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NOTICE BIBLIOGRAPHIQUE

NOTICE DE LA REVUE	
Auteur(s) ou collectivité(s)	O'Neill, Charles
Auteur(s)	O'Neill, Charles (1831-)
Titre	The textile colourist : a monthly journal of bleaching, printing, dyeing, and finishing textile fabrics, and the manufacture and application of colouring matters
Adresse	Manchester : Palmer and Howe ; London : Simpkin, Marshall, & Co. ; Glasgow : Porteous Bros. ; Bradford : Thomas Brear ; New York : John Wiley & Son, 1876-1877
Collation	4 vol. ; échantillons, pl. ; 22 cm
Nombre de volumes	4
Cote	CNAM-BIB 8 Ke 524
Sujet(s)	Colorants Colorants synthétiques Industries textiles Teinture -- Fibres textiles Textiles et tissus
Notice complète	http://www.sudoc.fr/10346753X
Permalien	https://cnum.cnam.fr/redir?8KE524
LISTE DES VOLUMES	
VOLUME TÉLÉCHARGÉ	Vol. I
	Vol. II
	Vol. III
	Vol. IV

NOTICE DU VOLUME TÉLÉCHARGÉ	
Auteur(s) volume	O'Neill, Charles (1831-)
Titre	The textile colourist : a monthly journal of bleaching, printing, dyeing, and finishing textile fabrics, and the manufacture and application of colouring matters
Volume	Vol. I
Adresse	Manchester : Palmer and Howe ; London : Simpkin, Marshall, & Co. ; Glasgow : Porteous Bros. ; Bradford : Thomas Brear ; New York : John Wiley & Son, 1876-1877
Collation	1 vol. (XVI-408 p.) : échantillons ; 22 cm
Nombre de vues	428
Cote	CNAM-BIB 8 Ke 524 (1)
Sujet(s)	Colorants Colorants synthétiques Industries textiles Teinture -- Fibres textiles Textiles et tissus
Thématique(s)	Matériaux
Typologie	Revue
Langue	Anglais
Date de mise en ligne	05/02/2026
Date de génération du PDF	06/02/2026
Recherche plein texte	Disponible
Permalien	https://cnum.cnam.fr/redir?8KE524.1

HENRY INGHAM.

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THE

TEXTILE COLOURIST:

A MONTHLY

JOURNAL OF BLEACHING, PRINTING, DYEING,

AND

FINISHING TEXTILE FABRICS,

AND THE

Manufacture and Application of Colouring Matters.

EDITED BY

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VOL. I.

MANCHESTER:

PALMER AND HOWE, 1, 3, & 5, BOND STREET.

LONDON: SIMPKIN, MARSHALL, & CO. GLASGOW: PORTEOUS BROS.

BRADFORD: THOMAS BREAR. NEW YORK: JOHN WILEY & SON.

1876.

CONTENTS.

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INDEX.

—:o:—

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THE TEXTILE COLOURIST.

No. 1.—JANUARY, 1876.

INTRODUCTION.

ALTHOUGH the Editor would prefer to let this journal speak for itself, it is evident that the plan laid out for it could not be fully developed in the single number now before the reader, and some preliminary explanations seem necessary.

The object of the Textile Colourist, is mainly to give an account of what is doing or has been done by practical or scientific men in connection with the dyeing, printing, bleaching, and finishing of textile fabrics or materials. The word "textile" is defined in the dictionaries as what is woven or can be woven, and it is here employed in that sense, and therefore includes not only calico, woollen cloths, linen, &c., but also yarns, hanks, and other unwoven materials when they fall into the dyers, printers, bleachers, or finishers' hands.

