communications to the Society contained succinct details of my proceedings during the years 1817, 1818, and 1719; and it will now be necessary, by way of introduction, and before entering upon other topics, to continue the detail, by relating what I have done, and what improvements I may have made, since that period.

In the beginning of June 1820, I proceeded, as on former years, to the west coast; but it was some time before the herrings made their appearance. Those that first appeared off the headlands and bays, came in such very small quantities, that it was impossible to cure them; some fishermen not being able to obtain more than a hundred, or half a hundred, within the twenty-four hours; and the boats were, consequently, so much spread, and at such distances from one another, that the herrings were generally *sun-struck;* which injured the scales so much, that I could not attempt to cure them. All herrings which are allowed to lie exposed to the sun, or even to rain, for any length of time, before getting salt, appear of a lead-colour; and no care or attention afterwards will restore the brightness of the scales: they also become extremely soft; and cannot be brought, by pickling, to that degree of firmness which is necessary for their preservation: for I have found, by repeated experiments, that they do not discharge, as fresh herrings do, the fixed-oil, on being primed, but rather seem to absorb it. Hence it is impossible they can either be well-flavoured, or expected to keep for any length of time; and this is, among others, the reason why a great proportion of the herrings, cured by coopers and peasants on the north and east coasts of Scotland, are black at the bone, and so very inferior to those of Holland.

Independently of quantity, I also found that the herrings were inferior in quality to those of the preceding year; the greater part being what are called, by the Dutch, *Nacht-skaam*, or *Sea-sticks*, a species of herring which will not find a market in Hamburgh: on the contrary, if only a few of such fish are admitted into a barrel of sound herrings, they will not bring one-third of the price they would otherwise have done.

The appearance of the herrings in general was poor; and they were more lean, and less succulent, than I had found them in former years. After a few fine showers, however, they began to improve, and the shoals became larger. It was, however, the 20th of June, before I could venture to cure; and, on the 27th, I had only twenty-eight barrels primed or bung-packed; the contents of which were packed from as great a quantity of herrings as would have filled at least thirty barrels; but this was absolutely necessary, from the quantity of Sea-sticks and Stragglers that appeared in every net. Finding that the Canal gates were shut (to admit of some repairs being made on the locks or banks, which are generally performed at Midsummer), I sent my herrings to Glasgow: and, in order to save time, had them conveyed to Leith by carts; an expedient which nothing but necessity could warrant; for the jolting of the carriages, and the exposure of the casks to the sun, are extremely injurious to the herrings, in many respects: but I had no choice; for a few days might have enabled my opponents, the Dutch, to reach market before me. On my arrival at Leith, I found that the herrings had suffered considerably: two of the barrels had lost nearly all the pickle; while a great proportion of the fish, by rubbing against the ends and sides of the barrels, were not only divested of their scales, but had their skins stripped off, as if they had been rasped. Of the twenty-eight barrels, I could only make up twenty-four, that were at all passable; which I shipped by the smack Albion, and consigned to the respectable house of Cordes and Grönemeyer, of Hamburgh. *They left Leith on the 29th of June; and reached their destination on the 4th of July, four days before the first Dutch Jager; and, with all their imperfections, brought, by public sale, about 3000 marks-banco; netting a profit of about one hundred pounds sterling!*

From the proportion of lean and poor fish, that continued to appear in the shoals up to the middle of July—the small quantity taken, and the great prices that were given by the wherry-men, who supply the fresh-fish market at Glasgow—I declined curing any more early herrings at that time: for, although the prices began to decline in Hamburgh, they were still the same there; and as, by carefully picking the herrings, I should be forced to reject all the Sea-sticks and lean fish (which cost me as much as the sound ones), I saw that no advantage could be gained by making a second exportation to Germany.

Over and above the twenty-eight barrels, I also filled a quarter-barrel and a few small kegs. The former of these I sent to the King; in uniformity with the Dutch, who always transmit a barrel of the first-cured herrings to their Sovereign. I was honoured with a Letter in return, from Sir Benjamin Bloomfield, Bart. by command of his Majesty, who was graciously pleased to accept of my offering, and "*considered the herrings to be of the finest and most delicate flavour.*"

Towards the end of August, and beginning of September, the herrings improved considerably; and I cured between twenty and thirty barrels, which I afterwards packed into kegs, for the supply of my Agents at Edinburgh and other places. A considerable portion of this quantity I cured, by way of experiment, in the following manner:—

IMPROVED PROCESS FOR CURING WHITE-HERRINGS.

I caused the herrings, after being gutted and assorted, to be regularly laid, in half-dozens, on a thick plane-tree board, made on purpose; and their heads to be cut off, by means of a knife with two handles, such as is used by tanners and curriers. This operation was easily performed, by pressing down the one hand after the other. They were then packed into a barrel, in the Dutch manner; that is to say, a little fine Cadiz salt was strewed on the bottom of the barrel, and the fish laid regularly on their backs, with their bellies upwards; and so closely wedged together, as to prevent them from sliding out of that position: between each layer of herrings, *half* the quantity of salt usually employed was carefully strewed, with a tin drainer; and when the barrel was packed to within eight inches of the top, a quantity of strained or refined pickle, sufficient to fill the interstices, was poured in at the top. The lid was then loosely put on; and, in this state, they were suffered to remain for three days. On removing the lid, the fixed-oil was floating on the top: this, being removed by means of a brush made with goose-quills (the use of which I have introduced, as being preferable to the tin-skimmer used by the Dutch and British), the pickle appeared higher in colour than usual, and less slimy. A part of the pickle being then removed, the barrel was fully packed, from another cask *of the same night's taking*; and a little salt being strewed on the top, it was headed up. The barrel was next turned topsy-turvy, and set on end; in which position it stood for eight days: it was then opened as it stood; and, as some fixed-oil still appeared, a quantity of pickle was poured in, to make it rise; when it was wiped off as before; and the barrel, being packed with an additional layer of the same herrings, was headed up, and laid on the *bulge*, as being complete.

In my own opinion, these herrings were very superior, in the points of flavour and softness, to the best Dutch herrings cured with their heads on: they were much more succulent; and, from the whole of the blood-vessels being opened and discharged, would certainly keep much longer than those cured in the common way. But I am sorry to say, that the public were startled at their appearance, and, without giving them a trial, purchased those with heads in preference. I sent a cask of these herrings to the King, in October 1820; and had a Letter in return, from Sir Benjamin Bloomfield, Bart. acquainting me, *that his Majesty was much pleased with my attention; that the herrings were most excellent; and that the King had been most graciously pleased (as a mark of Royal favour) to appoint me Purveyor of Herrings to his Majesty!*

I also sent samples of these herrings to several scientific Gentlemen of Edinburgh; who expressed their approbation of the improvement; and were decidedly of opinion, that, *were our colonial merchants to order their herrings to be cured in this way, they would reap much benefit from the experiment.*

In May 1821, I freighted a very fine fast-sailing cutter, called the General Johnston, of Greenock; with which I sailed from that port, on the 5th of June following: but, owing to the state of the weather (continued gales of wind from the W. N. W. and N. N. W. with no rain), I could procure no herrings until the 23d of that month. I also freighted a large open boat, and had her stationed at the mouth of one of the Highland Lochs, where early herrings are frequently found. But all my endeavours to procure herrings, at all fit to be cured, proved fruitless, until the night of the 23d of June; when a very few *maatjes* were got, amongst a vast quantity of Sea-sticks and Stragglers. On the night of the 26th, I made up, with much difficulty, 25 barrels sea-stock, (that is to say, herrings in the priming, which require to be afterwards filled up,) which I sent on to Leith, where they were reduced to 23 barrels in the making up, and shipped to Hamburgh on the 30th of June, by the smack Courier. After the first of July, when it began to rain, great bodies of herrings sprung up from the bottom of the deep, like flocks of small birds, with such velocity, that the nets appeared to be raised by them above the surface of the water; and as the rain continued to fall, they increased in number; and seemed to crowd into all the inlets and bays where the bottom was sandy, or where the points or projections of the coast indicated a profusion of *algæ*, common fucus, or other marine vegetables. On the 7th of July, I sent to Leith 97 barrels sea-stock; which were reduced, in filling up, to 89 full-packed barrels; and were shipped to Hamburgh on the 12th, by the smack Rhine: and on the 14th, I transmitted to Leith 48 barrels sea-stock; 30 of which, when made up, were shipped to Hamburgh, by the smack Glasgow: and the remainder were packed into kegs for family use, and sent to my Agents at London, Edinburgh, Leith, and other places.

Independently of the 25 barrels first cured, I also made up a cask for the King; which was sent off from Leith on the 2d of July. *These herrings gave so much satisfaction, that, as I was informed by a Letter from Sir Benjamin Bloomfield, Bart. they were served up at the Coronation Banquet, by express command of his Majesty.*

(To be continued.)

LXXXV.—*Survey of the Metallurgic Products of France; as exhibited at the Louvre in* 1823. *Extracted from the Report made to the Central Jury, by* M. Heron de Villefosse, *Inspecteur Divisionnaire au Corps Royale des Mines, &c.**

Lead.—Mines of this metal are worked in the departments of Finistère, Lozère, Isère, and Haute-Loire. The working of the mines of Lacroix and Sainte-Marie, in the departments of the Vosges and Haut-Rhin, have recommenced with an activity which promises the greatest success.

Other researches, made in various parts of France, and particularly in the department of La Charente, have discovered new beds of lead-ore.

French industry continues to be usefully employed on this metal. The exhibition contained specimens of *rolled-lead*, from the thickest to the thinnest, sent from the departments of the Vosges and the Seine.

Drawn-lead pipes, of every diameter, and without solder, were sent from the departments of the Bouches-du-Rhône, and the Seine.

Lead-shot, from the departments of the Indre-et-Loire, and the Seine. The shot of the latter is made, of all sizes, at Paris, in the tower of St. Jaques-la-Boucherie, by the process of precipitating lead in fusion from the top to the bottom.

White-lead, or *ceruse*, from the departments of the Loiret, the Bouches-du-Rhône, the Seine, the Nord, and the Ardennes.

Red-lead, Orange-lead, Litharge, and other preparations from lead, were sent by the departments of the Seine, Indre-et-Loire, and Bouches-du-Rhône.

Copper.—The mines of this metal are in full activity in the department of the Rhône. Many new veins of this metal have been discovered. The Exhibition presented beautiful specimens of copper-ores from the department

* From *Férussac's Bulletin Universel des Sciences*, &c.

of the Corrèze, and various products obtained from this metal.

So numerous are the beautiful productions from this metal in the French manufactories, that if the greater part of the copper were imported from other countries, France would be materially injured.

The Exhibition presented fine sheets of *rolled-copper*, large bottoms of boilers, and various other works in copper, such as tubes, baths, apparatus for distillation, &c. These articles came from the departments of the Eure, Nièvre, Haut-Rhin, Haute-Vienne, Doubs, Oise, and Seine.

Copper-rods, for wire-drawing, from the departments of the Rhône and Haut-Rhin.

Zinc.—Large leaves of rolled zinc, from the department of the Ardennes.

The department of the Seine afforded cocks and baths of zinc.

The department of La Manche afforded rolled-zinc, nails for ships'-bottoms, and a bugle-horn, sent by an inhabitant of Paris, who is the proprietor of the celebrated mine of Vieille-Montagne, in Limbourg, and has lately established a large zinc-manufactory at Valcanville, in the department of La Manche.

Brass.—The manufacture of brass, which was introduced into France about twelve years ago, continues to make progress. Many manufacturers of copper also make brass, particularly in the departments of l'Eure, Haut-Rhin, and the Ardennes.

Bronze.—Candelabras, tables, statues, table-ornaments, and other works in bronze, were sent from the department of the Seine.

Two gongs were sent by the Royal School at Châlons, department of the Marne.

Medals cast in bronze, from the Royal Mint.

Mercury.—Vermilion, or the sulphuret of mercury, from the department of the Seine.

Cast-iron, which has been cast in the open sand, and in moulds, was particularly distinguished.

Specimens of rough castings were offered to the notice of the public, from the departments of the Nièvre, the Yonne, the Isère, and the Loire. The first of these establishments, situate at Bizy in the department of the Niève, furnished a rough cast-iron, which had been successfully employed in the manufacture of steel. The second, situate at Ancy-le-Franc, in the department of the Yonne, and which was only founded in 1822, has already supplied soft cast-iron of the best quality. The third, at Saint Hugon, in the department of the Isère, produced excellent grey cast-iron, for steel, in the furnaces which have been recently constructed on the plan of those used in Styria, and which greatly economize the charcoal employed. The fourth, situate at Janon, near St. Etienne, in the department of the Loire, afforded a recent example, *till now unique in France, of the fusion of iron ores from the iron- and coal-mines, without the addition of any other mineral than pit-coal.*

A great number of articles of iron cast in moulds were presented from manufactories in the various departments; viz.

Cast-iron tiles, from the first fusion, from the department of the Haute-Saône.

Pieces of machinery, cast in damp sand, from the department of the Haut-Rhin.

Plough-shares, *vases*, and other articles of cast-iron, from the departments of the Eure and the Nièvre.

Toothed wheel-work, from the department of the Nord.

Various articles in soft cast-iron, from the Eure-et-Loire, and from the Loire.

Vases, *palisades*, and *statues*, from the department of the Haute-Marne. Iron, cast in moulds, from the manufactory of Ancy-le-Franc, as above mentioened.

Various articles of cast-iron, executed in the workshops of the Royal School at Châlons-sur-Marne.

Vessels and culinary articles of cast-iron, coated internally with enamel, from the department of the Doubs.

Chimney-fronts, clock-stands, endless chain-wheels, mortars, small rollers, busts, medals, and all kinds of ornaments in iron, cast in moulds, from the department of the Seine.

We likewise observed a great number of steam- and other engines, parts of which were made of cast-iron; proving that this branch of French industry continues to make great progress.

Bar-iron.—It was only in 1823, that France saw, for the first time, among the products of her industry, a great quantity of bar-iron, refined in reverberatory furnaces, by means of pit-coal, and made into bars by cylindrical and grooved rollers. The Exhibition of 1819 presented the first essays in the manufacture of these iron-bars, which gave the promise of very important improvements; but, at that period, they had never refined cast-iron in a reverberatory furnace with pit-coal, except in the department of the Isère, at the manufactory of Vienne; and iron had never been formed into bars, by means of various-channelled rollers, but in the department of Cher, at the forges of Grossouvre.

France now possesses a great number of establishments, all created since 1819, wherein is employed with success the process of refining and laminating, known, for about 30 years, by the denomination of the *forge à l'Anglaise.* The French had continually been reproached with remaining in the back-ground, in this respect; but completely to justify us, we have now the pleasure of mentioning the principal manufactories of this kind, that are either established, or are on the point of being erected, at the following places; viz.

At Saint Julien, near Saint Chamond, in the department of the Loire;

At Moyœuvre, and at Hayange, Moselle;

At Basse-Indre, near to Nantes, Loire-Inférieuze;

At Château-la-Vallière, near Tours, Indre-et-Loire;

At Bigny-sur-Cher, in the department of Cher;

At the forge of Bruniquel, near Montauban, Tarn-et-Garonne;

At the forge of Maisières, between Vesoul and Besançon, Haute-Saône;

At Fourchambault, Nièvre;

At Raismes, near Valenciennes, Nord;

At Janon, and other places, in the neighbourhood of Saint Etienne, Loire; and

At Charenton, near Paris.

Other manufactories of the same kind are forming,

At Oberbruck, department of the Haut-Rhin;

At Magnaincourt, near Saint Loup, Haute-Saône;

At the forges of Montcey, Doubs;

At Montataire, Oise, and other places.

There are also similar ones projected in the neighbourhood of the coal-mines at Decize, in the department of Nièvre; at Commentry; at Allier; at Ronchamp, Haute-Saône; and many other parts of France; particularly amongst the coal-mines of Saint Etienne, in the department of the Loire.

Wrought-iron, manufactured by means of pit-coal, was sent from the departments of the Moselle, the Nièvre, the Doubs, and the Oise.

We also saw bar-iron, and iron forged by the hammer to various sizes, made from cast-iron obtained by means of pit-coal, at Janon, in the department of the Loire.

The departments of the Indre and the Cher, corresponding with Berri, have for a long time been celebrated for the good quality of their iron; and exhibited it both in bars and rods, made according to the old process of refining it with charcoal.

The manufactory at Chatillon, in the department of the Côte d'Or, exhibited iron made by a new process, being refined in a reverberatory furnace, by means of wood.

In many of the departments, the proprietors of forges continue with success to increase the height of their high-furnaces, in which iron-ores are reduced to the state of cast-iron by means of charcoal. Several persons have announced their intention of reducing iron-ores in the reverberatory furnace, either with pit-coal or wood.

It appears from the Report made in 1819, that France produced and consumed annually little less than one million of metric quintals of forged-iron in large bars, which quantity employed about 300 of the old forges. But if we consider, on the other hand, that one forge upon the English plan—such, for instance, as the manufactory of Fourchambault—would furnish annually more than 50,000 metric quintals of iron refined by pit-coal, we see that twenty such manufactories would be sufficient to make all the iron which is consumed in France.

We must now remark, that there already exist in the French territories nearly twenty manufactories on the English plan. And thus the moment cannot be far off when the iron-works in France must necessarily experience a kind of revolution, the results of which will be as serious, as they are difficult to foresee. Whatever may happen, let us hope that the amelioration of the processes will turn to the profit, both of French industry, and the numerous consumers of iron.

Steel.—The exhibition of 1823 was much richer in French steel than any of the preceding ones. There was steel of all sorts; such as, natural steel, cemented steel, and cast-steel, sent from the following departments; viz. Nièvre, Isère, Loire, Ariège, Côte-d'Or, Loiret, Meuse, Moselle, Haute-Saône, Doubs, Haute-Vienne, Pyrénées-Orientales, Haute-Garonne, Aude, Indre-et-Loire, Seine-et-Oise, and Seine.

We shall mention the products of these various kinds of steel, under the following titles; viz. scythes, files, saws, cutlery, tools of various kinds, and fire-arms: in which we cannot but remark the excellent quality of the French steel, as well also of the French iron; which was confirmed by the goodness of the articles made of sheet and tinned-iron, as well as of the iron-wire produced from it.

Scythes and *sickles.*—The departments which furnished scythes to the Exhibition of 1823, were the following; viz. Ariège; Puy-de-Dôme; Haute-Garonne; and Doubs.

The progress which this manufacture continues to make in France, although but recently established, increases our hope of seeing France freed from the necessity of importing foreign scythes.

Files and *Rasps.*—Articles of this description were sent from nineteen different places for exhibition in the year 1823. We noticed, with pleasure, in the Exhibition for 1819, that ten manufacturers had sent specimens; while in that of 1806, only seven had sent articles of their manufacture; and yet we then congratulated ourselves thereon. The manufacture of these articles is in full activity in the following departments; viz. Ariège, Haute-Garonne, Aude, Nièvre, Indre-et-Loire, Loiret, Côte-d'Or, Bas-Rhin, Moselle, Haute-Marne, Seine-et-Oise, and Seine.

The first manufactory of this kind was established in 1784, at Amboise, in the department of the Indre-et-Loire. This establishment could not be maintained, notwithstanding the encouragement of Government: the Revolution annihilated it. It is, nevertheless, now flourishing, though surrounded with numerous manufactories of the same description, which continue to increase daily. We may judge, from this fact, of the progress which French industry is making in the metallurgic arts.

Saws.—This manufacture also continues to make great progress in France. The Exhibition of 1823 contained specimens from five manufacturers; viz. from the departments of Puy-de-Dôme, Moselle, Doubs, Bas-Rhin, and Seine.

The manufacture of saws from rolled-steel, both natural and cast, was introduced at Molsheim, in the department of the Bas-Rhin, in the year 1819; and, about the same time, both there and at Paris, circular-saws of cast-steel were made—articles, the use of which is now widely diffused, and which England alone had until then furnished.

Sheet-iron.—The reputation of the French sheet-iron was fully confirmed in the Exhibition of 1819, as well as in that of 1823. The products exhibited came from the departments of the Moselle and the Nièvre.

Amongst the specimens of sheet-iron sent from the manufactory at Imphy, in the department of the Nièvre, we remarked two boilers of thick sheet-iron rivetted together: this is a new manufacture in France. The excellent quality of the sheet-iron from this establishment, and also that from Mayœuvre, in the department of the Moselle, as well as that from Pont-Saint-Ours, in the department of the Nièvre, was shewn by the beautiful specimens of tinned sheet-iron also sent from those manufactories.

Sheet and *rolled-steel.*—The manufactory at Bèze, in the department of the Côte-d'Or, furnished beautiful sheets of steel. That at Molsheim, in the department of Bas-Rhin, furnished bands of rolled-steel for springs, which were perfectly uniform in width; and one of them was thirty-six metres long.

In order to shew the incontestable progress in this branch of manufacture, we need only remark, that, twenty-five years since, sheet-iron or steel was only made in France by means of the hammer; whilst, now, the use of the laminating-rollers is very generally diffused.

Tinned sheet-iron.—This was chiefly sent from the departments of the Vosges, the Moselle, Haute-Saône, Nièvre, and the Oise.

The manufacture of tinned-sheet-iron is brought to perfection in France, not only by the use of the rollers, but also from a process in which the oxidation of the sheets of iron is greatly lessened, by the use of furnaces of a particular construction; so as to be more readily cleaned, by the action of weak acids, before tinning them.

We know that the removal of the scales occasioned by the fire, in the usual mode of manufacturing tinned-iron-plates, occasions a great loss in iron, from the surfaces of the sheets being necessarily freed from the oxide of iron, which would prevent the tin from adhering to them. This process is now effected with a certainty of success, which appears deserving of remark. For instance, in the manufactory at Imphy, in the department of the Nièvre, the diminution of weight in the iron, which results from the trifling oxidation in the fire, is always compensated by the augmentation in weight which it receives in the tinning. One hundred and fifty sheets of iron, each 12 inches long and 9 wide, and which weigh, on an average, 80*lb. poids de marc*, lose only 5*lb.* of this weight in the cleaning, and acquire an equal weight in the tinning. Thus, about six per cent. in weight of the sheet-iron employed is lost in the cleaning, and again replaced by tinning. The thinness, the pliability, and the smooth surface of the sheets of tinned-iron now manufactured in France, are fully shewn by the variety of articles exhibited.

Metal-wire.—Under this head we shall distinguish iron, steel, copper, zinc, and brass-wire; also copper-wire silvered or gilt; and copper-wire covered with zinc or brass.

Iron-wire, from the departments of the Doubs, Vosges, and l'Orne.

Brass- and *steel-wire,* from the department of the Doubs.

A model of a bridge, made of iron-wire, was sent from the department of Ardèche; after which model it was proposed to construct a bridge over the Rhône, between Tain and Tournon.

Cast-steel-wire, from the department of the Loire. This wire, made of French steel, from the same department, was fit for making pieces of clock- and watch-work, and needles. This establishment is now able to furnish all the kinds of steel-wire required in the works of France.

The department of the Seine exhibited steel- and iron-wire, and wire-strings for musical instruments, made of different metals.

Copper-wire, from the departments of the Haut-Rhin, the Ardennes, and the Orne.

Zinc-wire, from the departments of La Manche, and the Orne.

Brass-wire, from the departments of the Eure, and the Ardennes.

The departments of the Haut-Rhin, and the Rhône, exhibited white and yellow copper-wire, of the fineness of hair.

The yellow wire was obtained from cylinders or rods of copper, on which zinc was applied, by a species of cementation; so that the exterior surfaces of the cylinders passed to the state of brass.

The products of the French wire-drawers shew at once the excellent quality of the metals employed, and of the processes to which they have been submitted.

Not many years since, wire was drawn in France by means of tongs; which left marks of their teeth upon the wire, very injurious to it. But now the use of tongs is nearly abandoned by the employment of a very simple machine, in which the wire is drawn and applied upon the surface of a revolving-cylinder; and thus the marks left by the teeth of the tongs are completely avoided. This is not the only improvement which we have observed in the French wire-drawing processes, and which have become so celebrated.

Needles.—In the Report on the Exhibition of 1819, we regretted that there did not exist in France any manufacture of needles: one of this description was, however, founded in 1820 at l'Aigle, in the department of the Orne; and in the Exhibition of 1823, both sewing- and knitting-needles were sent from it. The eyes of the needles made at l'Aigle are grooved and pierced by means of a machine. These needles are said to be from twelve to fifteen per cent. cheaper than those imported; and the manufactory employs upwards of a hundred and sixty men, women, and children. Another manufactory of this kind is also established at l'Aigle, which is likely to produce the happiest results; but this has not yet exhibited any specimens. We hear of a third, at Paris, in the Champs-Elysées; but it is said that they only finish needles which are prepared in England.

Cards.—The improvement of the iron-wire cards which are employed in the manufacture of cloths is shewn in the beautiful products from various establishments. We saw in the Exhibition, superfine cards, and ribbons of cards, for wool and cotton, from the departments of the Nord, the Eure, the Seine-et-Oise, and the Seine.

Reeds of drawn wire, for weaving cloth, from the departments of the Haut-Rhin, the Rhône, the Seine-Inférieure, and the Seine.—The number and fineness of the teeth, and the combination of these reeds, greatly contribute to the superiority of the French cloths.

Awls.—There are two manufactories of awls, in great activity, in the department of the Meurthe, which have sent specimens.—One of these establishments annually makes six hundred thousand awls for shoemakers and others; and the other, fifteen hundred thousand. We know that the fabrication of these instruments, so useful in many of the arts, is also carried on at Marseilles, in the department of the Bouches-du-Rhône. Thus, these awls, which could only be procured in France, a very few years since, from foreigners, are now furnished in abundance by French manufactories.

Metallic- or wire-cloths.—The utility of these cloths, in which we see the metal rivalling in fineness the most delicate stuffs, is known in numerous workshops where sieves are employed, in the paper-manufactories, and in all other establishments where metallic-cloths are employed, either as fire-guards, screens for safety-lamps, window-blinds, &c.

Articles manufactured of iron, copper, brass, or silver wire (amongst which we remarked some with cross tissues of steel, gold, silver, and steel bronzed and burnished) as well as other similar products, were sent from the department of the Bas-Rhin, the Seine, Charente-Inférieure, and the Nord. The beauty of these works attracted the attention of the public. We remarked, also, with surprise, metallic gauzes of an equal tissue and exquisite finish, and even a waistcoat made of metallic tissue. These objects shew that this species of manufacture is greatly improved in France, since the Exhibition in 1819.

Nails.—Large nails were sent from the department of the Meurthe, made at an establishment already noticed for the manufacturing awls and points. Other nails of every kind were sent from the department of the Somme. In one manufactory they make, annually, 300 metric quintals of nails.

The department of the Seine presented nails, called *Joiners'-points,* used by locksmiths, glaziers, and others; the points of which are made round.

The department of the Ain sent *Paris-points,* or *glaziers'-points,* which were produced from a manufactory recently established.

It would be superfluous to dwell on the importance of the nail manufactories, as they are indispensable articles in almost every art.

Polished-steel, and fine hardware.—The department of the Seine furnished polished-steel for clock- and watch-work, and various other articles: these products were worthy of the reputation acquired by the French manufactories. Owing to the beautiful polish which French steel will receive, the steel trinkets made of it were the most admired of any that were exhibited in 1823.

Steel trinkets.—Polished-steel combs were sent from the department of the Nord.—Buckles, and fans, from the department of the Bas-Rhin, and the Moselle.—Rings, buckles, various trinkets, sword-hilts, crosses, medallions, a bouquet of artificial flowers, and a scarf, were exhibited from the department of the Seine.—The beauty of the workmanship manifested in all these articles will maintain and increase the reputation of French manufactures.

Locks.—A great number of locks, of the finest workmanship, were brought from the departments of the Haut-Rhin, the Somme, the Aube, the Maine-et-Loire (Royal School at Angers), the Hautes-Alpes, and the Seine.

The well-known manufacture established at Beaucourt, department of the Haut-Rhin, presented, amongst its numerous articles of hardware, locks, and padlocks with circular bolts, for which the manufacturer took out a patent in 1822.

The flourishing manufactories established at Escarbotin, in the department of the Somme, exhibited safety-locks, secret-locks, and other articles of the same kind.

The department of the Aube sent a lock with four keys, each of which differed in form from the three others, and nevertheless opened and closed the lock. Besides this fine specimen of a lock, many other curiosities in mechanism were also sent.

The Royal School of Arts &c. at Angers sent door-locks and strong chest-locks. The department of the Hautes-Alpes sent a newly-invented lock, with no apparent key-hole; and an *espagnolette* window-fastening

Articles sent by the various manufacturers in the department of the Seine consisted of locks, strong iron-chests, combination-padlocks, a great number of models, and other articles in the higher classes of lock-making.

All these products merited the attention of the Central Jury; some, for their ingenious combinations and fine execution; and others, for their moderate prices.

We particularly remarked, amongst these articles, iron window-frames with ornamental mouldings, which were bent and formed with the hammer; a newly-invented compass; models of the various articles made by locksmiths; the model of a mausoleum, of polished iron; also a monument erected to the memory of a Prince whose loss afflicted all France.

Cutlery.—Fifty-two different kinds of cutlery were exhibited. They were sent from the departments of Calvados, La Manche, Côtes-du-Nord, Meurthe, Haute

Marne, Vienne, Loire, Bouches-du-Rhone; Puy-de-Dôme (a department which has presented thirteen different specimens), and the Seine (which has exhibited the products of twenty-six manufactories).

Among these numerous productions—which were nearly all remarkable, either for the goodness of the blades, the elegance of their workmanship, their mountings, or for their variety, and the moderate prices of them—we particularly distinguished excellent razors, table-knives, penknives, and scissars; as well as surgical-instruments, worthy of being employed, as they are employed, by French surgeons.

Tools, and large Hardware.—A great number of tools, and articles of large hardware, were sent from the following departments:

The Bas-Rhin exhibited—besides edge-tools for joiners, turners, and others—a great number of articles in hardware, the making of which has been introduced into the establishment at Molsheim since the year 1819. This manufactory belongs to the same proprietors as those for making fire-arms at Muntzig; and swords, bayonets, &c. at Klingenthal; as well as many other large manufactories situated in this department.

The Haut-Rhin sent, from the manufactory at Beaucourt, iron and copper hinges, wood-screws, rings and ferules, copper-screws, and nails for water-vessels (used in ships and locks) as already mentioned.

The Ardennes sent iron forks, both tinned and polished; curbs for bridles; and other articles in hardware.

The Aube—plane-irons.

The Jura—iron-work, of various instruments used in agriculture.

The Hautes-Alpes—stone-cutters' tools.

The Doubs—various tools, from a manufactory where turf is employed as the fuel.

The Haute-Marne—engravers' tools.

The Royal School at Châlons-sur-Marne—anvils, vices, and wire-drawing plates.

The Royal School at Angers—vices, anvils, with beak-irons, planes, chisels, and curriers' tools.

The department of the Moselle—cooking-stoves, and agricultural-instruments.

The Charente—agricultural instruments and coopers' tools.

The Orne—a machine for drawing iron-wire for cards, and a hammer for dressing mill-stones.

The Loire-Inférieure exhibited iron-chain-cables for the use of shipping. These articles will probably very soon be made in the Royal forges for the marine, at Guérigny, in the department of the Nièvre.

The department of the Seine alone sent the products of twenty-four manufactories in various tools and articles of hard-ware. Among these were principally remarked, tools for the use of gardeners, carpenters, pasteboard-makers, and others; instruments for ropemakers and basket-makers; agricultural instruments; turning-lathes, vices, screws, shovels, tongs, bells of various sizes, thimbles, steel cymbals, screw-presses, gravers, tools used in clock-making, and a miner's borer.

Swords, &c.—Specimens of damasked swords &c. were furnished from the departments of the Nièvre, Bouches-du-Rhône, the Seine, and the Bas Rhin.

Those sent from the department of the Seine consisted of cast-steel sword-blades, damasked; which were the products of the scientific labours of the Assayer-general of the Mint at Paris.

The art of damasking steel, which was for a long time, in France, an object of fruitless research, is now become completely French. This damasking is even esteemed in the East. The manufacturer of the above-mentioned articles from the department of the Bouches-du-Rhône sent to the East damasked blades in which platina was alloyed with steel.

In the ordinary swords, &c. the superiority of the French manufacturer has long been renowned; but the emulation of the whole country seems to be concentrated in the manufacture of damasked blades, which accounts for there not being any of the other descriptions exhibited in 1823.

Fire-arms.—Seventeen specimens of fire-arms were presented from the departments of the Ariège, Loire, Saône-et-Loire, Orne, Meuse, Ille-et-Vilaine, Seine-et-Oise, and the Seine. Nine specimens were sent from the latter department; whereas, in the exhibition of 1819, seven specimens only of this art were furnished from the whole of France.—Among these products of 1823, we particularly remarked a gun with a turning-magazine, a percussion-gun, a gun with a piston, a double-gun, and gun-barrels made of ribbons of steel and platina, ornamented with steel; double-guns, with one flint-lock; two carbines, with seven barrels each; a case of pistols, with double detents, or hair-triggers; a great quantity of arms for the chase; guns; and elegant pistols.

Among other articles, which confirm the reputation of the French fire-arms, we must not omit to mention the water-proof-pellets, and metallic caps, for firing guns, &c. by percussion, which were sent from the department of the Yonne.

LIST OF PATENTS FOR NEW INVENTIONS,

which have passed the Great Seal, since March 22, 1824.

To Charles Demeny, of Paris, in the kingdom of France; but now residing in Fenchurch Street, in the city of London, merchant; who, in consequence of a communication made to him by a certain Foreigner residing abroad, is in the possession of an Invention of an Apparatus, containing within itself the means of producing Gas from Oil and other oleaginous substances, of burning such gas for the purpose of affording light, and of replacing the gas consumed. Dated March 22, 1824.—To be specified in two months.

To Namen Goodsell, late of the State of New York, in the United States of America; but now at No. 13, Leigh Street, Burton Crescent, in the county of Middlesex, Engineer; for a Machine, or Piece of Machinery, for breaking, scutching, and preparing Flax and Hemp for use, upon an improved method, and threshing out the seed thereof; and which is applicable to the threshing of any other kind of grain, and also for shelling clover and other seeds. Dated March 25, 1824.—In six months.

To Edward Jordan, of the city of Norwich, Engineer; for a certain improvement or improvements in the form or Construction of Water-Closets, or of the Apparatus connected therewith. Dated March 27, 1824.—In six months.

To Joseph Spencer, of Belper, in the county of Derby, Nail Manufacturer; for certain improvements in the construction of Furnaces or Forges, for the preparation of Iron or Steel; and for the process of manufacturing of Nails and other articles, from the said materials. Dated April 7, 1824.—In six months.

To Jonathan Schofield, of Rastrick, in the parish of Halifax, in the county of York, Manufacturer; for certain improvements in the Manufacture of a Cloth, or Fabric, which he denominates British Cashmere. Dated April 7, 1824.—In six months.

To Thomas Ryalls, of Sheffield, in the county of York, Warehouseman; for an Apparatus for Shaving, which he denominates, "The useful and elegant Facilitator." Dated April 8, 1824.—In two months.

To Samuel Hall, of Basford, in the county of Nottingham, Cotton Manufacturer; for an improved Steam-Engine. Dated April 8, 1824.—In six months.

To James Tulloch, of Savage Gardens, in the city of London, Gentleman; for a certain improvement, or improvements, in the Machinery to be employed for Sawing and Grooving Marble and other Stone, or in producing Grooves or Mouldings thereon. Dated April 12, 1824.—In six months.

To Henry Potter Burt, of the borough of Devizes, in the county of Wilts, Ironmonger; for an improvement in the Construction of Cranks, such as are used for Bells, and other purposes. Dated April 14, 1824.—In six months.

To William By, of Joy Cottage, Ivory Place, Brighton, in the county of Sussex, Stationer and Bookseller; for a Method or Apparatus for the preservation or protection of Books and Covers. Dated April 14, 1824.—In six months.

To John Gunby, of New Kent Road, in the county of Surrey, Sword and Gun Manufacturer; for an improvement in the process of manufacturing of Cases, for Knives, Scissars, and other articles. Dated April 1824.—In six months.

To David Gordon, of Basinghall Street, in the city of London, Esq.; for certain improvements in the construction of Portable-Gas Lamps. Dated April 14, 1824.—In six months.

To John Burn, of Manchester, in the County Palatine of Lancaster, dealer in Cotton Twist and Weft, and General-Commission Agent for Manufactured Goods; for a new Apparatus for dressing various kinds of Cotton, Flaxen, Woollen, or Silk Manufactures. Dated April 14, 1824.—In six months.

To Thomas Gethen, of Henry Street, Pentonville, in the county of Middlesex, Gentleman; for improvements in the Machinery and Process of making Metallic Rollers, Pipes, Cylinders, and certain other articles. Dated April 15, 1824.—In six months.

To Daniel Tonge, of Liverpool, in the County Palatine of Lancaster, Ship-Owner; for an Apparatus, by means of which an improved Method of Reefing Sails is effected. Dated April 15, 1824.—In six months.

THE TECHNICAL REPOSITORY.

LXXXVII. — *On curing British White-Herrings, equal to the best Dutch Herrings; and on the Migration and Food of the Herring.* By Mr. James Frederic Denovan.

[Continued from p. 342.]

My first shipment reached Hamburgh on the 5th of July, *five days before the first Dutch jager* arrived; but I was, nevertheless, sadly disappointed in my expectations. Although my example had failed to rouse the torpid spirit of my own countrymen, it opened the eyes of other nations whose laws are better calculated to support and encourage adventurers in this branch of trade; for the Fishing Company of Altona, who have about thirty large busses, and the Herring Company of Emden, in Hanover, who have probably more, sent their whole fleets to sea in the month of May. During that month and the greater part of June, it will be recollected that the wind blew incessantly from W. N. W. and N. N. W., and the drought was so great as to be severely felt in every part of the United Kingdom. Several of these busses suffered so severely, that they were forced to put back in distress; and the others must, in general, have sustained greater or less damage in their sails and rigging. Nevertheless they succeeded in reaching the north coast of Scotland, where they were enabled to fish in smooth water, under the lee of the land. With me the case was very different: I was on a lee-shore, exposed to all the severity of the weather, where the swell from the Atlantic was so great that it was in general impossible to cast a net with any degree of safety; while, from the causes which will afterwards be explained, it was altogether improbable that I could expect to get herrings either in quantity or quality equal to my opponents. The consequence was, that a large buss belonging to the Altona Company arrived at Hamburgh with a cargo of excellent herrings on the 27th of June; the earliest shipment, I am told, that ever was made to that port; while a buss belonging to the Hanoverian Company followed her on the 2d of July, with another cargo, *eight days* before the Dutch, and *three days* before my first shipment reached that port. Thus the market for early herrings was unfortunately pre-occupied; and retailers and fishmongers, many of whom are individually interested by acting as agents for the Dutch and other foreign busses, having been supplied before the arrival of my parcel, endeavoured by every means in their power to turn the circumstance to the advantage of their constituents. My herrings, as I have observed, were inferior, in point of intrinsic quality, to any I had ever seen (they were of the small maatje species), dry, lean, and not juicy; yet, under all these disadvantages, some of them sold as high as 150 marks Banco per barrel. My second and third shipments were, no doubt, much superior, for the herrings improved daily after it began to rain; but by this time the market for early herrings was fully supplied, and great prices could not be expected. I got about from 2*l.* 10*s.* to 3*l.* 10*s.* for the last of my herrings; but the first Scotch herrings from Caithness, cured in the usual way, with Liverpool salt, and unassorted, did not average 25*s.* per barrel.

During the months of July and August, the Dutch, Danes, and Hanoverians, made considerable importations to Hamburgh; and the price of common Scotch salted herrings fell to 16*s.* and 17*s.* per barrel! But this prodigious fall, which has been the ruin of many individuals, was not to be attributed altogether to the importations of foreign-cured herrings, but to the fallacy of a too-generally-received opinion, that by *glutting* Hamburgh *with an inferior article,* we shall be able to undersell the Dutch, and force them to abandon the German market!

The quantity of Scotch salted herrings exported to Hamburgh during the last two years was in due proportion with the immense preparations made at all the fishing stations in the country. The consequences, however, have been ruinous; and although the *extent* of the mischief is not yet known, still the number of bankruptcies that have taken place among our coopers in this part of the United Kingdom, who are generally in the habit of salting great quantities of herrings without any regard to quality or cure, is truly lamentable! These were, in general, men of capital and credit; who looked not to such profit as might have been derived from more judicious management, but aimed solely at receiving the Government bounty of 4*s.* per barrel; which is nearly equal to 20 per cent on their advances in the way in which they cure herrings, and which, on a few thousand barrels, amounts to a very large sum. But the mischief was not confined to the families and friends of wealthy speculators; it extended itself to a quarter where its operations were severely felt by many a poor industrious individual; for the masses of Scotch herrings that arrived in Hamburgh in 1820, *after* the market had been supplied by the Dutch, were so great, that no vent could be obtained for them, even at *one half* of the intrinsic price; and many thousand barrels, after lying the whole winter and spring in cellars, were foolishly put up *along with the new herrings* as they arrived in 1821, which not only injured the sale of the latter, but excited a strong suspicion that the *new were actually mixed with the old;* and as this malicious report had no doubt been raised and circulated by the agents for foreign-cured herrings, at Hamburgh, there is no doubt that it operated its full effect in favour of their constituents. To this, therefore, and not to foreign importations, was the rapid decline in the Hamburgh market to be attributed.

Those, on the other hand, who had cured a few hundred barrels either for the Baltic or Colonial market, were, by holding them, placed in nearly as bad a situation as the exporters. The unfavourable reports of that market not only reduced the selling price at home, but enabled our colonial merchants to purchase herrings at nearly one-third less than they cost the unfortunate curers!

It would be idle to say that such mischiefs may not in future be prevented: for as they originate with the Legislature, it will only be necessary, I presume, to point out the cause and suggest the remedy. Unequal as I admit myself to be to such a task, yet a sense of duty to my country prompts me to try it. I have had a good deal of experience. I have spared neither pains nor expense to make myself master of the subject; and as I have no other object in view but the public welfare, I trust that my best endeavours to be useful may, at least, be regarded with indulgence.

I shall first, however, conclude the narrative of my proceedings of last year, with a description of a machine I have tried, and found to be of the most essential service in completing the cure of herrings; and which, I flatter myself, may greatly tend to their preservation in a tropical climate: and as accounting for the scarcity, the dryness, and the poor condition of the herrings in May and June, 1820 and 1821, on the west coast of Scotland, I shall offer a few remarks on their supposed migration, and the actual food of the herring, which has, until now, puzzled all the writers on natural history.

It has always been, and still is, a matter of the greatest difficulty both with the Dutch and British curers, to clear the pickle of the fixed oil: the Dutch have, no doubt, the advantage, by curing all their herrings on board ship; for the motion of the vessel not only keeps the fish continually covered, but naturally causes the oil to rise more rapidly to the top, when the barrel is put on end. But where herrings are caught in boats on the coast, and cured on shore, the oil often adheres to the fish in rising upwards; and when the barrels are too soon laid on the bulge, which is almost always the case, a great proportion of the herrings are destroyed, especially when they are very closely packed together and laid flatly, instead of being carefully placed on their backs with the belly upwards. The only method hitherto adopted by the Dutch and British, is, to skim off what oil appears on the top, with a round tin plate, as often as may be convenient: and although the Hollanders are much more careful than our own countrymen in this respect, yet, in re-packing on their arrival in Holland, they often find it necessary to throw aside a considerable number that are *rancid in the head;* for one herring affected in this way soon injures the others with which it comes in contact: but as the practice of excluding such herrings forms no part of the British system, even when fish are re-packed for the West-India market, it may easily be figured in what state of perfection they can possibly be, even in the short period of six months from the time of their being first headed-up.

In the last paper I had the honour of transmitting to the Society, I particularly detailed the way in which I pickled the gut, gills, and bloody part of the herring. The difficulty I found in clearing this pickle of oil, first suggested the idea of using a brush made of goose-quills, instead of a tin plate; for when the cask was full, I could brush off the oil in an instant with the former, while it required frequent applications of the latter, to clear the top of the barrel even imperfectly; and as the operation required to be repeated at least eight or ten times before the pickle was cleared, I soon found the benefit of the goose-quill brush, for the use of it not only saved much time, but did the thing completely in four repetitions.

Anxious, however, to try the experiment on a new plan, and in such way as might afford definitive proofs of its efficacy, I caused my cooper to make a large iron-bound vat, capable of containing about four hundred gallons, and insert a wooden stop-cock about six inches from the bottom, into which was poured the pickle from the gills, &c., as we collected it; and in place of simply filling up the barrels of herrings, after the priming was completed, I caused the people to pack them into new barrels, and throw the pickle, out of which they were taken, into the large vat, until they made it quite full: it was then stirred round with a pole, and allowed to stand for about an hour, until the top was completely covered with oil; and this being removed with the brush, the operation being repeated as the oil appeared, the pickle was drawn off gradually by the stop-cock below, and poured into the barrels of re-packed herrings in the most pure and perfect state.

Simple as this invention may appear to be, it will nevertheless be acknowledged, by every one who may try it, to be one of the greatest improvements that has been made for many years in the practice of curing herrings. I am sorry it is not in my power to make the experiment on mackarel, as they are seldom taken in sufficient quantity on this coast; but I am satisfied, that were this method to be adopted *in curing mackarel*, very great benefit might be expected to result from it.

Before taking leave of this part of the subject, however, I must observe, that during excessive heat in summer, and when, under priming, or even after it, the barrels have been exposed to the noon-day sun, the pickle of early fat herrings is very apt to become glutinous and ropy; and if not attended to in time, will soon become sour and pungent. When this occurs, the barrels should be immediately removed to a damp cellar, and the herrings taken out. Two pretty close sieves of horse-hair (one a little below the other) should be suspended with cords within the mouth of the barrel, and the pickle out of which the fish are taken gently poured through them for several times; but the sieves must be repeatedly cleared of the slimy matter which adheres to them; and the pickle will then be improved. Before re-packing the herrings, however, they should be carefully washed in a *tub of the pickle*, into which a small quantity *of herring-roes* having been previously bruised; and a little fresh salt, finely pounded, should be used in re-packing them, before pouring in the pickle. This treatment will completely remove the evil.

If, on the other hand, the pickle has become inviscated by the introduction of ox-blood, which is sometimes used by herring-curers, I know of no method by which it can be restored: this injudicious practice ought to be entirely abolished.

Migration and Food of the Herring.

It is generally believed, that after the great shoals of herrings disappear on the east and west coasts of Great Britain, they retire to some high northern latitude; as they have been observed in great quantities to the north-west of the Shetland Islands, during the spring months, *as if returning* to their former haunts. But if this hypothesis were correct, they must also have been seen, in their passage to the northern ocean, in the bays of Iceland, or even on the coast of Greenland. Our oldest whalers declare that herrings were never seen on that coast; and on examining the history of Iceland*, I find that herrings never formed any part of the fishery of that island. I have also conversed with gentlemen from North Fœroe, who assure me that even there herrings were never perceived.

It is observed by all fishermen, that during strong northern or eastern winds, the herrings retreat into the deeps; but during mild showery weather and southerly winds, they appear in shoaler water and approach the shores; and that in some bays and arms of the sea, they are not only seen but taken during the whole of the winter and spring.

Herrings, like all other fishes, are liable to migrations at certain seasons; and, in common with other creatures, have their periods of maturity: they migrate for two reasons, it is said—in quest of food, and for the purpose of propagation. But how these are to be answered in a high northern latitude seems altogether inconsistent with the nature of

* Island i det Attendaar hundrede. af. C. F. Stephensen. *Copenhag.* 4to. 1807.

the fish; for when they make their *first appearance from the deep*, in the early part of summer, they are without milt and roe, and generally lean and poor; but as the summer advances, they increase in size, the milt and roe become large, they spawn in August and September, and their progeny are seen in myriads about the headlands, arms of the sea, and bays which they have left.

It is supposed by some naturalists that the herrings return in *one* immense shoal from the Northern Ocean, about the beginning of June. On approaching the Isles of Orkney and Shetland, they separate, it is said, into three divisions; one of which passes to the eastward of Shetland, and through the Pentland Frith, and extends itself from Caithness to the coast of Norfolk—another takes its course to the westward of the Hebrides, and along the west coast of Ireland—and the most considerable division passes betwixt Cape Wrath and the Lewis Islands, through the Minch, and enters the several lochs, bays, and arms of the sea on the coast of the West Highlands and Frith of Clyde, &c. If this supposition was well founded, the herrings caught on both sides of the island, as forming part of this great shoal, would naturally appear the same, in shape, size, and quality; but so far from this being the case, it will be found that they consist of many distinct tribes and families, all differing in some respect or other, and varying in size and appearance. To prove this, it will only be necessary to place a herring, such as I had the honour of transmitting to the Society, on a plate along with a herring which has been caught and cured at the same period on any part of the east or north-east coast. Not only will they appear to differ materially in shape and in the formation of the fins, but the scales of the east-coast herring will be found to be at least one-third larger than the other, and perhaps as large again; consequently, the number of scales on the west-coast herrings is considerably greater than on those of the east: the size of the latter frequently exceeds that of the former, especially at the spawning season. The head and shoulder of the west-coast herring is somewhat similar in shape to the pilchard; and the quality is so very superior, that in Edinburgh, where both are brought to market in a salted state, when the Caithness or east-coast herrings only bring a guinea or twenty-five shillings per barrel, those of Lochfine, or from the west coast, are readily sold at two guineas.

A shoal of herrings generally makes its appearance off the Loffoden Isles, on the coast of Norway, in the month of July; which passes along, it is supposed, to the southward, where they are taken in immense quantities, in the rivers, or rather friths, of Dronthiem and Bergen, during the whole of the autumn and winter. I have seen and examined several samples of these herrings: those taken near the North Cape appear to be of a species entirely different from those met with on any part of the British coast; they contain an immense quantity of fixed oil, are longer by two or three inches than our largest herrings, and, in the texture of the fish, and flavour, resemble the gasperoe, a species of herring taken in the River St. John in Nova Scotia. The North-Cape herring differs from all others, in the following particulars: the head is shorter in proportion, and more flat and round; the eyes less prominent, the dorsal fin is broader, and the scales are nearly as large as those of the salmon. The herrings, however, taken near Christian Sound in the district of Dronthiem, and also in the Frith of Bergen, differ materially, both in size and shape, and are of very superior quality. The North-Cape herrings have a harsh disagreeable flavour; while those caught in the Frith of Bergen are equal in flavour to our best Caithness herrings, and during the last winter brought as high price in the Baltic ports.

Now, if any credit is to be given to the theory of the herrings coming in one great shoal from a high northern latitude and branching off into several divisions, as they are intercepted in their course southward by the mainland of Scotland, the Hebrides, and the Orkney and Shetland

Islands, it may naturally be inferred that the division which is said to pass to the eastward of Shetland, in the beginning of June, should be that which appears off the North Cape in June and July, and along the coast of Norway during the summer, and as being of the same great family, that there could be nothing in their shape or quality to indicate a difference of species.

Independently, however, of dissimilitude in shape, size, and flavour, there is a striking peculiarity in the natural habits of the Norway summer herring, which distinctly places the disparity of species beyond all doubt. When the summer herrings make their *first* appearance off *any part* of the coast of Scotland, they are small in size, but grow larger as the season advances; whereas, the largest herrings are first seen off the Loffoden Isles in June and July, and the better and less-sized herrings are never caught off Christian Sound, in the Frith of Drontheim, or Bergen Frith, before the months of August or September.

No sooner do the summer herrings disappear on the Norway coast, than they are succeeded by great shoals of winter herrings, which continue in the friths and bays of that country until the month of April; and the same species of herring is also found on the coast of Jutland, the Elbe and Wezer, and even in the Zúyder Zee.

In the month of November, a shoal of herrings enters the Frith of Forth in Scotland, and generally remains until the month of March. These herrings appear to be of a similar species to those caught on the coast of Norway, Denmark, and Holland. About twenty-six years ago, the fishery in the Forth was carried on to an immense extent, and many thousand barrels of these winter herrings were salted for the West-India market. A similar fishing was also carried on at Kessock, near the head of the Murray Frith: now, although these herrings appeared at both places about the same time of the year, they differed materially in shape, size, and flavour.

About the same period an extensive herring fishery was carried on at Wingoe Sound, and at other places on the coast of Sweden; and the herrings caught there being deemed of a quality better suited to the West-India market than our own winter herrings, were frequently purchased by British merchants and exported to the colonies. Owing, it is thought, to the number of men-of-war and other ships that lay in Wingoe Sound during the late war, and the frequent firing of cannon, the herrings that used to frequent that coast in winter have entirely abandoned it, at least no other reason has hitherto been assigned for their disappearance. As the shoals of winter herrings are now, however, much more extensive on the coast of Norway (particularly near Fahrsund) than they were known to be during the Swedish fishery, it may at least be presumed that the same tribe or family has migrated from the one coast to the other.

Although the same reason will not apply to the fishery in the Frith of Forth, yet it is a well-known fact, that since the year 1806 the shoal which annually appeared in that arm of the sea in winter has gradually decreased and dwindled to nothing, for the whole quantity taken during last winter did not exceed an hundred barrels. I examined them carefully, both in November, December, and January, and found them to be unfit for curing—they were all carried to market in a fresh state.

When that fishery was at its height, it was generally remarked, that the herrings first appeared on the coast of Cornwall, in England, mixed with pilchards, where there is a considerable annual fishery of the latter. Their progress along the east coast of England was distinctly traced; great quantities were taken off the coast of Yorkshire and Northumberland a few days previous to their appearance in the Frith of Forth; and when the shoal did enter that *frith from the southward*, they were so intermixed with pilchards, that they were separated by the curers—the herrings were salted in the usual way, but the pilchards were smoaked. Previous to that period, the pilchard was unknown in Scotland; and for the last twelve years none of the species have been seen on our coast.

Some years ago, the shoal of winter herrings in the Frith of Forth was succeeded by shoals of a different genus, called by our fishermen *garvies;* and this was also the case at Kessock, in the Murray Frith; they appeared frequently in such immense quantities, that the peasants laid them on the land for manure. It is generally believed that the sprat is a distinct species of the herring, but I doubt whether the garvie found in the Scotch friths is the same with the Clupea Sprattus of Linnæus. Sometimes the garvies appeared before the shoal of winter herrings in the Frith of Forth, and sometimes after them; but it was remarked by all the fishermen, that all the herrings or garvies which were taken in the Bay of Inverkeithing, or to the westward, where the water is brackish, were much more lank and less in size than those which were caught, at the same period, a few miles to the eastward.

The Clupea Sprattus of Linnæus appears in great shoals on the coast of Norway in the months of August and September; they are much less in size than our garvie, and contain more oil. The Norwegians pickle them in small kegs, and export them under the name of anchovies: they are very neatly put up, and, being judiciously spiced, bring a good price in many of the chief towns of Russia, Prussia, and Germany.

Last year I had an opportunity of examining these Norwegian anchovies, and comparing them with the young Gipsey herrings which are found in immense quantities in this frith during the months of June, July, and August; and I could not perceive the smallest difference. The largest Norwegian anchovies, and young herrings of equal length, had each forty-four vertebræ, and that roughness of the breast peculiar to the sprat and which distinguishes it from the young summer herring, was the same in both. I am thus inclined to think that the sprat is not a distinct species, but merely the Gipsey herring which has been spawned during winter.

Be this as it may, I intend to try the experiment of curing these young herrings in the Norwegian manner, as soon as I can discover the process employed for this purpose. I see no reason why we may not have British anchovies; and I flatter myself they would find a ready market in every large city in the kingdom. When I try the experiment, I shall send a keg to the Society.

Although it is evident that there are several species of the herring, (Linnæus enumerates ten in his *Systema Naturæ*, and there are probably more,) and although all these may, in some particulars, differ from one another, still it must be presumed that the aliment on which the whole subsists is the same. Many instances might be adduced of herrings choosing one place instead of another for their summer and winter residence — of appearing there regularly for many seasons, and of abandoning these haunts, and again revisiting them after a period of years. These desultory habits I attribute to the supply or scarcity of food they find at these places, and the nature of the weather and temperature of the atmosphere at the time they emerge from the deep.

It is admitted on all hands, that the herrings enter the different bays and arms of the sea which indent both sides of the island, for the purpose of depositing their spawn: indeed, the fact is clearly proved, by the myriads of fry which shew themselves shortly afterwards in all the little inlets of the rocks where the water is smooth. As this fry is first perceived where the bottom is covered with the *alga marina*, or where the rocks which jut out into the sea are clad with the common *fucus* or kelp-weed, it may naturally be inferred that the spawn is deposited in the gravel under these marine plants, which serve to protect it, as well from the convulsions of the ocean, as from being destroyed by other fishes.

If I am right in this hypothesis, it must follow, as a natural consequence, that the spawn of the herring, on being vivified, draws its subsistence from some attenuated aliment adhering to, or connected with, these marine plants: for it would be inconsistent with the economy of nature, to suppose that the herring would deposit its spawn in a situation where the fry could not be supported—but, on the contrary, that it would carefully select those places, where, on emerging from the deep, it had itself found the greatest quantity of food.

It is said that shoals of herrings have been seen on the great bank several leagues to the north-west of Shetland with their heads to the south-east, as if making for the coast; but as no herrings were ever taken to the north-west of Shetland, or even of the mainland, it is difficult to say in what state they were when so seen, or in what state they are in the month of April, before they appear off the coast: indeed, their appearance at such a distance from the land may have arisen from some unknown cause, which may not again produce the same effect. But I am satisfied that the herrings *which first appear* either off the east or west coast in the beginning of May (for I have carefully examined them) *are lank and spare;* but in the course of ten or twelve days become plump and round; and after the middle of July, the milt and roe increase rapidly.

In the months of June and July last, I had many striking proofs of this fact; and being convinced that the poorness of the herring was owing to the great drought of the season, I resolved to open the stomachs of a number of the fish, and ascertain, if possible, on what they subsisted. In trying the experiment with those that were brought in a boat from some distance, I frequently found nothing, and at other times a kind of slimy substance; but, as it occurred to me that this might be owing to the strong digestive powers of the fish, which speedily converts into chyle the food it has swallowed, I saw the necessity of cutting up the fish the moment it was taken from the water: for in man, as well as in animals, the power of the gastric juice is known to continue after death, so as not only to liquify the contents of the stomach, but even to corrode the stomach itself. I therefore pulled with a small boat close in shore, where the rocks were profusely covered with *alga* and kelp-weed, on the one side of a little sandy bay, where the herrings appeared in quantities after a shower, crowding to the surface and leaping at flies; and, throwing over two or three lines with unbated hooks, drew up several full-grown herrings. These were instantly cut up, and their stomachs examined: in some, I found a soft substance, almost like the milt of a herring, which became somewhat firmer when exposed to the air. In others, this substance appeared to be less digested; and the claws or feelers of small crustacea were, I thought, discernible. I persevered; and found young prawns and shrimps entire; a few of which were so complete, that I preserved them in a little herring-pickle, and afterwards in a small phial with spirits, which I now send along with this paper. I also found young herrings in the stomachs of many; but this frequently occurs. Satisfied, however, that the substance I first perceived was different from all these, I continued my exertions for some succeeding days in the same manner, and still found the same substance most prevalent, but in such a mutilated state that I almost despaired of success: at length, a fisherman having drawn his net, at a very short distance from me, in which was a very large herring, I was fortunate enough to get hold of it immediately; and on cutting it up, found the stomach actually crammed with the same substance. I spread this out on a board; and on examining it with a glass, was enabled to trace the figure of the animal, for some of the claws were perceptible; but it was greatly under the size of any of that species I had ever seen, and had evidently been swallowed when divested of its shell. The fish to which I allude is the only species of the *pagurus*, or soldier-crab, found in our seas; it is considered by the vulgar as the young of the common lobster; but all our fishermen know that it never exceeds six inches in length, from the tip of the great claw to the tail. All the species are parasitical, inhabiting the empty cavities of turbinated shells, the animals of which they are supposed to attack and devour, to gain possession of their shell. Like other crustaceous fish, they cast their shell: they also change their habitation with their growth, first occupying the shells of the periwinkle or *trochus*, then, perhaps, a *nerite* as large as a walnut, and after that a whelk. The tail is naked and slender, being covered only with a skin of very delicate texture; but it is furnished at the extremity with two or three hooks, by means of which it secures itself to the shell which it makes choice of. Although this species of soldier-crab is not noticed by Buffon and many other modern naturalists, it was not unknown to the ancients. Aristotle has very accurately described it, under the name *καρκινιον*. And a favourite old German author thus describes it: "Ein kleiner meerkrab: ein meerspinnle, wonet in schnek enschalen im meer, inn den schalen et licher labenden schnecken oder muscheln, ein muschelgast." And this description is illustrated by a very accurate engraving*.

I have often heard the most experienced fishers express their astonishment at the comparative small quantity of lobsters and other crustaceous shell-fish found in our bays, considering the very prolific nature of these creatures. They spawn in the spring and autumn; and the quantity they deposit must, at least, be quadruple to that of any other kind of fish. Of this every person will be convinced, on examining the roe of the lobster, of the different species of the crab, and of the shrimp; for in this and other respects, unless it be the disparity of size, there is little difference in their habits. The spawn of the lobster is like a cluster of small peas, which they carry under their tail until it is ripe for exclusion, which generally takes place in

* Conrad Gesner Icones Animalium aquatilium in Mari, &c. lib. 3, De Crustatis, ordo XIV. p. 209. *Heidelberg*, 1560. fol.

May and September, at the former of which periods it is known to change its shell. Although the spawn both of the lobster and crab is deposited at the bottom, it is observed to emerge and float on the surface, in mild, warm, showery weather, where it is vivified by the heat of the sun: and in small sandy bays and inlets of the sea the fry are perceived in countless myriads. Whenever the heat is succeeded by cold, however, not only does the spawn disappear, but the young shell-fish sink to the bottom, or seek for refuge among the common fucus and alga, which covers the deep shelving of the submarine rocks.

In the Lewis and several of the Western Islands, where small shell-fish of every kind is in very great abundance, and which, indeed, about a century ago, constituted a principal part of the food of the inhabitants, it has always been remarked, that when the wind is south or south-west, and showery, great quantities of these creatures are caught at the ebbing of the tide; but whenever the wind veers round to the northward, they sink into the deep, or burrow in the sand, like sand-eels, while the larger kind disappear entirely. When this happens previous to any change, it is regarded by the inhabitants as a certain indication of northerly wind.

If, therefore, crustaceous animals and their spawn be the food of the herring, which, I think, can hardly be questioned, the scarcity and poorness of the latter, on the west coast of Scotland, during the months of May and June 1821, is well accounted for.

If crustaceous animals be not the food of the herring, how does it happen that, on emerging from the deep, they should flock in shoals to those places *only* where they are to be found—where they deposit their spawn, and where their fry are seen in myriads?

The lobster is known to change its shell once a year; and when in a state of nudity, is devoured by the cod, ling, saith, and other large fishes. It may therefore be inferred, that the smaller genera of the crustaceous tribe do the same thing: for the different soldier-crabs which I found in the stomachs of the herrings, although covered with a kind of skin or integument, had no shell; and thus, while the full-grown herrings feed on these and other shell-fish, their progeny are subsisted by the spawn and fry of these creatures, with which the water teems, and with which the alga marina and other plants are covered.

As the greatest profusion of lobsters and other shell-fish are found in the bays of Orkney and Shetland, of the Western Islands, and of the northern points of the mainland, it is no way astonishing that the herrings should, on emerging from the deep when the weather becomes warm, be seen *first* at these places.

Shortly before the lobster-fishery commences in Orkney and Shetland, the herrings, it is said, appear in great quantities to the northward of these islands, and also in the Minch, where a singular substance is seen floating on the surface—in all probability the spawn of the lobster, which may be carried in that direction by the tides, and the operation of a southerly wind. In Norway, lobsters are got in great abundance in the neighbourhood of Fahrsund, from whence the spawn may, by the same natural means, extend to the Loffoden Isles and North Cape; but it is remarked, that the herrings generally spawn near Fahrsund, where, at least, their fry are seen in great quantities, and where the shoal of sprats and winter-herrings make their first appearance.

A learned and ingenious writer on natural history, in speaking of this floating substance, thus expresses himself: "The different accounts given me by skilful mariners, who were also conversant in the herring-fishery, agreed in this, that the substance consists of separate globules of a *roundish figure*, and of the *size of a pea*, resembles blubber, covers the surface of the sea to a great extent, and makes it to appear as if covered with oil; that the herrings are known to feed upon it; and that it has been observed in great profusion to the north-west of Shetland, where the herring-shoal existed at the same time. If this account, given me by persons of observation and veracity, is admitted, we need be no longer surprised at the retreat of the herrings to these tracts of the Northern sea, nor at their return in a full-fed and fat condition. The substance here intimated is probably a small species of medusa, or some similar marine animal, which is not as yet known to naturalists."

Although he is incorrect in his idea of the medusa, which is, in fact, the sea-nettle, and is always found of a bright-red colour; yet his description of the floating substance corresponds so exactly with the spawn of the lobster, that there cannot, I think, remain a doubt on the subject.

That the flesh of the herring flavours more of shell-fish than any other, is often remarked, particularly if boiled or roasted; and when eaten raw, with vinegar, it is acknowledged to be an excellent substitute for the oyster. This flavour in the herring, however, and even the richness of the herring itself, must depend greatly on the state of the coast where it is taken. If, after feeding on the floating spawn to the northward, the weather be such as to fill the bays and inlets with a profusion of small shell-fish, the herring must improve on entering them. If these creatures, on the contrary, have burrowed in the sand, or sought refuge from the cold among marine plants, the herrings must, necessarily, as I found them in May and June last, be dry and poor. To the immense quantity of small shell-fish that are in general found on the west coast of Scotland, may be attributed the superior quality and flavour of the herrings, and to the many bays and arms of the sea which indent that part of the coast, where, in smooth water, these shell-fish become a more easy prey to the herring; and which, I think, has the effect of rendering the flesh of those caught in Lochfine and that neighbourhood more firm and less fibrous than the herrings which are taken off Caithness and the whole of the east coast, where the water is deeper in-shore, and where small shell-fish are less abundant.

When the herring fry are observed to leave our bays and lochs, in the beginning of summer, the shoal moves so very slowly, that it would require a period of years to complete their journey to the Frozen Ocean. My opinion is, that they retire into the deep, but at no great distance from the shore, where they remain at the bottom in a kind of torpid state during the winter, from which situation they are recalled by the spring and the heat of summer. Were not this the case, we should see them much earlier than we do with a long prevalence of north or north-west winds, which would naturally facilitate their return from a high northern latitude. But as they invariably make their appearance with a south or south-east wind *much sooner* than when it blows from the opposite point, it is altogether impossible that they could buffet the mountain billows of the ocean, and traverse such an immense extent of sea in the course of a few days.

Of herrings, as of all other fishes, I imagine there are many distinct tribes and families, who have each their separate place of resort, both in winter and summer; and that their qualities and properties are as different as the places they frequent: for one herring-shoal has frequently been seen to pass another, with much regularity, and without the least commixture. They appear in this respect to be similar to the salmon: like them, they form gregarious shoals or associations, into which only those are admitted who are of the same family. Although the herring seeks no mixture of salt and fresh water, yet they approach the coast for the same purpose that the salmon emerges from the deep: he enters his native river, and the herring his loch or bay; and having answered the purposes of nature, both retire again to the deep, with the same regularity and order in which they left it.

(To be continued.)

LXXXVIII.—*On the Assaying of Gold, by Cupellation, with Lead; and by Parting, with Aqua-Fortis. By the late* WILLIAM LEWIS, M. D.*

THE quantity of gold allowed for an assay, among us, is six grains; in France, as we learn from Hellot, nearly the same; in Germany, according to Schlutter, about three times as much. It is evident that great nicety is requisite, in regard both to the weights and the conduct of every part of the operation, where the value of a large mass of gold is to be determined by an experiment on so small a quantity. Care must be taken, also, that the portion to be assayed is of equal fineness with the rest of the mass; as the alloy may in some cases be unequally distributed in fusion, and the upper and lower parts of the mixture prove different in richness: in large ingots or pieces of cast gold, a little should therefore be collected from the bottom, and a little from the top, so as to obtain a mixture corresponding, as nearly as may be, to the quality of the whole mass.

The assaying of gold consists of two processes; one for separating it from silver; the other from base metals. The separation of silver from gold is effected by aqua-fortis (nitric acid), which dissolves the silver, and leaves the gold entire behind: but that this separation may succeed, it is necessary that the mixture contain considerably more silver than it does gold; for, otherwise, the particles of silver are enveloped by the gold, and defended from the action of the acid. Some judgment must therefore be previously formed of the contents of the mass, from its colour on the touchstone, or by the hydrostatic balance: if it appears to be about the standard fineness, it is melted with about twice its weight of silver: if it is finer, a little more silver is added, and if coarser, less; so that the alloy and additional silver together may always amount to somewhat more than twice the quantity of the gold. The writers on assaying, in general direct three parts of silver to one of

* From his *Commercium Philosophico-Technicum.*

gold: but a less proportion is found to be sufficient; and more than is sufficient should never be used, for reasons which will appear in the sequel of the process.

The separation of base metals is effected by keeping the mixture in fusion for some time upon a cupel, with the addition of lead. The lead by degrees turns to a scoria or dross; which rising to the surface, and liquefying, looks like oil, and is no longer miscible with any metallic body in its perfect metallic state: all the metals, silver and platina excepted, change into dross, and separate from the gold, along with the lead. As silver stands this operation equally with gold itself, the gold and the additional silver are submitted to it together: and indeed, though there was no base metal to be separated, the small quantities of gold and silver employed for an assay are more commodiously mixed, form a neater bead, and with less danger of loss, upon a cupel with a little lead, than by fusion in a crucible. It is obvious, that both the silver and lead ought to be pure from any admixture of gold.

Cupellation with Lead.

The cupel is a small vessel, which absorbs metallic bodies when changed by fire into a fluid scoria, but retains them, so long as they continue in their metallic state. One of the most proper materials for making a vessel of this quality, is the ashes of animal bones (phosphate of lime): there is scarcely any other substance which so strongly resists vehement fire, which so readily imbibes metallic scoriæ, and which is so little disposed to be vitrified by them. In want of these, some make use of vegetable ashes; freed, by boiling in water, from their saline matter, which would occasion them to melt in the fire.

The bones, burnt to perfect whiteness, so as that no particle of coaly or inflammable matter may remain in them, and well washed from filth, are ground into a moderately-fine powder; which, in order to its being formed into cupels, is moistened with just so much water as is sufficient to make it hold together, when strongly pressed between the fingers: some direct glutinous liquids, such as whites of eggs or gum-water, in order to give the powder a greater tenacity; but the inflammable matter, however small in quantity, which accompanies these fluids, and which cannot easily be burnt out from the internal part of the mass, is apt to revive a part of the metallic scoria that has been absorbed, and to occasion the vessel to burst or crack.

The cupel is formed in a brass ring, from three-quarters of an inch to two inches in diameter, and not quite so deep, placed upon some smooth support: the ring being filled with the moistened powder, which is pressed close with the fingers, a round-faced pestle, called a "monk," is struck down into it, with a few blows of a mallet; by which the mass is made to cohere, and rendered sufficiently compact; and a shallow cavity is formed in the middle of it: the figure of this cavity is nearly that of a portion of a sphere; that a small quantity of metal, melted in it, may run together into one bead. To make the cavity the smoother, a little of the same kind of ashes, levigated into an impalpable powder, and not moistened, is commonly sprinkled on the surface, through a small fine sieve made for this use, and the monk again struck down upon it. The ring, or mould, is a little narrower at bottom than at top; so that, by pressing it down on some of the dry powder, spread upon a table, the cupel is loosened, and forced upwards a little; after which, it is easily pushed out with the finger, and set to dry, in a warm place, free from dust.

Of the Muffle.

Another kind of vessel is required in cupellation, called a muffle, formed of any clayey earth that will bear a strong fire; with a flat bottom, arched at the top, and open in the front: it is made nearly of a semi-cylindrical figure, its length about double its height, and the height somewhat less than the width of the bottom. This is placed upon bars, in a proper furnace, with its mouth facing the door, and fitting as close to it as may be. The furnace being filled up with fuel, some lighted charcoal is thrown on the top; and what fuel is afterwards necessary, is supplied through a door above. One or more cupels are set in the muffle; and being gradually heated by the successive kindling of the fuel, they are kept red-hot for some time, that the moisture, which they strongly retain, may be completely dissipated; for if any vapours should issue from them, after the metal is put in, they would occasion it to sputter, and a part of it to be thrown off in little drops. In the sides of the muffle are some perpendicular slits, with a projecting knob over the top of each, to prevent any small pieces of coals or ashes from falling in. The door, or some apertures made in it, being kept open for the inspection of the cupels, fresh air enters into the muffle, and passes off through these slits: by laying some burning charcoal, on an iron plate, before the door, the air is heated before its admission; and, by removing the charcoal, or supplying more, the heat in the cavity of the muffle may be somewhat diminished or increased, more speedily than can be effected by suppressing or exciting the fire in the furnace, on the outside of the muffle. This renewal of the air is necessary, also, for promoting the scorification of the lead.

The cupel being of a full-red heat, the lead, cast into a smooth bullet, that it may not scratch or injure the surface, is laid lightly in the cavity of the cupel: it immediately melts; and then the gold and silver are cautiously introduced, either by means of a small iron-ladle, or by wrapping them in paper, and dropping them on the lead with tongs. The quantity of lead should be at least three or four times that of the gold: if the gold is very impure, ten or twelve times its quantity will be necessary. It is reckoned, that copper requires, for its scorification, about ten times its weight of lead; that when copper and gold are mixed in equal quantities, the copper is so much defended by the gold, as not to be separable with less than twenty times its quantity of lead; and that when the copper is in very small proportion, as a twentieth or thirtieth part of the gold and silver, upwards of sixty parts of lead are necessary, for one of the copper. The cupel must always weigh at least half as much as the lead and copper; for otherwise it will not be sufficient for receiving all the scoria: there is little danger, however, of cupels being made too small for the quantity of a gold assay.

The mixture being brought into thin fusion, the heat is to be regulated according to the appearances; and in this consists the principal nicety in the operation. If a variously-coloured skin rises to the top, which, liquefying, runs off to the sides, and is there absorbed by the cupel, visibly staining the parts it enters; if a fresh scoria continually succeeds, and is absorbed nearly as fast as it is formed, only a fine circle of it remaining round the edge of the metal; if the lead appears in gentle motion, and throws up a fume a little way from its surface; the fire is of the proper degree, and the process goes on successfully.

Such a fiery brightness of the cupel, as prevents its coloured parts from being distinguished, and the fumes of the lead rising almost up to the arch of the muffle, are marks of too strong a heat: though it must be observed, that the elevation of the fumes is not always in proportion to the degree of heat; for, if the heat greatly exceeds the due limits, both the fumes and ebullition will entirely cease. In these circumstances, the fire must necessarily be diminished: for, while the lead boils and smokes vehemently, its fumes are apt to carry off some part of the gold; the cupel is liable to crack, from the hasty absorption of the scoria; and part of the gold and silver is divided into globules; which, lying discontinued on the cupel, after the process is finished, cannot easily be collected: if there is no ebullition, or fumes, the scorification does not appear to go on. Too weak a heat is known by the dull redness of of the cupel; by the fume not rising from the surface of the lead; and the scoria is either like drops in languid motion; or accumulated, and growing consistent, all over the metal. The form of the surface affords also an useful mark of the degree of heat: the stronger the fire, the more convex is the surface; and the weaker, the more flat: in this point, however, regard must be had to the quantity of the metal; a large quantity being always flatter than a small one, in an equal fire.

Towards the end of the process, the fire must be increased: for the greatest part of the fusible metal, lead, being new worked off, the gold and silver will not continue melted, in the heat that was sufficient before. As the last remains of the lead are separating, the rainbow colours on the surface become more vivid, and variously intersect one another, with quick motion: soon after, disappearing all at once, a sudden luminous brightness of the button of gold and silver shews the process to be finished. The cupel is then drawn forwards, towards the mouth of the muffle; and the button, as soon as grown fully solid, taken out.

It is observable, that when fine gold is thus cupelled with lead, it retains always a portion of the lead, very minute indeed, but sufficient to render it pale and brittle. Ercker endeavours to prevent this inconvenience, by patting the cupel with the tongs, so as to produce a tremulous motion in the gold, just before it hardens; but, though this practice may be of use in some cases, it cannot produce a total separation of the lead, when the gold has no other admixture. Mr. Scheffer observes, in the Transactions of the Swedish Academy for the year 1752, that if the gold is mixed with a little copper, as one twenty-fourth of its weight, it parts in cupellation with all the lead, and retains nearly all the copper; that if a small portion of silver be superadded, greater than that of the copper, it, contrariwise, parts with the copper, and retains a little of the lead; but that if the quantity of silver is nearly equal to, or greater than, that of the gold, as in the present process, both the copper and lead may be completely worked off, and only the gold and silver left.

The metal principally intended to be separated by cupellation is copper. If the gold contained any tin, the process does not succeed well, the tin calcining with a portion of the lead, and rising up in a powdery or spongy mass; which is apt to retain a part of the gold, and which cannot easily be made to melt; the calx of tin being extremely refractory. In this case, which rarely occurs to the assayer, the addition of a little iron-filings is of use: the tin having a strong affinity to iron, and forming with it a new compound, which works off pretty freely with the lead.

Though the lead continues to emit fumes during the cupellation, yet little of its substance is dissipated. The cupel, after it has absorbed the scoria of the lead, weighs as much as the cupel and lead did at first, and even more; metallic bodies being found to gain weight in their scorification. Several experiments of this kind, made at the Tower, by the direction of Lord Brouncker, are inserted in Spratt's History of the Royal Society: when lead, or a mixture of lead and copper, were worked off in a cupel, there was always an increase of weight; though not quite so great as lead commonly acquires in the process of slow calcination.

Parting, with Aqua-fortis.

Aqua-fortis is an acid spirit, prepared from nitre, by the intervention of other bodies. The principle, on which the extraction of the acid depends, has been but lately understood; and hence, in the earlier writers on these subjects, as Ercker and Agricola, we meet with many incongruous compositions; some containing powdered flint, sand, and other ingredients, which serve only to take up room in the distilling vessel; some, quick-lime, which can do no more than to lessen the produce of acid, by absorbing and detaining a part of it; and some, common salt, whose acid, mingling with the nitrous, forms with it a menstruum of quite a different nature from that here required. What is wanted is the pure acid of nitre; and the extrication of this from the alkaline basis of the nitre is effected by the acid of vitriol.

Those who prepare aqua-fortis in quantity use, frequently, green-vitriol (sulphate of iron), uncalcined, or undried. This method is accompanied with two capital inconveniences: the watery parts, which the vitriol abounds with, being expelled, first by the heat, together with a portion of the acid: this part of the vitriolic acid is thus so far diluted, as not to act sufficiently upon the nitre, and, rising over into the receiver, fouls the aqua-fortis that succeeds: at the same time, the vitriol, which at first liquefies in the vessel along with the nitre, concretes, on the dissipation of its watery moisture, into a hard mass, from which the full quantity of acid cannot be forced out by any violence of fire.

The more judicious workmen calcine the vitriol, before its mixture with the nitre, till it is freed from its phlegm, and will no longer liquefy in the fire. For this purpose, a quantity of the vitriol may be put into an iron pot, such as one of those which are used as sand-pots, for furnaces: the vessel is set over a gentle fire, which is gradually increased when the vitriol melts, till the matter thickens again, and acquires an ash-grey colour: the vitriol is to be constantly stirred, till it becomes dry and powdery, and is then to be taken out whilst hot; for if suffered to cool in the vessel, without stirring, it concretes so hard, as scarce to be beaten off with a hammer. Some calcine the vitriol in an open pan: the pan is at first about half filled; and when this has sunk down, and incrustated about the sides, more is added, till the vessel is full, which must afterwards be broken, for getting the matter out.

Eight pounds of vitriol, thus calcined to about four, and three pounds of nitre, made likewise very dry, are to be reduced separately into very fine powder, and thoroughly mixed together. The mixture is to be put into the same iron-pot in which the vitriol was calcined; a stone-ware head with a large glass-receiver fitted to it, and the junctures luted with Windsor-loam, or a mixture of clay and sand, beaten up with some cut tow, and moistened with a solution of fixed alkaline salt. In the receiver may be placed a pint of water, which will promote the condensation of the nitrous fumes, without rendering the acid too dilute for the purposes which it is here designed for. During the distillation, there arises a quantity of elastic vapour, which must be suffered to escape; as it would otherwise either force the luting, or burst the receiver. The most convenient way of procuring an outlet for it, without endangering any loss of the acid, appears to be, by making a hole in that part of the receiver which is to be placed uppermost, and inserting into it a slender glass pipe, four feet long, or more, which is to be secured by the same lute as the juncture of the head and receiver: the pipe allows a free passage to the air or unconfineable vapours, while little or nothing of the more sluggish acid fumes will arise so high. The hole in the receiver may be made, by pasting on it a piece of thick leather, having a hole of the intended size cut in it; then filling the cavity with emery and water, and turning round in it a steel instrument, with a hollow in the point, for retaining the emery, till the glass is worn through.

A gentle fire being made under the pot, the receiver soon grows warm, and appears covered with dewy drops, which are the more watery part of the mixture. The receiver beginning to grow cool again, the fire is to be gradually increased, till yellow or reddish fumes appear; and when these cease, it is to be further urged by degrees, till the pot becomes red-hot, and nothing more can be forced over.

This process is nearly the same with that commonly followed in the way of business; differing little, otherwise, than in the size of the vessels, and the quantity of the materials used at once. But as the effect of the vitriol depends wholly upon its acid, and as the acid of sulphur is the same, and is now to be procured at a very cheap rate, the most advantageous way of making spirit of nitre, or aquafortis, is, to use the acid spirit, instead of vitriol. Two pounds of oil of vitriol are to be mixed with an equal quantity of water, in a stone-ware vessel, a little at a time; for, if the acid is added all at once to the water, the mixture becomes so hot as to be apt to make the vessel crack. Three pounds of nitre being put into a glass retort, the mixture is to be poured on it through a long-necked funnel, that none of the vitriolic acid may adhere to the neck, and foul the nitrous spirit, as it distils. The retort being placed in an iron pot, on a little sand, and a receiver with its upright pipe luted on, the fire is to be gradually increased, so long as any red fumes arise, or any drops fall from the neck of the retort.

In either of these methods, a portion of the vitriolic acid frequently rises along with the nitrous; and frequently also, as nitre has often an admixture of sea-salt, the distilled spirit partakes of marine-acid. If a piece of silver be put into this impure aqua-fortis, some part of the silver will be dissolved by the nitrous acid: but the other acids will immediately seize it, and form with it an indissoluble white powder. For this use, therefore, the aqua-fortis must be previously purified from these extraneous acids: and their property, of uniting with and precipitating dissolved silver, affords a commodious and effectual means of its purification. A little solution of silver, already made, is dropped, at intervals, into a quantity of the aqua-fortis; which, if it contains any marine or vitriolic acid, becomes instantly milky: when the addition of a fresh drop or two of the solution occasions no further milkiness or cloudiness, we may be sure that those acids are completely absorbed by the silver: the whole is suffered to stand, till the white matter has perfectly settled to the bottom, and the clear liquor is then poured off.

Care must be taken, that the common water, made use of in the process of *parting*, have no impregnation that would impede the dissolution of silver, or precipitate it when dissolved. Spring-waters have generally such an impregnation, most of them producing a strong milkiness with solution of silver: rain-water, collected with proper care, is, for the most part, sufficiently pure; as is likewise that of most rivers, though the preference is always to be given to such as has been distilled. Those waters which turn milky with solution of silver may be made fit for this use, in the same manner as the impure aqua-fortis, by dropping in a little of the solution, till all the matter, that is capable of precipitating the silver, is separated: in this case, great care must be taken not to use more than is necessary of the solution; for so much of the dissolved silver as is added, after the marine and vitriolic acids have satiated themselves, will continue dissolved in the water; and as the gold is at last to be washed in the water, the moisture, that hence adheres to the gold, containing a proportionable part of the dissolved silver, will, on drying, leave it in the gold.

Besides the purity of the aqua-fortis, a good deal of caution is requisite in regard to its strength. The only sure mark of its due strength, for the *parting* assay, is its effect in the process itself: and the manner of adjusting it will be more intelligible after the process has been described.

The little bead of gold and silver, remaining after the cupellation, is carefully hammered a little, and passed several times between polished steel rollers, screwed gradually closer and closer, till it is extended into a very thin plate; which is coiled up into a spiral form, so as that the several circumvolutions may not touch one another: by this means it lies in a small compass, so as to be covered by a quantity of aqua-fortis sufficient for dissolving the silver, and yet exposes a large surface to the action of the dissolvent.

The metal is now and then annealed during the flatting; and after this part of the process is finished, it is again made red-hot, both to burn off any unctuous matter that may have adhered to it, and to soften the silver, which in this state is supposed to yield more easily to the menstruum. The coiled plate is put into a small glass vessel, called a parting-glass, broad at the bottom and tapering upwards; with twice its weight, or more, of the prepared aqua-fortis. The vessel is set in a sand-bath or other moderate heat, not exceeding that of boiling water; and its mouth stopped lightly with paper, or covered with a plate of glass, so as to keep out dust, without preventing the escape of the elastic vapours which rise during the dissolution. So long as the acid continues to act, the metal appears everywhere encompassed with minute bubbles, which issue from it in jets: the disappearance of these, or their uniting into a few large ones, is a mark that the acid is satiated.

The coiled plate, after the silver is thus eaten out from it, should retain its original form: for if the gold falls into powder, it can scarcely be collected without the loss of some particles, which though small in bulk, may amount to a considerable proportion of the small quantity of metal made use of. This cohesion of the gold depends, partly, upon the quantity of silver not being so large as to leave the golden particles discontinued; and partly on the action of the acid not being so violent as to divide and disunite the gold by its impetuous extraction of the silver. The strength of the acid is to be ascertained by previous trials on gold and silver, mixed together in the assay proportions; if it is found to disunite the gold, it must be lowered with water, till it leaves the plates entire. These trials are to be made, exactly in the same manner as the assay process itself.

The liquor is poured off whilst hot, lest some of the dissolved silver should crystallize in cooling upon the remaining gold. To the golden plate, which appears spongy, and of a dark reddish-brown colour, a little fresh aqua-fortis is added, and heated more considerably than before, to extract what silver may still be left in it: this may be repeated a second or third time; after which, some water is poured on, and renewed two or three times, to wash off the saline matter. The parting-glass being then full of water, a small gold vessel (a silver one will do) is applied closely on its top; and both being nimbly inverted, and the parting-glass carefully raised a little, at one side, the golden plate is washed down into the lower vessel: if this last is insufficient for receiving all the water, the glass is to be lifted up a little, so as that the thumb, or a piece of stiff paper, can be applied to its orifice under the water; after which it may be removed, without disturbing the liquor, or damaging the brittle plate. The water being poured off, the plate is dried, and gradually heated till the gold resumes its proper colour, which happens soon after its becoming red-hot. Some make use of an earthen crucible; but, in this case, small particles of the earth are apt to adhere to the gold, whence the assay becomes less certain.

If the gold, after having passed through these operations, is found to be of the same weight as at first, it is reputed nearly fine, but not entirely so; for the aqua-fortis leaves always in the gold a small portion of the silver, amounting, commonly, to above a three-hundredth, and sometimes to a hundredth part of its weight; whence, if the gold was at first fine, it will in this process receive an increase. If it is required to determine exactly the proportion of this increase, it may be done by submitting to the same operation an equal quantity of gold, known to be fine, mixed with the same proportion of silver. The differences in the quantity of silver, thus left in the gold, are supposed to proceed from unheeded differences in the quality of the aqua-fortis, particularly in its strength; so that the assayer ought to examine, in this view, each parcel of aqua-fortis he employs, and deduct, from the weight of gold remaining in the assay, the proportion of silver which that particular aqua-fortis is found to leave.

The assayer's report, of the fineness of the gold which he has examined, expresses the number of carats, with the odd grains, or fourths of a carat, and quarters of these, by which it is finer or coarser than the standard. Thus, standard gold being of twenty-two carats (that is, twenty-four parts of it losing two in the purification), if the mass assayed lose one less, it is reported *B.* 1 *car.* or one carat better; and if it loses one more, it is reported *Wo.* 1 *car.* or one carat worse.

By these processes, gold is separated from all the known metallic bodies, platina excepted: if any of this was mixed with it, nearly the whole of the platina will still remain, not destructible by the lead, and not dissoluble by the aqua-fortis. If the quantity of platina is considerable, it may be distinguished by the brittleness and ill-colour of the mixture: but there are proportions of it, not sufficient to sensibly affect the gold in these respects, though they may nevertheless deserve regard. If the gold is suspected to be thus debased, the abuse may be discovered by the following means.

After the golden plate has been weighed, and its fineness determined in the common method, a part of it is to be dissolved in a little aqua-regia, and a filtered colourless solution of any fixed alkaline salt gradually dropped into the liquor, so long as it occasions any turbidness or precipitation: all the gold will fall to the bottom, with a part of the platina; but so much of the platina will continue dissolved, as to discover itself by communicating a yellow tinge. This intention may be answered still more effectually by ether; which, imbibing the gold, and carrying it up to the surface, leaves the full quantity of the platina to shew its colour in the acid liquor. By this method, a most minute proportion of platina may be distinguished; a little of this metal giving a high colour to a surprisingly large quantity of the menstruum.

LXXXIX.—*On an improved method of obtaining Early Crops of Peas, after severe Winters.* By THOMAS ANDREW KNIGHT, *Esq. F.R.S. President of the London Horticultural Society.**

CONSIDERING even trivial improvements to be important, relative to the management of those species of plants upon the culture of which much labour and capital are annually expended, for private use, and for the supply of the public markets—I address to the Horticultural Society the following *account of a mode of obtaining an Early Crop of Peas,* which I have practised, with great success, in the present spring (1823).

When severe winters, such as the last, have proved fatal to crops of peas sown in the preceding autumn, many gardeners have experienced the advantages of raising other plants in pots, with artificial heat, early in the spring, and subsequently transplanting them into the common soil: and the object of the present communication is only to describe an improvement in the mode of repeating this operation.

In the present spring, my garden, owing to its soil being cold, and the climate rather inhospitable, did not contain, in the end of February, a single living pea-plant; and I purposely delayed the experiment, which I proceed to relate, till the first day of March. Upon that day the ground was prepared, and part of the seed sown, as usual, in rows, where the plants were to remain: at the same time other peas, of the same early kind, were sown in circles, within the circumference of pots, of ten inches in diameter, inside measure. These pots were nearly filled with a compost of a peculiar kind; from the highly nutritive and stimulating qualities of which, I anticipated much acceleration in the growth of my plants; with the advantage of being able to remove them, at the proper period, to the open ground,

* From Vol. V. Part 3. of the Society's Transactions.

without having their roots at all detached from their pasture, owing to the fibrous organic texture of the compost. This was made of equal parts of thin turf, to which much lifeless herbage was attached, and unfermented horse-dung, without litter; and a quantity of the ashes of burnt weeds, containing, as usual, a good deal of burnt mould, equivalent in bulk to about one-twelfth of the other materials*. The whole was reduced to small fragments, and well intermixed; and the pots were filled with it, within an inch of their tops. The peas were then sown upon the surface of the compost, and covered with common mould; and the pots were placed in my peach-house. In this they remained till the plants were an inch high, when they were removed into the open air; but they were protected, during the night, for some time, and particularly when the character of the evening indicated the probability of frost.

In the last week of March, the plants were taken from the pots, and planted in rows in the open ground: and I have the satisfaction to observe, that very nearly the whole of the compost adhered firmly to their roots; and that their growth, subsequently, was not apparently checked, in any degree, by their transplantation. They were placed in rows, contiguous to those which had been previously sown; a small quantity of compost, similar to that put into the pots, being added; and the common mould was then closed round their roots, and raised upon each side of the rows. Sticks to support and protect the plants were immediately added, in rather more than the ordinary number and quantity; and, subsequently, no particular care or attention was paid to them.

On the morning of the 29th of April, I ascertained the comparative growth of my plants, which had been subjected to the different modes of treatment above mentioned, in two rows which grew contiguous to each other: *when I*

* Equal parts of fresh soil, with unfermented horse-dung with litter, and a small quantity of quick-lime, or wood-ashes, would probably operate as powerfully as the compost above described.

found the height of those which had been raised in pots to be fifteen inches; and that of the others to be scarcely four inches; and I much doubt, whether I ever possessed, in the most favourable season, as forward a crop of peas as my garden now contains.

Many causes appear to me to have operated in conjunction, to produce the foregoing effects. It has long been known, that snow does not, in winter, lie so long upon ground which has been manured in the same season with fresh unfermented horse-dung, as upon unmanured ground; and therefore I conclude, that some degree of heat existed in, and emanated from the compost; though, probably, never in a sufficient degree to have been sensible to the touch of any warm-blooded animal. If placed in a considerable heap, such a compost as that described, and even when the horse-dung is much less in quantity, will heat violently. I have often suffered the compost of this kind, which I employ for pine-apples, to become hot, to prevent the subsequent appearance of earth-worms in it.

If heat was in any degree generated by the compost in which the peas grew, the escape of it was necessarily retarded, by the numerous sticks by which the ground was partially covered †; and little injury could have been sustained from the shade of those; because the quantity of light, comparatively with the temperature of the air, and growth of the plants, is very great after the vernal equinox; and it is every day increasing in power and influence.

Another cause of the rapid growth of the transplanted peas has, probably, been the very favourable state of the soil in which they have been placed; it having been turned over with the spade, immediately before transplantation took place: for peas never thrive well in strong soils, when such have been compressed, and soddened, in early spring, by much moisture. But the chief causes of their very rapid growth have, I believe, been the highly nutritive

† Wells's Theory of Dew.

and stimulating quality of the compost, and the presence of some degree of additional warmth: for I have, in former seasons, derived great advantage from placing a moderate quantity of nearly similar compost immediately under rows of peas which have been sown in the usual manner; except that the seeds were placed upon the surface of the soil within which the compost had been buried, and covered by having had the soil collected from each side, to form a ridge over them. In all cases, where a compost of the kind I have described is employed to accelerate the growth of dwarfish and early peas, it should be used in small quantities only; that the early growth of the plants may be promoted, without excessive, and consequently injurious, luxuriance being given. For transplanted peas, I should prefer a poor and light soil; so that the roots might be led, as they would be under such circumstances, to confine themselves to narrow limits; and the plants, consequently, be brought to an early maturity.

Note by the Secretary.

In a Letter received from Mr. KNIGHT, dated the 27th of June, he mentions that he had then seen the full result of his experiment on the mode of raising early peas, above described. *The plants so treated had produced a very abundant crop, at least twelve days earlier than those sown at the same time in the usual way, and with a much more rapid succession of produce.*

XC.—*On the Dutch Process of making Elastic Composition Inking-Rollers, for Printing; now frequently used instead of Balls.**

TO eight pounds of transparent glue, add as much rain or river water as will just cover it; and occasionally stir it during seven or eight hours. After standing for twenty-four hours, and all the water is absorbed, submit it to the action of heat, in a water-bath, and the glue will soon be

* From the *Journal d'Agriculture du Royaume des Pays-Bas*, 1823.

dissolved. Remove it from the fire as soon as a froth is seen to rise; and mix with it seven pounds of melasses, which has been previously made tolerably hot: stir the composition well together, in the water-bath, over the fire, but without suffering it to boil. After being thus exposed to the heat for half an hour, and frequently well stirred, it should be withdrawn from over the fire, and allowed to cool for a short time, previous to pouring it into a cylindrical mould, made of tin, tinned sheet-iron, or copper, having a wooden cylinder previously supported in its centre, by means of its end-pivots or gudgeons.

After remaining in the mould at least eight or ten hours in winter, and a longer time in summer, the roller is to be taken out of the mould, by means of a cord fastened to one of the gudgeons, and passed over a strong pulley fixed to the ceiling; but care must always be taken that the cylinder is drawn out slowly from the mould.

Old rollers are re-cast in the same manner; first taking care to wash them with a strong alkaline ley, and adding a small quantity of water and melasses. The best mode, however, of making use of the old composition, is, by mixing it with some new, made of two pounds of glue, and four pounds of melasses.

XCI.—*On the application of pure Alumine, to the Blanching of Sugar, Syrups, &c.**

M. Pajot des Charmes announces that *pure Alumine* may be employed with the greatest success in bleaching sugár, syrups, &c. His experiments have proved, that for discharging completely the colouring matters from a cold solution of brown sugar of inferior quality, it must be agitated for a few seconds with a tenth part of its weight of pure alumine; and, after decanting it, the solution must again be mixed and agitated with a tenth part of its weight of animal charcoal, and one-fifth of pure alumine. This

* From the *Bulletin des Sciences Technologiques.*

operation, which is effected without heat, and which does not even require the aid of filtration, is quick, easy, and very economical.

The coloured clays of Gentilly, Vanvres, Issy, and the environs of Paris, may be employed with much advantage, if care be taken to separate the particular salts contained in the alumine. This is easily effected, either by submitting it to the action of *liquid chlorine*, or to the fire of a reverberatory furnace. The clays above mentioned, powdered and sifted, after they have been slightly calcined, are susceptible, in this state, of producing an excellent effect.

M. Pajot des Charmes adds, that the same application is not less advantageous in blanching the sugar or syrup of beet-roots and potatoes, the honey of Brittany, and several other coloured fluids or liquids.

XCII.—*On an improved Stove, and Chemical Apparatus. By* Mr. G. Tigerb.

WITH A PLATE.

Our chemical readers must, no doubt, have often experienced the want of a ready method of increasing or decreasing at pleasure the temperature in the stoves employed for heating sand-pots, &c. in chemical operations. The contrivance about to be described will be found exceedingly convenient for this purpose.

AA, in Plate XIII. fig. 2, is a German-stove, the body of which is made, in the usual manner, of plate-iron; but with its grate, B, made moveable, so as to be raised or lowered, and retained at any required height. This is effected by means of the iron stem, C, affixed to the grate in its centre, and passing through a guide-hole D, in the cross-bar EE, which is secured to the legs of the stove. Holes are made in the stem C; and an iron pin, F, being put through any one of them, and resting upon the cross-bar EE, the grate is sppported at the height required; and, on withdrawing the pin, the grate, and the fuel upon it, is lowered, and the heat instantly abated in consequence.

GHI, is an improved support for a receiver, &c.; it being capable of the nicest adjustment in height, as well as sideways, by means of the screwed stem, G, which acts in a female screw, H, firmly affixed upon the table or stand, I, and passes through a hole, J, made in the table to receive it. The upper end of the screw H is made cylindrical; and is received into a cylindrical hole, made in the piece of wood, K, affixed underneath the square wooden-box, L. The cylindrical head of the screw has a groove or channel made around it, to receive a pin, which is affixed in the piece K, so as to prevent it from coming off the cylindrical head, and yet allow it to play around it. A hole is also made through the screw, near its head K, through which to pass a pin or lever to turn it by, so as to elevate or depress the box L, and adjust it to the greatest accuracy; and far more conveniently than can be done by the use of wooden blocks of various heights or thicknesses, and as generally recommended in chemical works.

The exact position of the box L having been thus found, it is to be afterwards retained in its place, either by means of the stays MM, or otherwise.

This box L has an opening made in its side, to receive one of the two necks of the receiver N, into which the beak of the retort, O, is fitted by grinding; and into its other neck the short tube, P, is fitted. This tube has one arm of the double-curved tube, Q, fitted upon it, by grinding; and its other arm is received into an upright tube, R, which passes through, and is secured in a perforation made in a thick cap of glass, S, which may be either ground to fit air-tight upon the top of the large receiver T, or be cemented upon it. U, is a safety-tube, of a peculiar shape; which is also ground air-tight into an aperture made to receive it, in the glass-cap S. This safety-tube may be four feet or more in length, as recommended by Dr. W. Lewis, in his article "On assaying gold," contained in our present Number; and it has its upper end, V, bent at a right-angle, and *loosely stopped* with a small cork, so as to readily open, in case of any undue pressure being exerted within the receiver, T. W, is a kind of bag, or cistern, made of a piece of oil-skin, sewed together at its edges, and securely bound around the outside of the glass-cap, S. Its use is, to hold water, to cool the gaseous matters distilled over, previous to their entering the large receiver, T; as well as to prevent the loosening of the cement by the heat, when the glass cap, S, is so secured to the top of that receiver. The bag, W, is supported by four strings affixed to the rim of it, and affixed to a nail, &c. above it; and the safety-tube, U, is also to be secured above, in a proper manner.

The whole apparatus described was used by its inventor for various chemical operations, and particularly for making the chlorate of potash, of which he could prepare two pounds per day, by charging the retort with the usual materials for generating chlorine, four several times. The large receiver, T, was a black glass carboy, such as are used to hold sulphuric acid; and it contained three gallons of the solution of potash. It was firmly secured to the table, I, by being let into its top, and cemented; and, indeed, excepting the removal of the glass stopper, X, of the retort, and of the safety-tube, U, to charge and discharge those vessels, (the latter of which operations was performed by means of a syphon,) the whole apparatus remained undisturbed during its use. He commenced the operation without employing much heat; but, in order to get off the most of the gas, the sand in the bottom of the bath required to be heated to about 300°. He ascertained this degree, sufficiently near for his purpose, by plunging a common gardener's thermometer into the sand, up to the mark for summer-heat; and when the mercury rose to 220°, it indicated that the lower part of the bath had attained the required degree of temperature.

XCIII.—*On Grafting Vines.* By JOHN BRADDICK, *Esq. F.H.S.**

DEAR SIR, *Thames Ditton, Jan.* 14, 1822.

IN compliance with your request, I now proceed to give you an account of the experiments made by me in *grafting Vines.*

I have for some years past amused myself in raising vines from seed; but many of these have produced fruit so much resembling each other, that it became necessary, in order to keep up a variety, to change the sorts: and as the requisite time to raise new seedlings to a bearing state is four or five years, I conceived it to be highly desirable to find out some sure method of making the vine take by grafting.

The information which I collected, from books on this subject, was, that vines may be easily made to grow by grafting; and that the proper time for performing the operation was in January and February, for vines growing under glass; and in March, for vines growing in the open border. But, out of forty or fifty vines which I operated upon, in the above months, I had the mortification to find, that very few of the grafts grew; and those which did take became weakly plants, and were as long a time in coming into bearing, as would have been lost, had I removed the old, and brought forward other new seedlings to supply their places.

I observed that the stocks of the vines, grafted as above mentioned, all bled profusely; and, upon unbinding those grafts which did not take, I found that the parts of the grafts which joined to the stocks were sodden, and turned black, by their being steeped for a considerable time in the thin sap of the stock, before it became glutinous enough to cause their adhesion.

To stop the bleeding, I tried every experiment, with styptics, cements, &c. that I ever read or heard of, with

* From Vol. V. of the Horticultural Society's Transactions.

many others suggested by my own imagination: but all without effect. One experiment I will mention, as it may serve to shew the great power of the rising sap in the vine, while its buds are breaking. On the 20th of March, in the middle of a warm day, I selected a strong seedling vine five years old, which grew in a well-prepared soil, against a south-west wall. I took off its head horizontally with a clean cut; and immediately observed the sap rising rapidly through all the pores of the wood, from the centre to the bark. I wiped away the exuded moisture, and covered the wound with a piece of bladder, which I securely fastened with cement and a strong binding of waxed twine. The bladder, although first drawn very close to the top of the shoot, soon began to stretch, and to rise like a ball over the wound, thus distended, and filled with the sap of the vine: it felt as hard as a cricket-ball, and seemed to all appearance as if it would burst. I caused cold water, from a well, to be thrown on the roots of the plant; but neither this, nor any other plan that I could devise, prevented the sap from flowing; which it continued to do with so much force, as to burst the bladder, in about forty-eight hours after the operation was performed; the weather continuing the whole time warm and genial.

I now fitted a graft to this stock; and after binding it on, I took a piece of bladder doubled, and made a small hole in it, so as just to let the tip of the graft and the eye pass through the hole: the inside of the bladder I covered with a cement made with bees-wax, resin, and tallow; and bound the whole with strong waxed twine, from just under the eye of the graft, to six inches below on the stock. The sap having now no other way to escape, was forced up through the pores of the graft: in a short time, I was pleased with observing the bud of the graft swell; and when the other vines on the same wall began to grow, it broke, and made a shoot with several joints. It however soon became evident that no union had taken place between the graft and the stock, as the shoot of the former turned sickly, and, before Midsummer, died entirely away. —The next season, I took a healthy growing vine in a pot; and carefully matched it with a seedling vine of the same size, growing in the open ground: these I inarched together; and bound a bladder round the wound, instead of using cement. Upon cautiously removing the bladder at different times, I found that both the vines bled profusely; and no adhesion began to take place, until they had both shot out four or five joints from each of their eyes: the bleeding then ceased, as I judged, by the sap becoming more glutinous. It consequently now occurred to me, that the proper time for cutting off the heads and grafting of vines, without incurring the danger of their suffering through bleeding, was when they had reached that period of their annual growth at which the sap ceases to flow thinly and rapidly. I accordingly cut the branches of several in that state, and grafted them with cuttings of the preceding year: all these grew, the operation being performed by whip-grafting; and no other covering was used than a binding of bass, surrounded with grafting-clay.

From these and various other experiments which I have since made, I feel confident in stating, that healthy vines may be successfully grafted, with young wood of the preceding year's growth, from the time that the shoots of the stocks, which the grafts are to be put upon, have made four or five eyes, until Midsummer; with every prospect of the grafts growing, and without the least danger of the stocks suffering by bleeding.

They may likewise be grafted with shoots of the same summer's growth, worked into the rind of the young wood, from the time that the young branches of grapes become visible on the stocks, till July, out of doors; or till a month later, under glass. The operation must not be performed later than the period here specified; because time is necessary for the young shoots of the grafts to become hard, and ripen, before winter.

Some cuttings of vines sent from Madeira, which I received from the Horticultural Society, were grafted by me on the 10th of last May, on seedling vines, which were growing under glass, but without fire-heat, with the following results.

1. The *Verdelho* graft shot fourteen feet, produced one bunch of small grapes, and ripened its wood well.

2. The *Negro Molle*, grafted on the same stock, shot upwards of twelve feet, produced no fruit, but ripened its wood.

Another graft, of which the name was accidentally lost, was not put on till the 1st of July; it was then worked-on to the top of a young shoot of the same summer's growth: this has also grown, and ripened three eyes of its wood.

Your most obedient servant,

To JOSEPH SABINE, *Esq. Sec.* JOHN BRADDICK.

XCIV.—*On a Drill for perforating Glass, Porcelain, China, &c.*

WITH FIGURES.

IN the article "On assaying gold," by Dr. W. Lewis, in our present Number, is a method of perforating receivers or other glass vessels, by means of a drill, supplied with emery and water. We now give our readers a description of a pump-drill for the same purpose, but of a different construction from his; and which we know to be exceedingly useful for the above purposes.

It consists of a cylindrical stem, A A, Plate XIII. fig. 1, of the size shewn; having an eye or hole, B, in its upper part, for the drill-string to pass through; and a shoulder, C, below, for the lead-ball or weight, D, to rest upon, as usual. The lower end of this stem is cleft open; and a hollow metal cone, E, open at both ends, is soldered to it. This cone may be formed either of sheet-copper, or iron-tinned plate; and a slight scratch being made, with a diamond, upon the surface of the glass, porcelain, &c. at the place where the perforation is to be made, as a guide to fix the drill; and emery and water being put into the cone, at the opening, F; it will, on being held upright, and worked in the usual manner of pump-drills, soon make the required perforation.

It may not be amiss, as a further guide and support for the nose of the drill, to employ the piece of perforated thick leather, in the mode indicated by Dr. Lewis, where it can conveniently be done.

Small holes are also drilled in glass, china, &c. by a drill, the point of which consists of a diamond spark, soldered to the stem of the drill.

XCV.—*Extract from a Memorial on Iron Ships, Boats, &c. By M. de* MONTGERY, *Post-Captain, &c.**

BEFORE any one thought of substituting metal for wood in the construction of large vessels, plates of iron or brass had been used for covering ships of war and battering-rams. The celebrated galley, built by Archytas and Archimedes, at the expense of Hiero tyrant of Syracuse, was covered with similar materials. Philo of Byzantium afterwards proposed using battering-machines, made entirely of metal; but Father Mersenne appears to be the first who thought of adopting it for ships. Captain Verdun de la Crène judged it necessary, at the siege of Gibraltar, in 1781, to apply an iron-grating on the floating-batteries. D'Arçon approved of this plan, and much regretted not having been able to adopt it. I pass over in silence several other projects and attempts of the same kind, in order to confine myself entirely to the subject of ships composed wholly of metal. It is said that Fulton had made one of his submarine boats of iron. M. Simond, struck with the gigantic proportions of a boiler which he saw, predicted, in the year 1810, that iron would, one day, be used instead of wood, in ship-building. Eventually, the English began to

* From *Férussac's Bulletin des Sciences Technologiques.*—The Memorial was published in the *Annales de l'Industrie*, Nov. 1823.

build vessels, about the year 1816, with ribs and knees of iron, and with iron-plates rivetted upon them.

The heads of the rivets, however, on the outside projecting considerably, could not fail to prevent the vessel from going quickly through the water. To remedy this inconvenience, it was proposed to drill countersunk holes in the iron plates, to sink the heads of the rivets into; but this would weaken the sides, and might occasion leaks if any of the rivets got out of their place. Besides, when it became necessary to shift any of the forged iron pieces, or any of the plates, it could only be effected with difficulty, and also expose the adjacent parts to injury. I think the following process will remedy every inconvenience.

The four sides of each plate of iron being bent at right-angles, the edges must be placed one against the other, and fastened with round-headed screws. The ordinary frames will be in some measure supplanted by the vertical edges, and the other edges will supply the place of ribs and knees. Besides this, we may apply, at convenient distances, between the edges, pieces of iron, which will surround the vessel horizontally and vertically. This mode of joining the plates will render the surfaces of ships perfectly even, will give great solidity to them, prevent leaks, and diminish the expense and difficulty of repairs.

There is a method of making it almost impossible to sink vessels, which was known to the antients, and is now employed by the Chinese. It is applicable to iron ships, as well as to those built of timber. To accomplish this, the hold must be divided into a certain number of compartments; so that if the ship spring a leak, or should her sides be stove in, in several places at once, those compartments only which are immediately adjoining to the leaks will fill with water, and the vessel will keep afloat. This method is susceptible of many improvements; and is particularly applicable to ships of war, the extent of whose stores and manner of stowage are known beforehand, and are not subject to be shifted about, like the cargoes of merchant vessels.

In the Memorial from which I have made this extract, I have examined the principal advantages and disadvantages of iron ships. Vessels of this description have no need of caulking and copper-bottoming. Little subject to leaks, they have less to fear from running ashore, and still less from fire, than ordinary vessels. They, besides, possess greater strength with less weight, and are more capacious in proportion to their exterior dimensions. In fine, if they cost more money to build, their duration is incomparably greater; and they are not in want of being hove-down, as common vessels are, every four or five years, to undergo the usual repairs. It is therefore economical and advantageous to adopt iron, even for the construction of merchant vessels; but for ships of war, *it is indispensable.* This last assertion is, at the first view, at variance with received opinions; but the following reflections will set the matter completely at rest.

For more than 350 years, it has been in agitation to throw shells from mortars, horizontally, instead of elevating them, according to the general practice. The adoption of howitzers on the field of battle, independently of a great number of special experiments, has at length proved, beyond doubt, the importance of this mode of firing; which it has also been proposed to adopt on board of ships, and on marine batteries. For my own part, I have continued to insist on this plan, ever since the year 1811, before the Minister of Marine and other persons in power. I have shewn that we ought to endeavour to surprise the enemy, at the beginning of a war, by the sudden use of a great number of hollow projectiles; but I did not print any thing on the subject previous to the year 1819, for fear of interfering with our maritime successes;—but at that period, I discovered it was unnecessary to keep it longer a secret; for the Americans, I was told, had, in 1815, adopted the use of shells and howitzers, with great success, on board their ships, and in their forts; a measure which the English are now beginning to imitate; and they will soon be followed by other maritime powers.

It may now be seen with how little reason M. Paixhans made a mystery of some similar plans, not possessing the same degree of perfection with others, so late as the year 1821; and with an account of which he filled an immense volume, intitled '*New Maritime Force*.' The old shells should no longer be made use of, although this author recommends them. We must imitate, or bring to a higher degree of perfection, the new projectiles of the Americans and English; but, above all, we must endeavour to render the sides of our ships impenetrable to shot and shells. This effect may be obtained by plating the present vessels with iron; or constructing new ships entirely of metal*.

Let us examine, according to the system which I propose for putting together the pieces of plate-iron, how a ship may be rendered shot- and shell-proof. To resist shot, the sides must be about six inches thick of iron; therefore the sheets of iron may be six lines thick, and their turned-up edges five inches broad. The space between the edges should be filled up with a block of cast-iron, of the commonest and cheapest kind; and in order to keep the blocks in their places, a lining of sheet-iron must be added, similar to that employed exteriorly, but thinner. As the blocks of cast-iron are only necessary in the parts exposed to the fire of the enemy, there is no need of any towards the keel of the vessel.

For sub-marine boats, particularly, it will be found advantageous to build them with iron instead of timber. The upper part of these vessels, by turns exposed to air and water, must be subject to leak, if it consists entirely of wood. The use of iron would prevent this serious inconvenience. Besides, a diving-vessel ought to be made of strong materials, to resist the pressure of the water; and have as much room as possible, to contain the machinery, and a sufficient quantity of respirable air.

* I have already published these two methods. See *Mémoires sur les Mines Flottantes;* Paris, 1819;—*Annales de l'Industrie*, of Dec. 1822, and Oct. 1823;—and *Annales Maritimes*, of Sept. 1833, and Jan. 1824.

[Some passages have been here omitted, which contained a tirade of national and political feeling by no means suited to the philanthropy and character of a Journal of Science.]

Let us hope, that a time will come, when patriotism, and even philanthropy, will not be constrained to invent new modes of destruction!—I shall terminate this paper, by reflections which are applicable to the industry and prosperity of all civilized nations. Already, in spite of precaution and very oppressive laws, the finest forests of the globe are almost insufficient to supply the timber required for ship-building. Large timber becomes every day more scarce; and the dimensions of new ships are daily increasing. In the mean time, as neither difficulty nor expense can deter Governments from building floating citadels, let us hasten to furnish other materials than centenary trees. They may be supplanted by metals; and the increase of activity in the mines will facilitate the progress of mechanical arts, commerce, and agriculture. It is now in motion. A multiplicity of objects, formerly composed of wood, are now formed of iron—bridges, arches, aqueducts, public highways; and other objects not so colossal, but very important in their application to maritime affairs; such as, wrought-iron tanks, and hollow cylinders for masts and yards; and chains, in lieu of hempen-cables and many parts of the cordage. Why, up to this time, have there been so few vessels constructed of iron? It is, because we can never perceive, but by degrees, the importance of the most useful inventions. The ordinary term of duration of ships is twenty years; during which time they must be hove-down, and thoroughly repaired, three or four times. The price of one of these vessels, completely fitted out, amounts to from thirty thousand to a million of francs. At some future period, mankind will wonder how enlightened nations could have thought of building objects so stupendous and so expensive with so fragile and perishable a substance as wood, whilst we possess a material, to substitute for it, so solid and durable as iron.

DE MONTGERY.

XCVI.—*On cutting Hard Steel and Crystal with Soft Iron.*

In Vol. III. p. 160, we gave an account of the experiments made by Mr. Barnes, of Cornwall, Connecticut, U. S. *on cutting Steel with Soft Iron.*

We learn from the *Anthologia*, for Jan. 1824, that the Director of the Museum at Florence has caused these experiments to be repeated, by the able mechanician of the Museum, Felix Goré. The result was perfectly conclusive. A large plate of crystal, also, was easily cut with a circular disk of iron, and became of a bright-red heat, at the place only where the iron was applied; a phænomenon which is not observable in metals; which, being good conductors of caloric, do not suffer it to accumulate in one point, but distribute it over the surrounding parts also.

XCVII.—*Rules by which the Commission of Metals proved the goodness of the Products exhibited at the Louvre. Extracted from the Second Part of the Report made to the Central Jury, by* M. Heron de Villefosse.

Lead.—In order that lead should possess that ductility which is peculiar to it, it must be free from alloy. The most unequivocal proof, therefore, of the goodness of lead is, its being ductile enough to be beaten with a hammer, passed between laminating-rollers, or drawn into wire, without fractures or flaws. All the lead exposed at the Exhibition of the year 1823 was acknowledged to possess these requisite qualities.

Copper.—To bear the operations of the hammer, the laminating-roller, and the wire-drawer, the copper must be refined, and managed with particular care. The beauty of the productions of this kind proved the ability of the French workmen. To be convinced of it, we have only to recollect the weight and dimensions of some of the pieces presented to public view.

Zinc.—The ductility given to this metal, which, for a long time, was considered as a semi-metal, depends, in a great measure, on the manner in which it is treated. Great difficulties in the way of its perfection have been overcome.

Brass.—This alloy ought to be entirely free from a defect very common to it, of not being well united in the fusion: it should yield readily and easily to the file; and be susceptible of being drilled, without cracking, or breaking into small pieces. It should be fit for soldering; and, in certain cases (such, for example, as in the making of wind-instruments), it should stretch, when beaten with a hammer, without cracking.

Bronze.—In all the objects of bronze, we have had merely to consider the quality of the metallic alloy, unless we except, indeed, the taste exercised in their formation. All the productions of this kind, which have been mentioned in the Report, sufficiently proved, by the variety and exactness of their forms, the good quality of the alloys employed.

The metallic mixture, of which the bronze medals are composed, consists of about ninety-two parts copper and eight tin. As the metal in cooling will shrink, it is necessary to make the model, from which the mould is to be formed, a little larger than the desired cast.

Mercury.—The sulphuret of mercury ought to be of an exceedingly brilliant red, to merit the name of vermilion.

Cast-Iron.—Cast-iron, whether to be employed in making malleable iron or steel, or to be run into moulds, ought to possess certain recognisable characteristics; such as, its colour; its appearance when broken; its action under the hammer and file, and its tenacity: but the best proof of its quality was, the appearance of the objects made of it. For this reason, the productions of this kind underwent an attentive examination.

Iron.—The good quality of this metal is judged of, by its not being brittle, either in a hot or cold state; but, on the contrary, ductile and close-grained, and undergoing the process of welding in a forge without injury.

All the iron exhibited gave, on trial, the most satisfactory results.

Steel.—The property of becoming very hard by tempering, without cracks, and at the same time possessing great tenacity—two advantages which seem incompatible with each other, are yet sought for in steel, in order to produce good tools. It is also necessary that each piece of steel be susceptible of being forged, and welded, either to itself, or to iron.

In assays of this kind, care must be taken not to heat the steel more than is necessary; and to employ, for the purpose, charcoal, as fuel. It is important, above all, to heat cast-steel, when it is forged, in earthen muffles, so inclined, that the air in them cannot be renewed.

As to the tempering of steel, it is proper to employ a bath of lead, raised to the temperature required for the quality of the steel, and according to the objects it is intended to make.—For tools, such as gravers, chisels, turning-tools, &c., after having completely hardened them, they must be brought to a proper temper, by heating, in the lead-bath, the end opposite to the cutting-edge of the tools, and then plunging them in cold water as soon as the colour of the steel assumes precisely the same tint as that which the workman keeps by him as a model during the operation.

Tempering in parcels; demi-tempering, which softens cast-steel; and the hard-tempering of cast-steel cutting-tools after carbonizing the surface (an operation which makes them capable of cutting iron); are very delicate processes. They require the utmost precaution, without which many a manufacturer has been deceived in the quality of the steel offered to him. At present, French manufacturers, having gained more experience, use French steel with success: and we only again mention the necessary precautions, to prove that they have not been omitted in our comparative assays of the different kinds of French steel.

Of every kind of steel which appeared at the Exhibition, gravers, chisels, and turning-tools, &c. have been made, which were tried by cutting and turning cast- and other iron with them, in order to put them to the proof.

Scythes and Sickles.—Scythes ought to acquire in the tempering enough hardness to cut what they are intended for, and at the same time possess ductility enough to be extended and thinned under the hammer, without cracking. These qualities cannot exist in the same instrument, if it be not composed of what is termed *stuff*, which is a proper mixture of iron and steel. It is also necessary that the scythes be made in different forms, to suit different places.

To prove the goodness of the scythes, they were notched into saws, and made to cut iron. The scythe that cut the deepest into the iron was considered as the hardest. The rest were classed progressively, by the same rule. They were then taken to the anvil, to try their ductility by the hammer.

In general, it was found that the French scythes were not, in any respect, inferior to those of other countries. They were all of convenient shapes, and of weights well proportioned to their dimensions.

Files and Rasps.—In files, it is desirable to find united the qualities of hardness and toughness; that the teeth may resist iron, and untempered steel, without crumbling. Their shape must also be regular, the teeth free from flaws, and the tool be generally without cracks or lumps. They must not cut when drawn backwards, nor fill up when employed upon copper or iron; neither must they make ridges, nor deviate from the direction the workman wishes to give them in use.

The files exposed were tried comparatively, in order to ascertain these qualities. To ascertain their hardness and tenacity, they were tried, both flat and edgeways, upon five bars of steel hardened to different degrees, forming a kind of progressive scale. In general, the files as well as the rasps were found to be of an excellent quality.

Saws.—To correspond with their various uses, saws must possess the combined qualities of good metal, exact forms, smooth surfaces, a proper distribution of the teeth, and, finally, the faculty of following easily the direction of the *saw-trace*; and also to wear well.

Sheet-iron, and Tin-plate.—Sheet-iron and tin-plate ought be ductile as well as firm, elastic, and capable of taking, under the hammer, any required form. In addition to these qualities, the tin-plate should possess the brightness of pure tin, and a perfectly smooth surface.

To test the ductility and firmness of sheet-iron and tin-plate, the pieces were doubled at their angles with pincers, and then again flattened with the hammer. Several articles were then formed out of them, with the hammer; such as trumpet-mouths, hemispherical caps, &c.

Wire-work.—The wire for this kind of work must be extremely ductile, otherwise it would be impossible to work it into the various shapes required. It must be soft enough to bend and twist about in every direction, without breaking.

In the sort denominated *traits*, excessive tenuity, brilliant polish, and perfect equality in size, are absolutely indispensable. In a word, it must possess all the qualities necessary to be able to compare with the celebrated wire-works of Germany.

Many of the specimens exhibited, possessed all these qualities in a satisfactory degree.

Needles.—Sewing-needles ought, in general, to be strong, and sufficiently elastic; sharp, and perfectly smooth and polished; with an eye neatly pierced, and a head well adapted to receive the thread and suffer it to escape easily. They must also be of proper sizes and forms, to suit the purposes for which they are intended.

Cards.—In the plates and ribbons of cards, the wire must be of good quality, strongly fixed, *secundum artem*, at proper angles.

Reeds of Drawn Wire.—These instruments are now employed instead of the reeds formerly used by cloth-manufacturers. The teeth of them ought to be smooth and supple, that the thread of the warp may pass easily between them, without injuring or breaking it. In a given space there ought to be a sufficient number of teeth, to correspond with the fineness of the article to which they are to be applied. They should be regularly arranged, and kept perpendicular their whole length; and should be united, either by a ligature or solder, at their ends.

Awls.—These articles, whether straight or bent, ought to be sharp enough to penetrate easily the substances on which they are employed. They must be stiff, but not brittle; their surfaces perfectly even; and their shapes, such as to suit their various uses.

Metallic Cloths.—We have already mentioned the metallic- or wire-cloths, and the uses to which they are put. It is desirable that they should be evenly woven, and proportioned to their different employment.

Not only did these cloths answer to these conditions; but some of them might even be deemed articles of luxury; as, for example, a waistcoat, and several other objects, made of metal-wire, which appeared to equal cambric in fineness.

Nails.—For this article it is only necessary to adopt that kind of iron which will best suit the purposes in which they are used.

Polished Steel, and Steel Jewellery.—The term *polished steel* sufficiently indicates the qualities it ought to possess. Its merit consists in having a brilliant surface; and its sale must be confined to high life. The principal aim of the manufacturer of this article is, to augment the value of the material by the costliness of the workmanship. When he can employ mechanical means as a substitute for manual labour, he not only derives from it greater advantage, but also benefits the buyer, by being able to afford his merchandize at a cheaper rate.

That steel jewellery is most esteemed which adds a brilliancy to the most vivid light. The most valuable trinkets are those composed of many small pieces, or of steel grains highly polished, and adapted to the reigning fashions.

Locks.—The art of the locksmith requires not only an ingenious combination of means of safety, but also much precision in every part of the workmanship; and a certain finish, which depends on the art of the workman, in his use of the file. The iron employed in this sort of work must be of the best kind; and capable of concealing, if we may so express it, the rigidity of its nature, at the same time preserving all its strength.

Cutlery.—The productions of the cutler's art are of two kinds; namely, fine and common. Both should be made of good steel; and the blades be capable of being kept to a good edge, by strapping or whetting. Fine cutlery requires a fine polish, elegant forms, and rich mountings. The common cutlery, not being an article of luxury, must afford good blades, at a moderate price, &c.

The cutlery exhibited, proved that our manufacturers in this line have made very considerable progress; and it was, in general, of a good quality, and cheap.

Swords.—It is well known that the steel of Damascus is found in a natural state, and is prepared by the Orientals in a manner peculiar to themselves. This kind of steel is distinguished from all other, by its hardness, by its resistance to the file, and by its mottled surface, consisting of fine veins of an ash-grey colour, termed *damasked.* We are indebted for these details to a French workman now employed in the foundry of Strasbourg, and who formerly worked at Damascus as a sword-cutler.

Many attempts have been made in France to imitate this *damask* property, by different mixtures of iron and steel, which are denominated *stuffs.*

M. Bréant, after a long series of experiments, has discovered that the metal of which the swords of Damascus are formed, is cast-steel, charged more highly with carbon than European steel, and in which, by the effect of cooling, well managed, a kind of crystallization is effected, or a separation of the two distinct combinations of iron and carbon. The same philosopher has discovered the means of directly converting cast- and bar-iron into cast-steel, by a simple and cheap operation. M. Bréant thus obtains damasked steel directly from cast- and bar-iron. His mode of operating approaches very closely to that used by the Orientals.

XCVIII.—*On the preparation of Catgut, for various uses.*

[Continued from p. 334.]

CATGUT *for Rackets or Battledores.*—The intestines of sheep, after they have been steeped in the alkaline lye, are cut slantwise, if they are in short lengths, and sewed together; carefully placing the slants in a direction contrary to each other, that the seams may not render the cords of an unequal size. This being done, and the intestines formed into one piece, it must be soaked in ox-blood, to give it the proper colour, and then be stretched on a proper frame; after which, one, two, three, or four of the intestines, according to the required size of the cord, are fixed to a piece of tape, and the other ends are turned twice round a peg. This done, the workman takes the tape, applies it to a hook on a spindle, and gives a few turns of the handle. As the cord shortens by twisting, it must be well stretched; and when this is effected, the workman squeezes the cord between his finger and thumb throughout its whole length, to remove all its humidity, and produce an equal thickness in every part of it. One or two hours after, he twists it again, and rubs it with a horse-hair cord, wetted.

Thinner cords are made of only one intestine; operating, as we have before indicated.

Catgut for Whip-handles.—Sheep's intestines, prepared with potash, are used for this purpose. The workman cuts them slantwise, and sews them together, observing always to keep them of an equal size. They are then stretched, and twisted at each end: it is very rare that this sort of cord is made of two intestines. They are then bleached, by the fumes of burning sulphur, once or twice; and sometimes coloured; as they readily receive any dye. Common ink is used for a black colour; and red-ink for a rose-colour, which is sometimes rendered lighter by a little sulphuric acid. A green colour is given by a composition sold for that purpose, by colourmen, to the manufacturers of catgut.

Catgut of Hatters' Bows.—These are made of sheep's intestines, of the longest and largest kind, after being prepared with potash, by twisting together from 4 to 12 of them, according to the size required. They are usually made from 15 to 25 feet long. During the twisting, the cord is placed in a long box, from 18 to 20 inches in breadth, and a few inches high, in order to keep it clean, and prevent it from trailing on the ground. The box is called the *refresher*.

This kind of cord must be void of seams and knots; to accomplish which, the workman attaches the intestines to a piece of tape, hangs them on a peg, and draws the whole of them straight, to fit their other ends to another peg: in doing which, if he finds the intestines too short, he makes a hole in their ends, and threads into them short pieces, till the whole is long enough to reach the other peg, placed at a given distance from the first. These ends are then affixed to a piece of tape, and fastened to the peg. This done, he applies them to the twisting-wheel, rubbing the cord well between his finger and thumb throughout its whole length, at every turn of the wheel, in order to make it of an equal size. When about half-dry, they are exposed twice to the fumes of sulphur; after each time, the cord must be well stretched and moistened with plenty of the solution of potash, at the same rubbing with the hair-rubber. It is then left to dry, and afterward cut, and coiled up for sale.

Catgut for Clock-makers.—This kind must be very fine; and of course requires the smallest intestines, well prepared with potash. Sometimes they are made by cutting, with a particular kind of knife, the intestine into two strips. The knife, which is fixed to a table, has two edges, in opposite directions; and above them, a ball of lead, which is introduced into one end of the intestine; and by drawing the latter continually over the ball, the projecting blades cut it into two strips, which the workman holds, one in each hand; drawing them regularly, till it be cut quite through.

Watch- and Clock-makers also use catgut of various sizes, consisting of more than one intestine, and made like the musical-instrument cords; which we shall next describe.

Catgut for Musical Instruments.—Of all the cords from intestines, this kind is the most difficult to make, and requires the greatest care and ability of the workmen. It is acknowledged that for many years they have been made as well in France as in Italy, with the exception of the treble-strings for violins, which our manufacturers have not been able to imitate, but on a very limited scale. This is either owing to the difference in quality of the intestines, or some other unknown cause. Whatever it be, we are still tributary to Naples for this article; and every exertion ought to be made to free us from this necessity. Experiments, made with skill, will no doubt succeed; and the Society for the Encouragement of National Industry, by calling the attention of artists to this subject, will have the glory of contributing to the perfection of an art, of which little is at present known.

The cleaning and scraping of the intestines for this purpose, to free them from the fat, must be done with much more care than is requisite for other cords; and, when they have undergone that process, they must be steeped in an alkaline lye, prepared as follows:—

An earthen pan, holding six quarts, is filled with water, and three pounds of potash are added to it; which must be well stirred, and suffered to subside. In a similar vessel, full of water, placed by the side of it, are put five pounds of pearl-ash; leaving that also to settle. If it be wished to make use of this solution within a short time, it will be necessary to add to it a little alum-water, which will clarify it quickly.

The scraped intestines are now put into earthen-pans, so as about to half-fill them. The pans are then filled up with the solution of potash, with as much water added as to double the quantity of fluid. This liquid is changed twice a day, increasing its strength each time, by adding more of the solution of pearl-ash, and diminishing progressively the quantity of water; so that the last solutions be the strongest. The intestines gradually become whiter, and begin to swell. After having suffered them to macerate from three to five days, or more, according to the state of the atmosphere, the operation proceeds as follows—

Every time that the alkaline solution is changed, the pans are placed upon the box called the *refresher*, placed on a table, or on tressels, in a slanting direction, so as to facilitate the running off of the water. This box must be large enough to hold the frame on which the cords are to be stretched. The intestines are scraped with the edge of a copper-cube, held in the left-hand. The forefinger of the left-hand is placed near to the edge of the copper-cube; whilst, with the right-hand, each intestine is drawn over the edge of the disk or cube, and between the fore-finger.

When they have all been treated in this manner, and placed in a fresh pan, a stronger alkaline solution is poured on to them than that from which they were last taken, as we have before mentioned. This operation is necessary for cleansing the intestine of its greasy quality, and bringing the cords to perfection.

As soon as it is perceived that the intestines begin to swell, and some little bubbles appear on their surface (for in this state they rise in the water), it is necessary to twist them *immediately*, or they will begin to shrivel; which sometimes happens, particularly in summer, and occasions the loss of the intestines, and also the time spent over them. In hot weather, the intestines are, indeed, most easily cleaned from fat; but then the workman must be more than ordinarily attentive; and the different lyes for the washings must be made stronger with alkali, and applied more quickly. In winter, all goes on in better order, and the operation is more certain. The manufacturers of this article generally place their workshops in cool places, where there is a little dampness.

The intestines being now ready to be twisted, they are taken out of the alkaline solution. Some manufacturers plunge them again into fresh water, and wash them well therein; but, although they become, by this method, of a better colour, and take the sulphur better, they run the risk of being weakened.

To twist and finish the cords, a machine is used—a kind of frame, two feet high, and five feet long; on one end of which are placed a number of pegs; and in the opposite end are bored, with a large auger, a number of holes, inclined in such a way, that when pegs are placed in them, to attach the cords to, they may not be liable to slip and come out. The intestines are now selected according to their size; and two or three of them are taken, and the ends twisted round one of the pegs first placed; and the other ends are carried to the opposite ones, and attached to them. Two turns of the intestines around the pegs are sufficient to prevent their slipping. When fixed to the pegs, they must not be drawn tight; as they would be subject to snap during the twisting, if sufficient play were not given to them for that operation.

If any of the intestines should be found too short to reach the opposite side of the frame, they must be lengthened, by pieces cut off any others which may be too long; and care must be taken to make the ligature near the last-placed peg, to preserve the cord of an equal size in its whole length; as otherwise it would be false in its tone.

The frame being filled up in the manner we have described, two or three of the pegs, bearing one end of the intestines, are fixed to spindles, if the machine contains several, and turned round several times; passing the finger and thumb of the left-hand frequently from one end of the cord to the other, beginning at the spindle. When all the cords have undergone this operation, and the pegs are all replaced, the whole frame is placed in the sulphuring closet, with several others; as it would not be worth while to sulphur one at a time.

The sulphuring closet is placed in a damp place, surrounded as much with water as possible. An earthen vessel, containing the sulphur, is placed in it, with the frames: the sulphur is then set on fire, and the closet well closed in every part, to confine the fumes. When the cords have remained a sufficient time—which, of course, varies in some measure, according to circumstances—the frames are taken out, and placed on the *refresher*, and rubbed with a horsehair cloth. This done, they are again placed in the frame, twisted anew, and returned to the sulphuring closet, to undergo the same process as before. If the state of the atmosphere require it, the whole of these processes must be twice or thrice repeated; and they are then left to dry.

When the cord is sufficiently dry, it is known by its not running up when a peg is taken out, and remaining stiff and straight, instead of flagging. If dry enough, they are well oiled wich good olive-oil, and coiled up into rings for sale. They become better by being kept some time.

To make the fourth strings for violins, or any other sized cords, intended to be oovered with metal-wire, the process is so well known, that it need not be here described.

The whole success of these operations depends principally on the ability and experience of the workmen in managing the different washings, stretchings and twistings, and in a judicious use of the sulphur. When the cord is too much sulphured, it readily snaps; and, on the contrary, when it is not enough so, it stretches too much, and never keeps in tune.

We may conclude, that there is no fixed rule yet adopted for the success of this branch of manufacture; but we have much expectation, that, with the aid of the Society for Encouraging National Industry, we should soon succeed as well as the Italians.

XCIX.—*On the Management of Fig-Trees in the open air; with the names of the best sorts. By Mr.* Samuel Sawyer, *Gardener to* Isaac Lyon Goldsmid, *Esq. F.H.S.**

Sir, *Camberwell, Jan.* 29, 1823.

I submit to the consideration of the Horticultural Society, the following account of my *mode of managing fig-trees in the open air*; with the names of the best sorts for cultivation; so as to have a regular succession of fruit, from August to October. I shall begin at the period when the trees are in an inactive state; that is, in November; following the seasons, round to the next autumn.

In the beginning of that month, I detach the whole of the branches from the walls, removing all the nails and shreds; after which, I carefully examine the autumnal fruits; leaving on the branches all that have a firm skin, and are of a dark-green colour, and do not exceed the common filbert in size. Those which are not of that description, I remove. I then draw into a sort of cone as many of the branches as are contiguous to each other, and tie them together; filling all the vacant spaces between the branches in those cones, with short, dry, and clean hay; and roll double mats over the whole; being particularly careful to guard the extremity of the branches from the inclemency of the winter's frost. I then lower the whole of the cones, either to the right or left, as may be convenient; in such a manner, that the tops of each may be at least two feet below the top of the wall: they are then made fast to the wall, with good ties of rope-yarn. I let them remain in this state until March, when I take off the mats, and remove the hay. Selecting the best-placed and most-productive branches, and taking out ill-placed, superfluous, and irregular ones, I train those which are preserved in proper regularity and good order, according to their situation; but not nearer to each other than six or eight inches.

* From Vol. V. of the Society's Transactions.

After the whole tree has been nailed over, I cover it with a single mat; which remains on until the middle of April, when it is taken off, and a net, three times folded, put in its place. The net is taken away, one fold at a time, according to the advance of the foliage and warmth of the weather; and the whole tree is cleared by the latter end of May. If I find, during the summer, that the leaves are so thick as to exclude the sun from the fruit, I take off a few of them, with care; but not so as to admit much reflection from the wall, which would be injurious to the fruit. In removing the leaves, I am always mindful to cut the foot-stalks directly under, or close to the leaf, that the oozing of the milk may soon dry up.

Experienced gardeners are well aware that the autumnal fruits will ripen sooner, and be larger and better-flavoured, than those which make their appearance in spring; and, by pursuing the practice above recommended, such may be obtained in full perfection.

As it is very desirable to have a regular succession of figs, from August to October inclusive, I cultivate the following sorts; which ripen in the order in which they are named :—

1. Brown Ischia—ripens in the middle of August.
2. Large White Genoa—ripens the end of August.
3. Green Ischia—ripens the beginning of September.
4. Murrey, or Brown Naples—ripens the middle of September.
5. Ford's Seedling—ripens the end of September.
6. Black Provence—ripens the beginning of October.
7. Yellow Ischia—ripens the middle of October.
8. Gentile—ripens the end of October.

These are all good kinds. The Murrey, or Brown Naples, will ripen its fruit as a standard, in fine summers; as will also the Blue Ischia, and Black Genoa, which are not enumerated in the above list, because they are not so certain bearers, in all soils.

The fig I have named Ford's Seedling is sometimes called the Pocock Fig; and is, I understand, more properly denominated the White Marseilles Fig. The Black Provence Fig, I originally found in the garden at Bookham Grove, near Leatherhead, then belonging to the Hon. Marmaduke Dawnay: it is of an oval shape, having a very dark brown skin, and with dark purple flesh: the plant grows vigorously, producing large leaves, and is a tolerably free bearer. I am, Sir,

Your obedient humble servant,

SAMUEL SAWYER.

JOSEPH SABINE, Esq. Sec.

C.—MISCELLANEOUS.

Queries, on the Striking-Parts of Turret-Clocks. By a CORRESPONDENT.—*With Remarks by the* EDITOR.

Bury St. Edmunds, May 16, 1824.

BEING a constant Reader of your valuable publication, the Technical Repository, and seeing that you sometimes insert articles from the Transactions of the Society for the Encouragement of Arts, and give us your remarks upon them, I observe that you have not given us a description of Mr. Wynn's improvement in the striking-part of Turret-Clocks, as described in Vol. XL. of the Transactions.

I should be glad to ask, of you, or any of your Correspondents, if it had ever yet been put in practice, and where? and likewise, whether a small hammer, lifted to a greater height than a large one, so as to strike with the same force, will produce the same tone from the bell? An answer to these questions would greatly oblige,

Sir, yours, &c.

T. GILL, *Esq.* A COUNTRY CLOCK-MAKER.

REMARKS.

In reply to the above Queries, we have to inform our worthy Correspondent, that we understand a few of Mr.

Wynn's striking-parts of Turret-clocks have been applied by himself, in different parts of the country; but we do not think the principle of them quite applicable to the striking upon the *sloping edge* of a bell.

We conceive that a small hammer, raised to a greater height, would not yield a tone of the same intensity with a larger one: the experiment, however, is so easily made, we only wonder that our Correspondent has not ascertained the fact.

Rewards *voted by the Society for the Encouragement of Arts, Manufactures, and Commerce; in the Session of* **1823—1824.**

To Philip Hurd, Esq. Kentish Town House, for raising oaks for timber —the large Gold Medal.

To Henry Blyth, Esq. Burnham, Norfolk, for embanking 253 acres of marsh land from the sea—the large Gold Medal.

To Messrs. Cowley and Staines, Winslow, Bucks, for cultivating 12 acres of poppies, and obtaining therefrom 196 lb. of opium—Thirty Guineas.

To Mr. R. W. Dickinson, Albany Brewery, Kent Road, for a machine for clearing beer while in fermentation—the large Silver Medal.

To Mr. H. Wilkinson, 12, Ludgate Hill, for an improved safety chamber to the oxy-hydrogen blowpipe—the large Silver Medal.

To Mr. T. Griffiths, Church-street, Kensington, for an improved stop-cock for chemical purposes—the Silver Vulcan Medal.

To Mr. G. Chapman, of Whitby, for a mode of consuming the smoke of steam-engine boilers—the large Silver Medal.

Fourteen Original Paintings, in Oil Colours.

Five Copies, in Oil Colours.

Five Original Paintings, in Water Colours.

Nine Copies, in Water Colours.

One Original Drawing, in Chalk.

Seventeen Copies, in Chalk, Pencil, and Indian Ink.

Ten Drawings from Statues and Busts.

Four Original Models, in Plaster.

Four Copies of Models, in Ditto.

Eleven Drawings in Architecture.

Two Drawings of Machines.

Two Engravings.

Fifteen Rewards for Bonnets made of British Grass, in imitation of Leghorn.

To Mr. S. Clint, Rolls-Buildings, for an original medal-die of a head —the large Silver Medal.

To Mr. James Howe, Little Tufton-street, for an original whole-length miniature in wax—the Silver Isis Medal.

To Mr. Edmund Turrell, 46, Clarendon-street, for an inproved menstruum for biting-in, on steel plate—the large Gold Medal.

To Mr. J. Straker, Redcross-street, Cripplegate, for a new mode of embossing on wood—the Silver Isis Medal, and Ten Guineas.

To Mr. F. Watt, for a screw-wrench—Ten Guineas.

To Mr. T. Eddy, 354, Oxford-street, for a screw-wrench—the Silver Vulcan Medal.

To Mr. G. Gladwell, 4, Lower Garden-street, Vauxhall, for an improved plane for carpenters—Five Guineas.

To Mr. G. Welsh, 12, Mount-street, Walworth-Common, for an original screw—the Silver Vulcan Medal, and Ten Guineas.

To Mr. J. Duce, Wolverhampton, for a quadruple lock for safe-chests &c.—the Silver Vulcan Medal, and Ten Guineas.

To Edward Speer, Esq. 7, New Inn, for concentric chucks for turners —the large Silver Medal.

To Captain Bagnold, 7, High-Row, Knightsbridge, for an improved culinary steam-boiler—the Silver Vulcan Medal.

To Mr. J. Aitkin, St. John-street, Clerkenwell, for a remontoire escapement—Twenty Guineas.

To Mr. J. Bothway, Devonport, Plymouth, Gunner in the Royal Navy, for an apparatus for raising invalids in bed—the Silver Vulcan Medal.

To Mr. J. Stirling, Glasgow, for a set of working drawings of a steam-engine—the large Silver Medal, or Twenty Guineas.

To Mr. R. W. Franklin, 92, Tottenham Court-Road, for an improved mode of feeding the boilers of high-pressure steam-engines—the large Silver Medal, and Fifteen Guineas.

To T. Bewley, Esq. Montrath, Ireland, for an improved mode of heating manufactories—the large Silver Medal.

To Mr. F. Richman, 35, Great Pulteney-street, for a method of raising a sunken floor—the large Silver Medal.

To Mr. A. Ainger, Everett-street, for his mode of supporting beams or other timbers the ends of which have become decayed—the large Gold Medal.

To Mr. R. Soper, Royal Dock-yard, Devonport, for a pitch-kettle and ladle for paying the seams of ships—Ten Guineas.

To Mr. W. P. Green, Lieut. R.N. for improvements in working ships' guns—the large Silver Medal.

To Mr. R. C. Clint, for his balanced masts—the large Silver Medal or Twenty Guineas.

To G. B. Burton, Esq. Capt. R.N. for his improved mode of catting an anchor—the large Silver Medal.

To Mr. W. J. T. Hood, Lieut. R.N. for his improved quadrant for naval use—the Gold Vulcan Medal.

To Mr. G. Smart, Pedlar's Acre, Lambeth, for an improved mode of supporting the topmasts of ships—the Gold Vulcan Medal.

To M. Chazal, Isle of France, for silk the produce of the Isle of France—the large Gold Medal, or Fifty Guineas.

To Mr. T. Kent, for preparing and importing from New South Wales, extract of Mimosa bark for the use of tanners—Thirty Guineas.

To J. M'Arthur Esq. Sydney, New South Wales, for the importation of the greatest quantity of fine wool, the produce of his own flocks—the large Gold Metal.

To Hannibal M'Arthur, Esq. Sydney, New South Wales, for the importation of the next greatest quantity of fine wool, the produce of his own flocks—the large Silver Medal.

LIST OF PATENTS FOR NEW INVENTIONS,

which have passed the Great Seal since April 27, 1824.

To Alexander Dallas, of Northumberland Court, Southampton Buildings, in the parish of St. Andrew, Holborn, in the county of Middlesex, Engineer; for a Machine to pick and dress Stones of various descriptions, particularly Granite stone. Dated April 27, 1824.—To be specified in six months.

To John Turner, of Birmingham, in the county of Warwick, Brass and Iron Founder; for a Machine for crimping, plaiting, and goffering Linen and Muslin Frills, and other articles. Dated April 27, 1824.—In two months.

To George Vaughan, of Sheffield, in the county of York, Gentleman; for an improvement or improvements on Steam-Engines, by means of which, power will be gained, and expense saved. Dated May 1, 1824.—In six months.

To John Crosley, of Cottage Lane, City Road, in the county of Middlesex, Gentleman; for an improvement in the construction of Lamps or Lanthorns, for the better protection of the light, against the effects of wind or motion. Dated May 5, 1824.—In six months.

To William Cleland, of Leadenhall Street, in the city of London, Gentleman; for an improvement in the process of manufacturing Sugar from Cane-Juice, and in the refining of Sugar and other substances. Dated May 6, 1824.—In six months.

To James Viney, of Shanklin, in the Isle of Wight, Colonel in the Royal Artillery; for certain improvements in, and additions to Water-Closets. Dated May 6, 1824.—In six months.

To John Theodore Paul, of Geneva, but now residing at Charing Cross, Westminster, in the county of Middlesex, Mechanist, in consequence of a communication made to him by a certain Foreigner residing abroad; for certain improvements in the method or methods of Generating Steam, and in the application of it to various useful purposes. Dated May 13, 1824.—In six months.

To John Potter, of Smedley, near Manchester, in the county-Palatine of Lancaster, Spinner and Manufacturer; for certain improvements in Looms, to be impelled by mechanical power, for weaving various kinds of Figured Fabrics, whether of Silk, Cotton, Flax, Wool, or other materials or mixtures of the same; part of which improvements are applicable to Hand-Looms. Dated May 13, 1824.—In six months.

To Jacob Perkins, of Fleet Street, in the city of London, Engineer; for an improved method of throwing Shells and other Projectiles. Dated May 15, 1824.—In six months.

To William Church, of Birmingham, in the county of Warwick, Esq.; for certain improvements in the Apparatus used in Casting Iron and other Metals. Dated May 15, 1824.—In six months.

To John Holt Ibbetson, Esq. of Smith Street, Chelsea, in the county of Middlesex; for certain improvements in the production or manufacture of Gas. Dated May 15, 1824.—In six months.

To Lemuel Wellman Wright, of Wellclose Square, in the county of Middlesex, Engineer; for certain combinations of improvements in Machinery for making Pins. Dated May 15, 1824.—In six months.

To Joseph Luckcock, of Round Cottage, Edgebaston, near Birmingham, in the county of Warwick, Gentleman; for an improvement in the process of Manufacturing Iron. Dated May 15, 1824.—In six months.

To William Henry James, of Cobourg Place, Winson Green, near Birmingham, in the county of Warwick, Engineer; for an improved method of constructing Steam-Carriages, useful in the conveyance of persons and goods, upon highways and turnpike-roads, without the assistance of rail-roads. Dated May 15, 1824.—In six months.

To Thomas Parkin, of Bache's Row, City Road, in the county of Middlesex, Merchant; for certain improvements in Machinery or Apparatus applicable to or employed in Printing. Dated May 15, 1824.—In four months.

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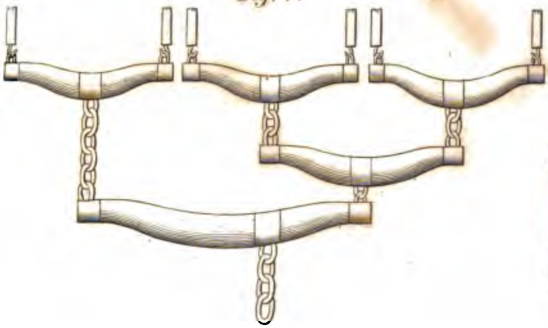

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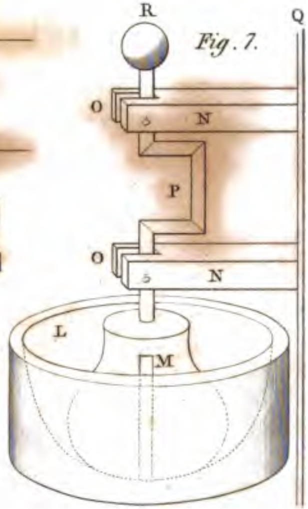

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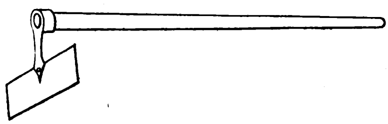

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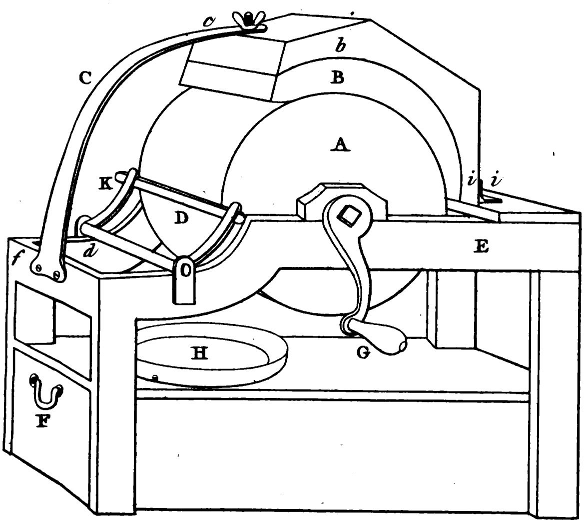

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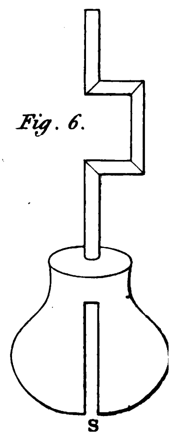

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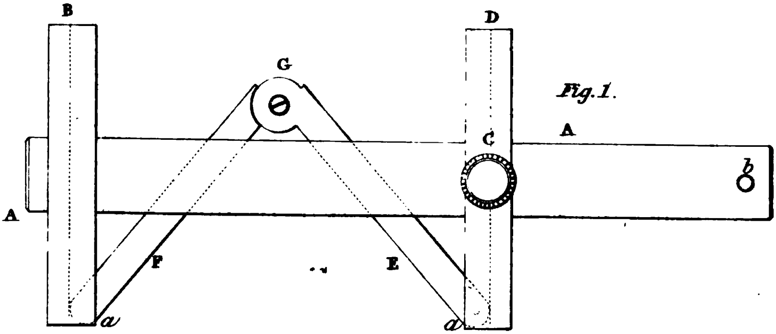

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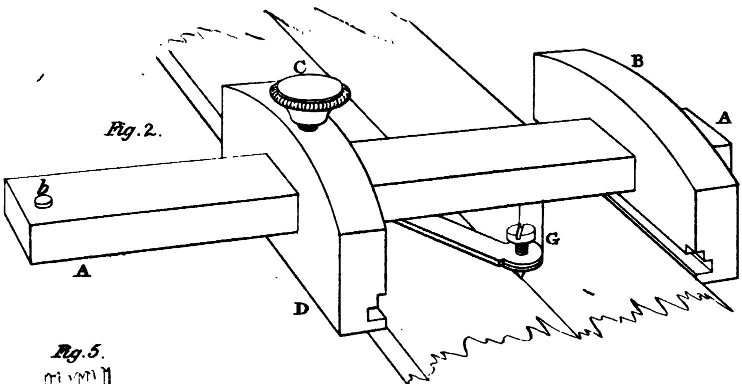

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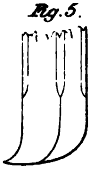

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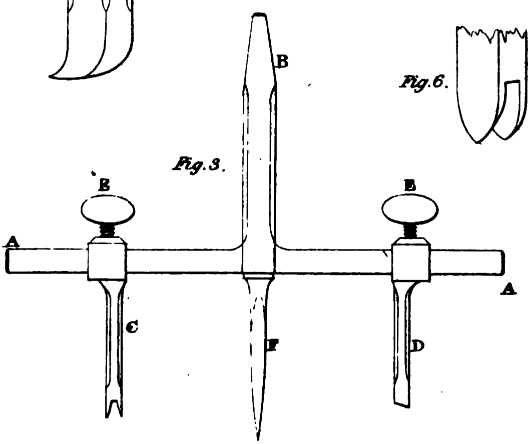

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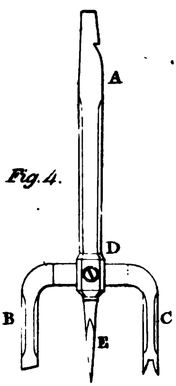

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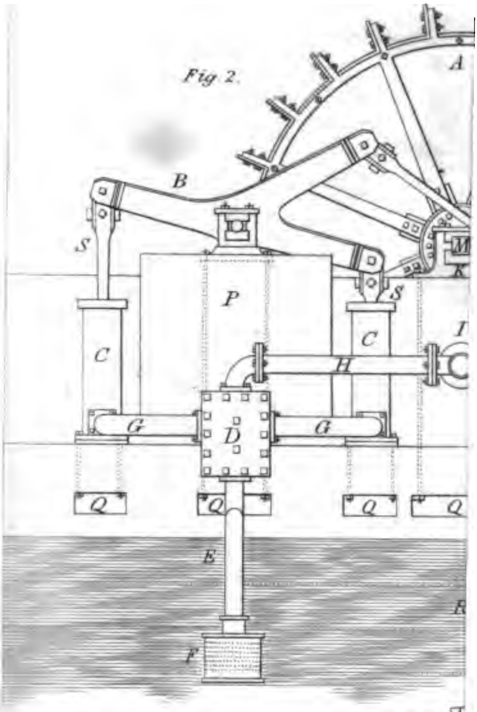

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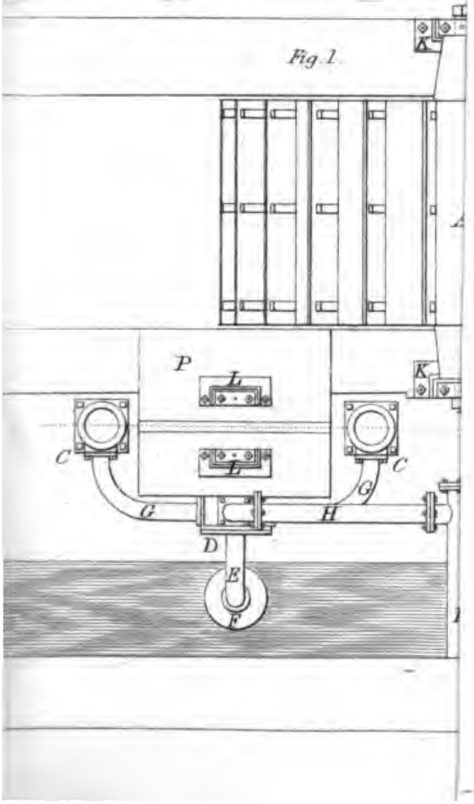

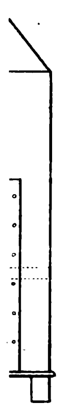

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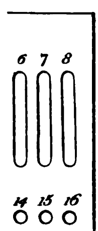

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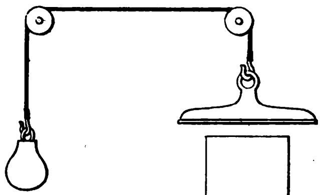

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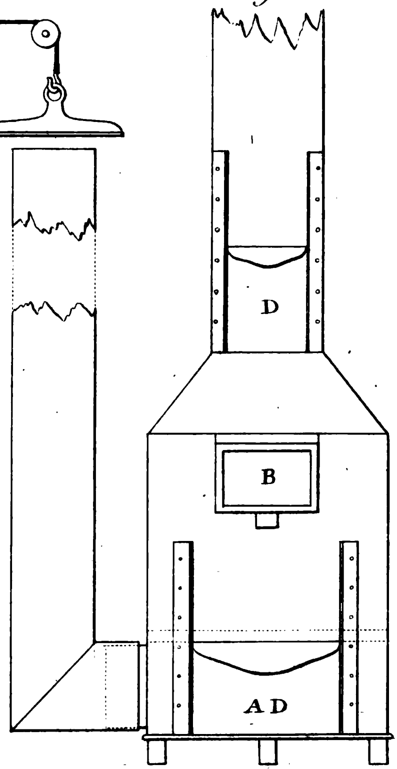

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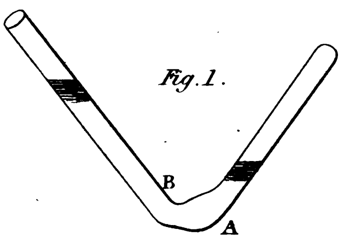

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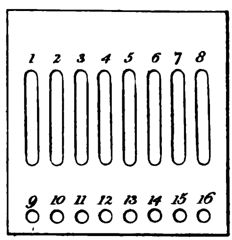

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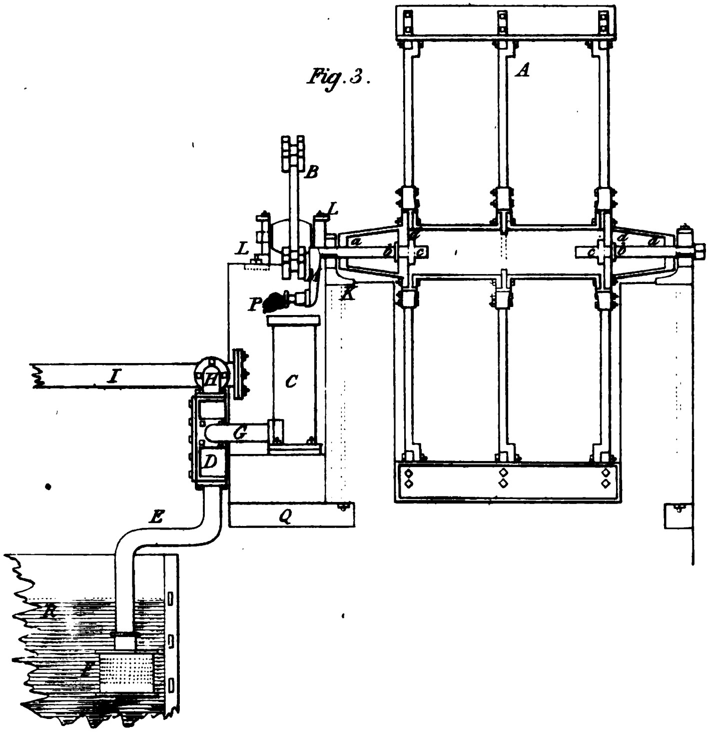

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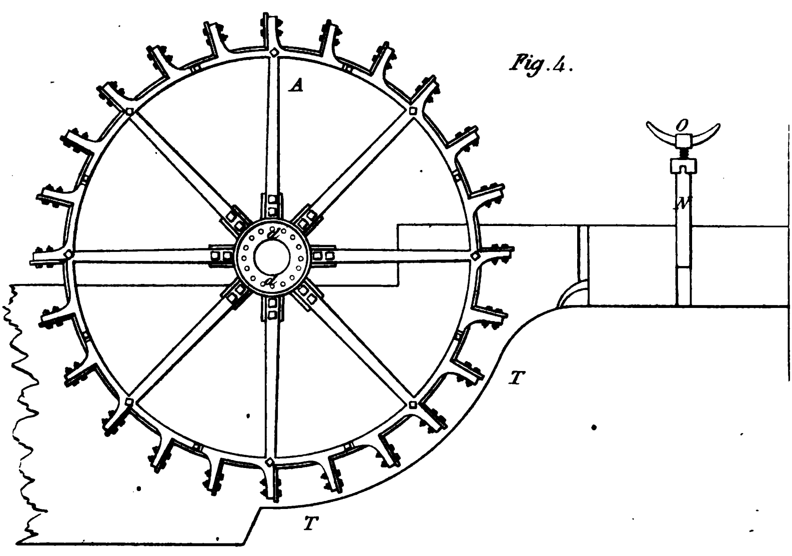

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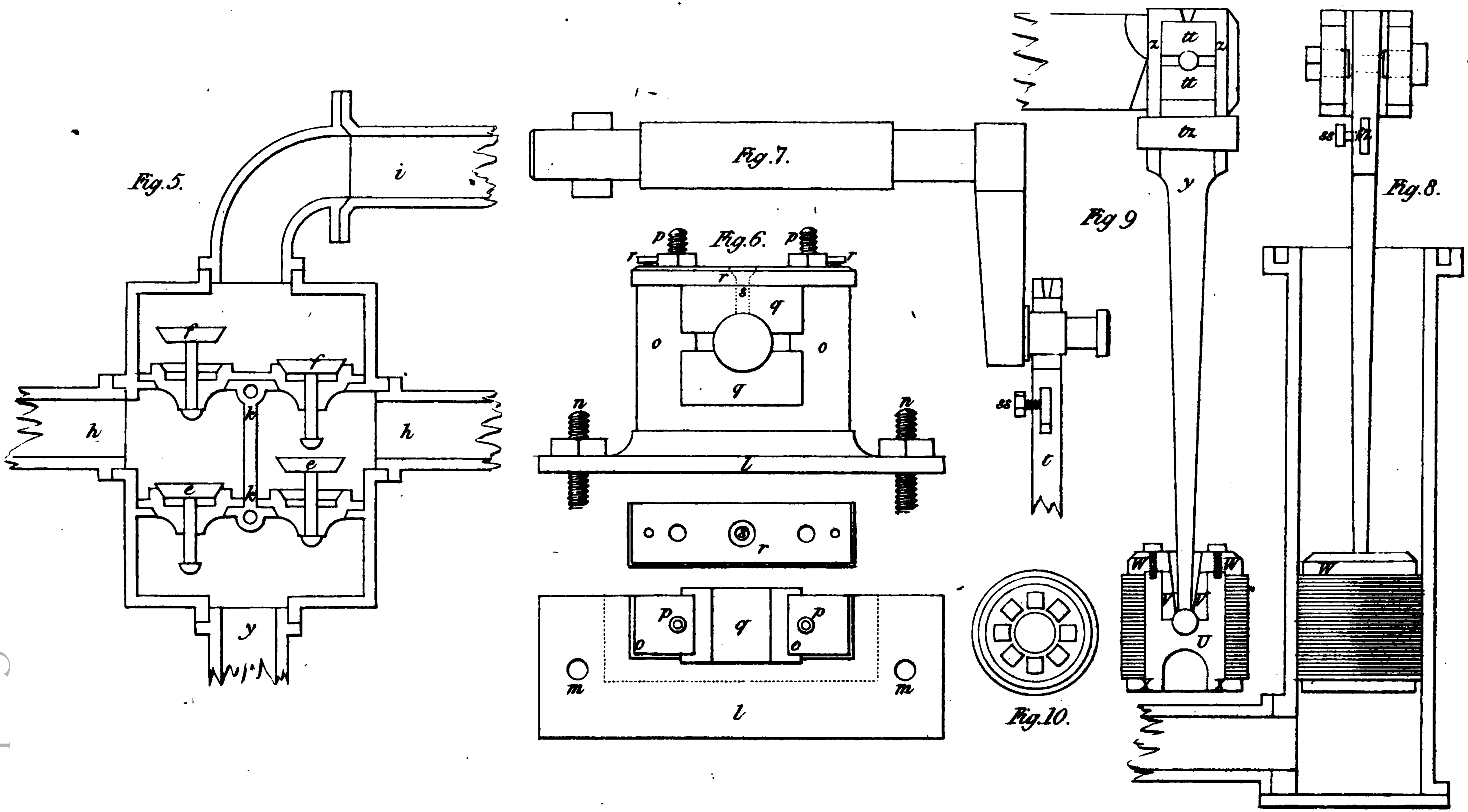
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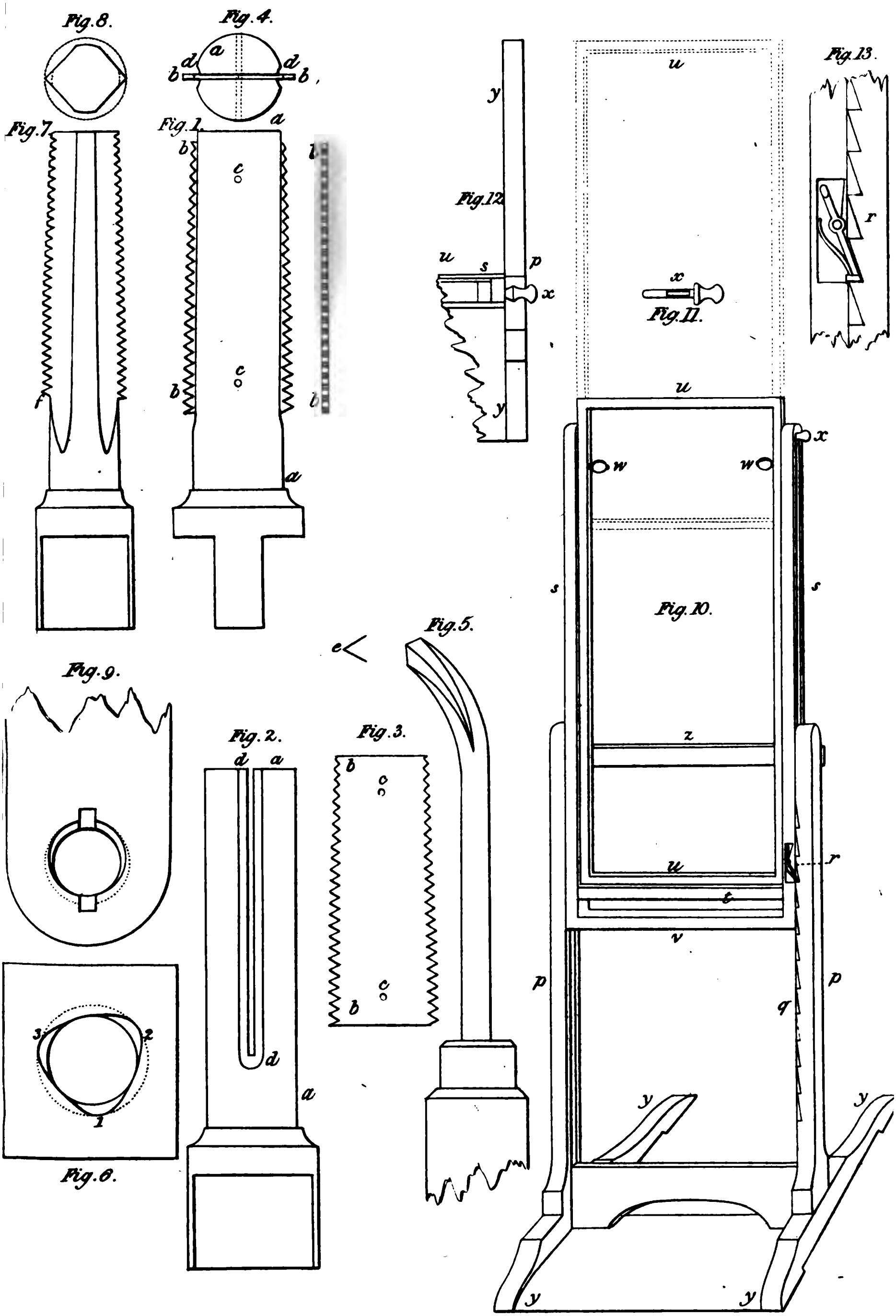

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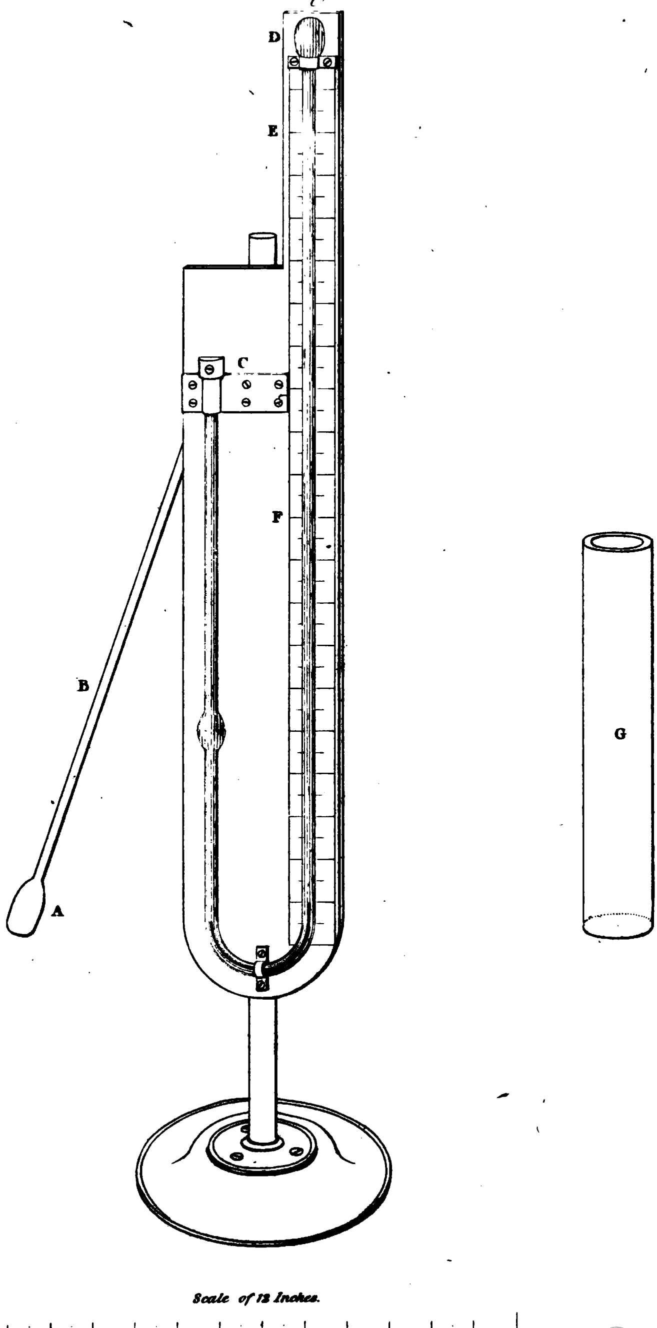

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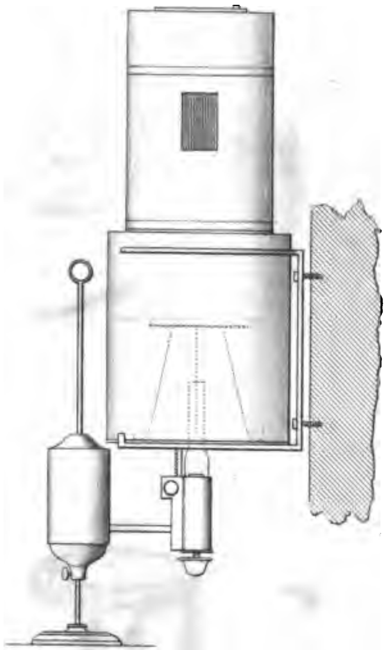

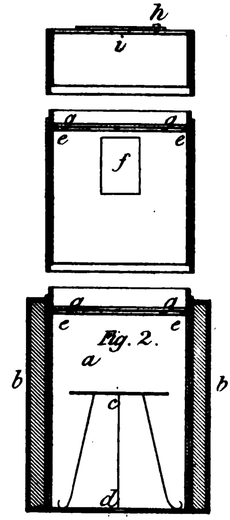

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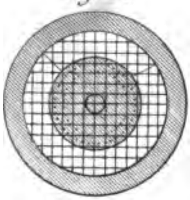

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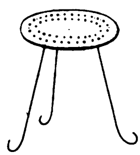

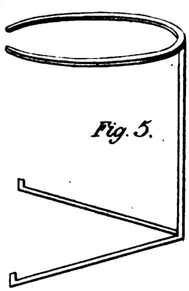

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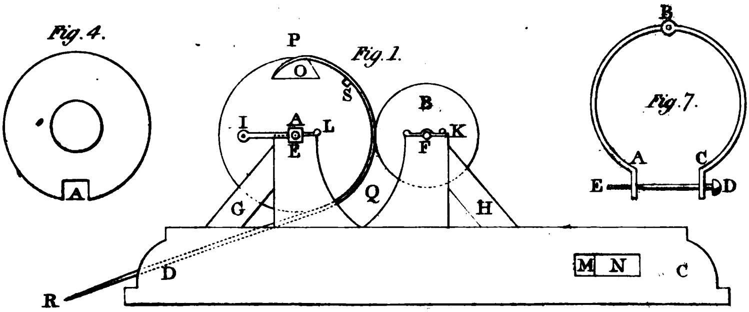

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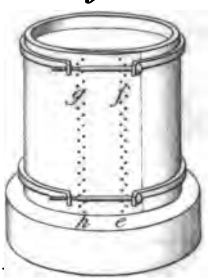

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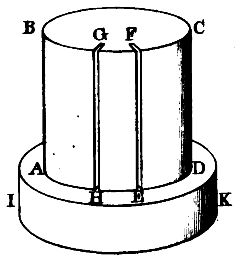

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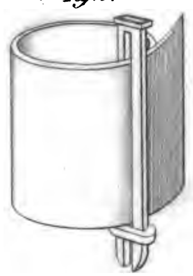

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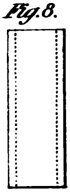

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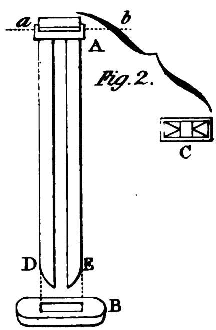

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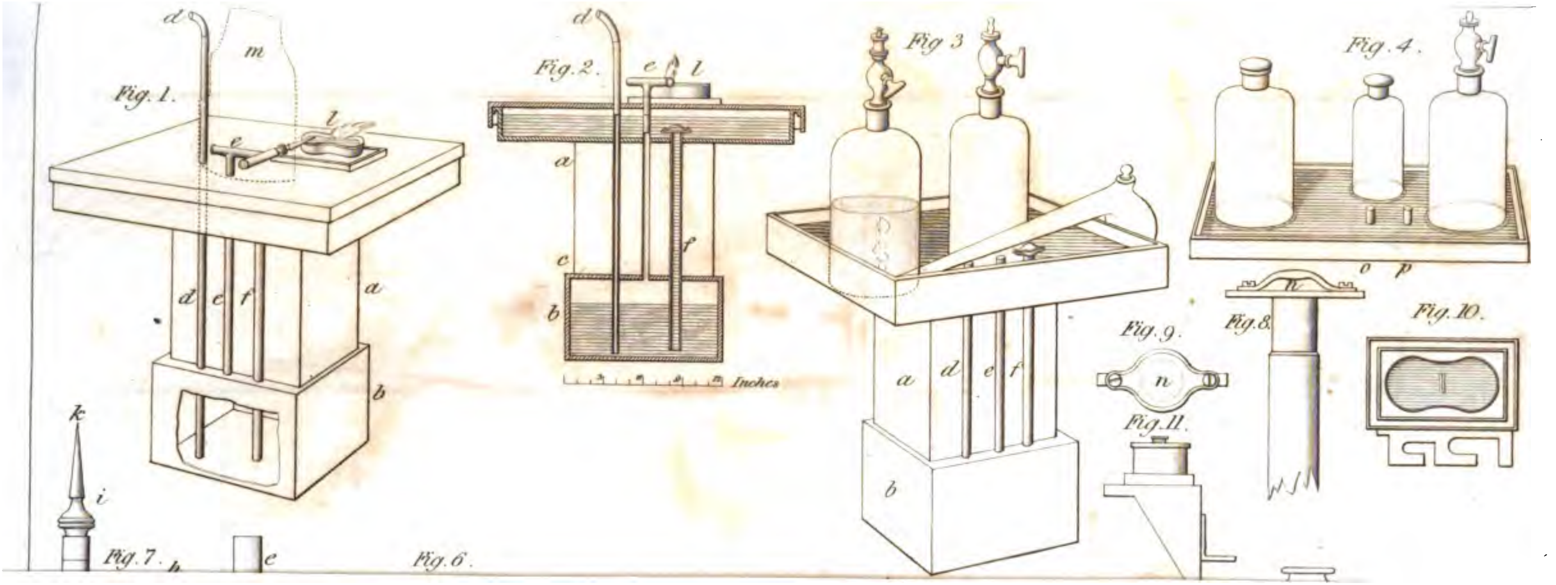

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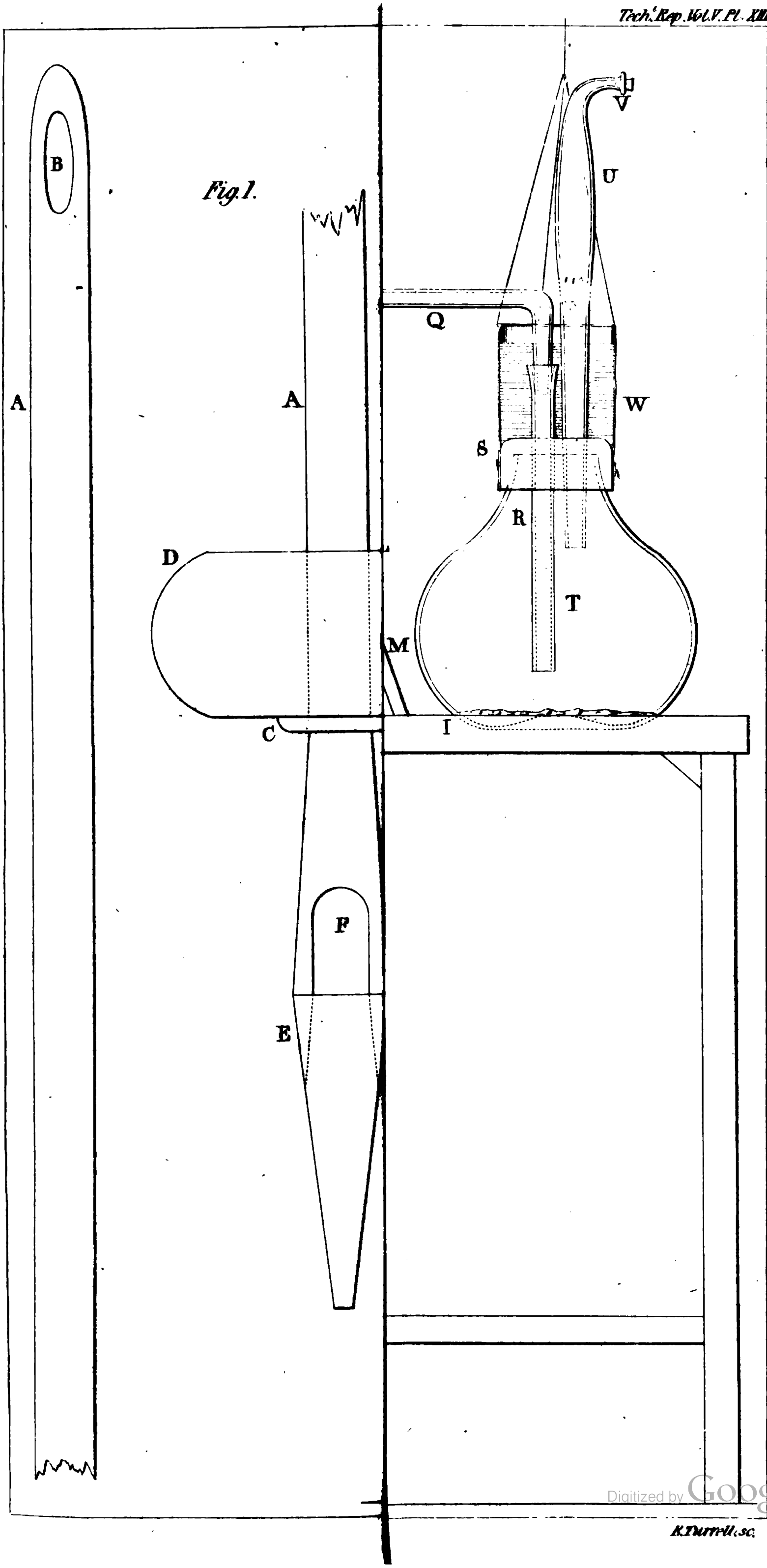
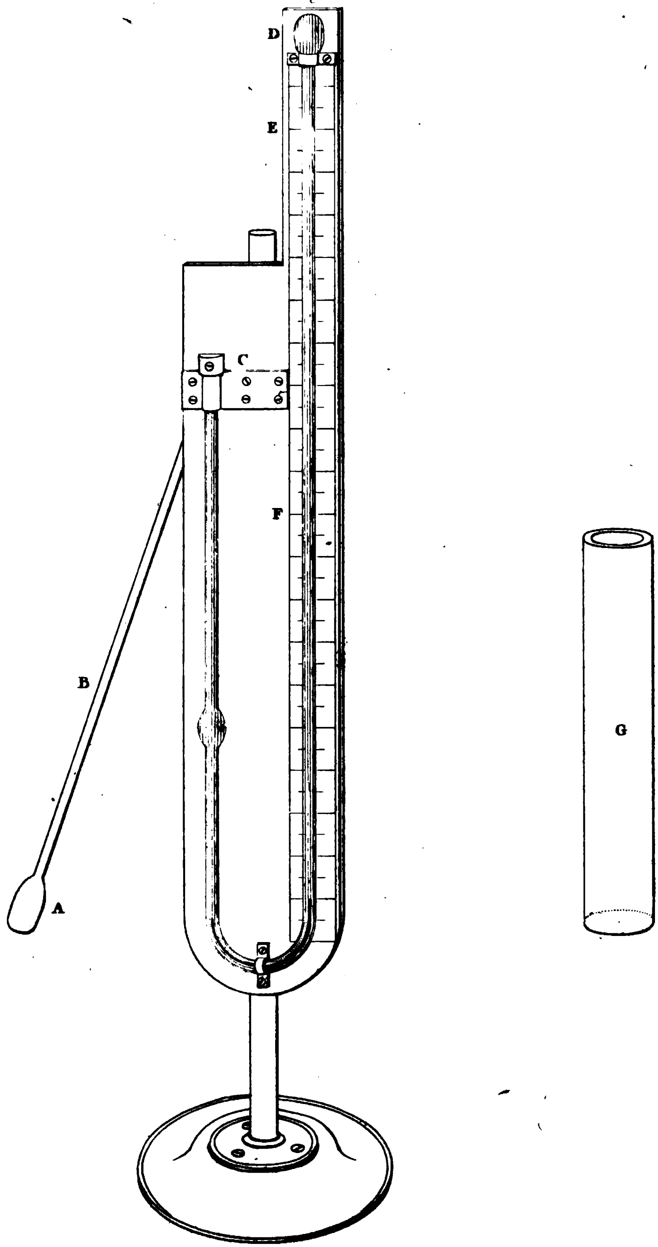
Fig. 10.
Fig. 11.



K. Turrell. sc.

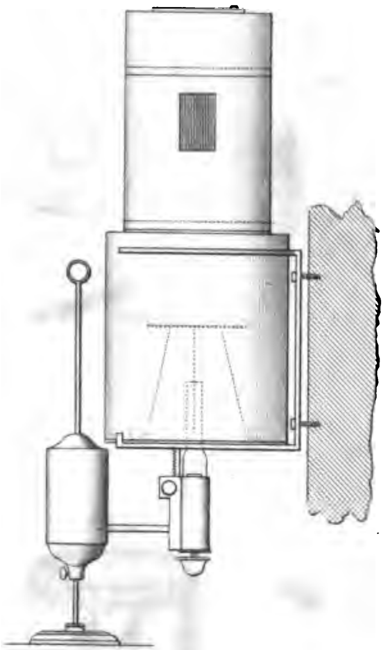
(Hill's Pyrometer.)



Scale of 12 Inches.

Jenkinson Sculp.t

Fig. 1.



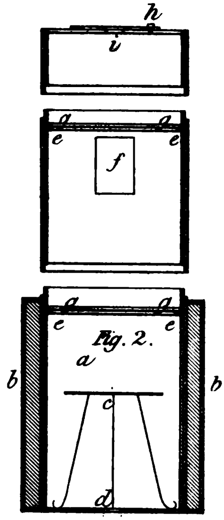


Fig. 2.

Fig. 4.

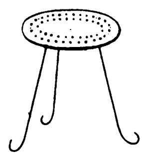
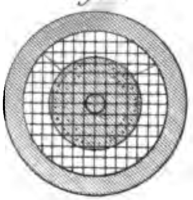


Fig. 3.



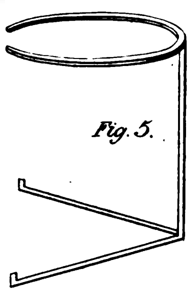


Fig. 5.

E. Turrell. sc.

Fig. 4.

Fig. 1.

Fig. 7.

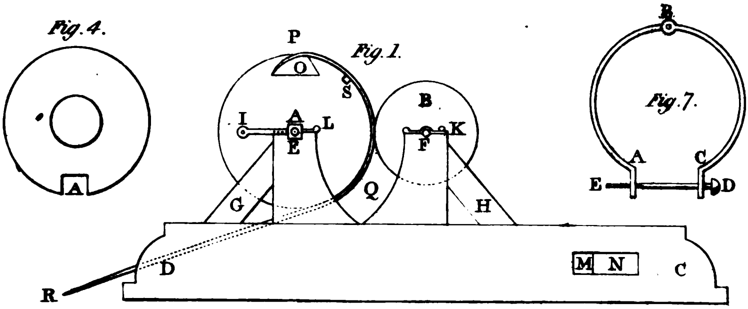


Fig. 6.

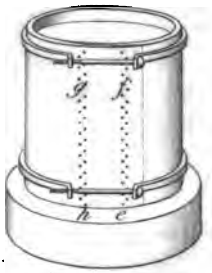


Fig. 5.

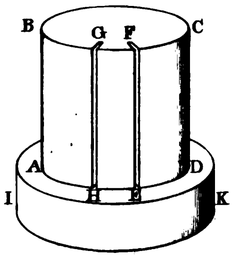


Fig. 3.

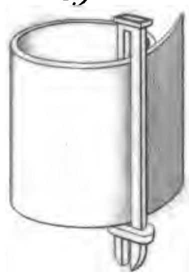
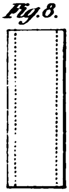


Fig. 8.



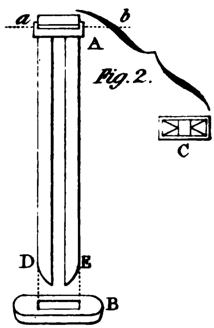


Fig. 2.

Fig. 9.

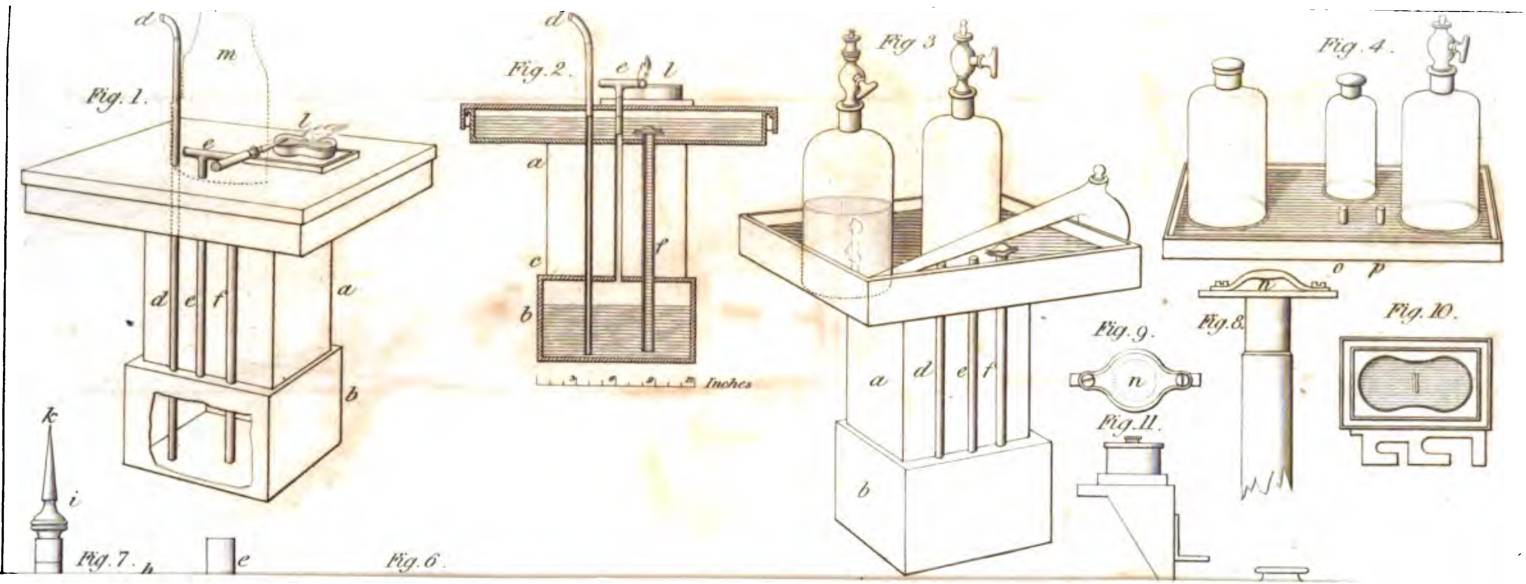
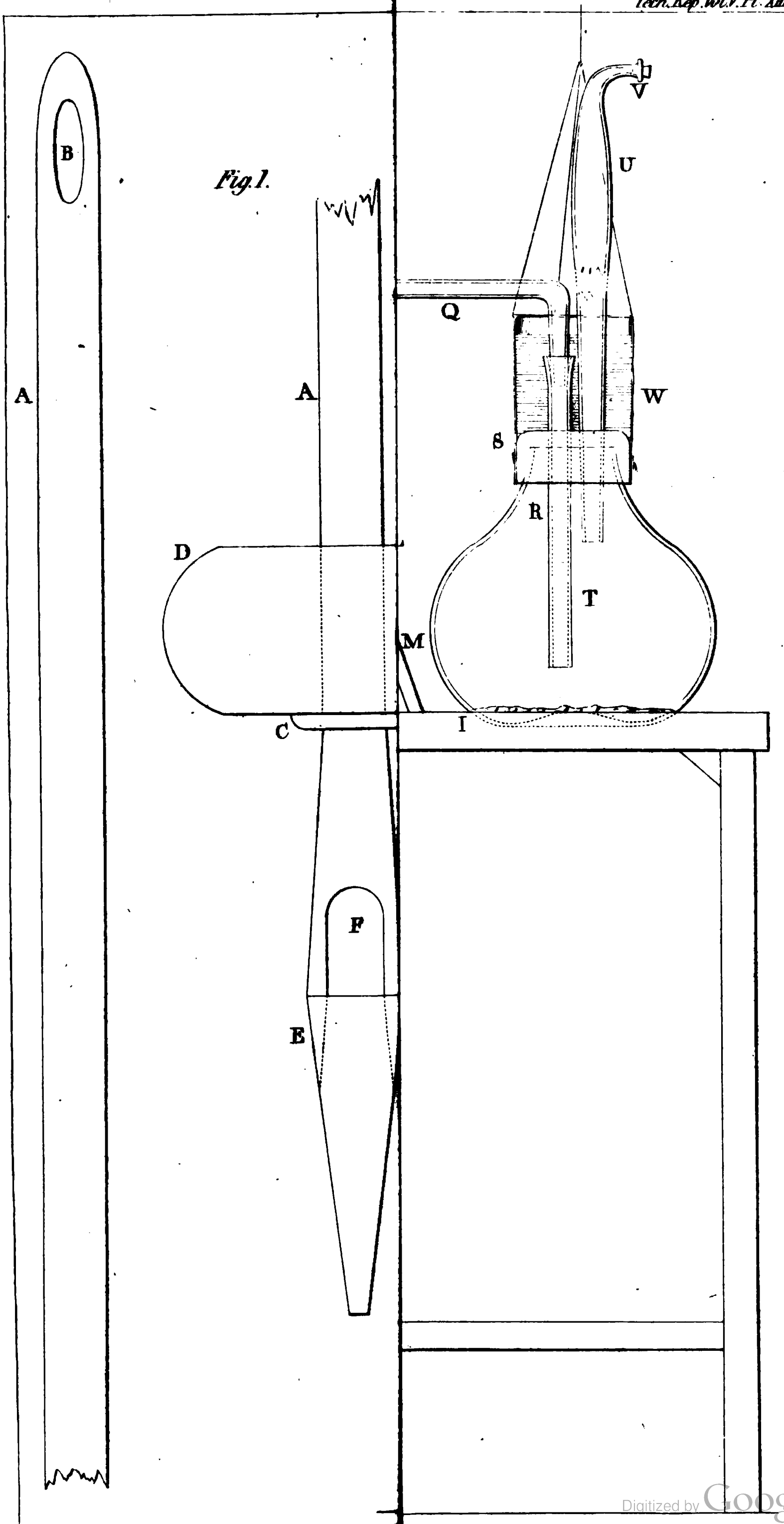


Fig. 1.
d
m
l
e
d e f
a
b
Fig. 2.
d
e l
a
c
f
b
Inches
Fig 3
a d e f
b
Fig. 4.
o p
n
Fig. 8.
Fig. 9.
n
Fig. 10.
Fig. 11.
k
i
Fig. 7.
e
Fig. 6.



R. Turrell. sc.