It is proposed to take a broad basis in the treatment of textile materials, and include in the scheme all that relates to the chemical, mechanical, and artistic operations bearing directly upon the colouring or finishing of them. Hence it will be seen, that such topics as engraving for calico printing, transferring of designs, purification of water, glossing of silks, construction of beetles, and other items remote from the every day routine of the manager of a printworks or a dyeworks, are held as properly falling within the province of the journal, and the justification for taking this wide range is that such

things, though seeming subsidiary, are really important to those in the trade, and many a valuable idea is developed in an intelligent mind by a knowledge of inventions which might at first seem too remote to be useful.

Beyond the current matter of the month, it is proposed at convenient times to take retrospective views of the history and literature of dyeing, printing, and bleaching, and as the publications upon these trades have been very limited in this country, it is hoped that a good deal that is novel and interesting can be laid before the general reader; and the Editor trusts he may receive assistance in this point from those now or lately in the trade, whose long experience would enable them to supply much that would be very valuable in the history of calico printing and dyeing in Great Britain.

Although some of the existing serials do give a little space to articles connected with textile colouring, this is the first attempt to establish a journal in this country entirely devoted to the subject; the Editor will endeavour to make it worthy of the support of those who take an intelligent interest in their business, and with these words submits it to their kindly consideration.

Manchester, January 1st, 1876.

1. Lime Juice and Argols: Citric and Tartaric Acids.

THE importance of lime juice to calico printers, and argols to wool dyers, induces us to draw their attention to a very excellent and exhaustive paper by Mr. Robert Warrington in the Journal of the Chemical Society for October, 1875. The author has been for several years chemist in a citric and tartaric acid factory, and this paper, which is confined to laboratory experience and processes, is published by the permission of the proprietor. Everyone who desires to see the extension of technical chemistry founded upon an accurate and scientific basis, while approving the liberality of Mr. Lawes, will re-echo the concluding words of the author of this lengthy paper when he says—"I venture to hope that the publication of these "notes may lead to many similar communications. A large "amount of information is acquired in the laboratories of our "great manufacturing concerns: most of this might be pub- "lished without any injury to the individual manufacturer. "Especially is this true of analytical methods, and the publica- "tion and discussion of these would do much to remove the "disgrace to which science is often subjected from the wide "discrepancies of commercial analysis."

The following notes have been made of the contents of Mr. Warrington's article as bearing upon the objects of this journal, with some remarks of our own.

Lime juice is principally imported from Sicily and South Italy. Concentrated bergamot juice from South Italy is also imported for the citric acid manufacture; small quantities are also exported from Montserrat and Dominica. It is only the windfalls and damaged fruit which are used for the production of lemon or lime juice. About 13,000 lemons are required to make one pipe (108 gallons) of raw juice.

Lemon juice is concentrated by boiling down in copper vessels over an open fire till it is supposed to mark, when

cold, 60° on the citrometer, it is then the syruppy, dark brown liquid familiar to calico printers. The concentrated juice will occupy one-ninth or one-tenth the bulk of the raw juice.

The graduations of the citrometer, or hydrometer, by degrees, of which lime juice is bought and sold, has puzzled more than one inquirer. The citrometer used by Mr. Warrington was found to indicate for each degree a specific gravity corresponding to ·004 (Twaddle's hydrometer indicates ·005 for each degree) so that 60° are equivalent to a gravity of 1·240.

No reliance can be placed upon the indications of the citrometer, and lemon juice is now generally purchased on the basis of its acidity.

"In the case of concentrated juice, the acidity is conveniently determined by diluting 50 c.c. of the juice to 500 c.c., and then taking for the experiment 30 c.c. of the solution. Standard alkali is added in quantity, about five-sixths of that which will be required, the whole is then boiled for a few minutes, and when quite cold the titration is completed. With unconcentrated juice 10 to 20 c.c. of the original juice may be taken. Owing to the want of sharpness of the reaction of citric acid with litmus paper, the determination does not admit of very great nicety; experiments with concentrated juice cannot be expected to agree nearer than $\frac{1}{4}$ oz. of citric acid per gallon."

The average density of lime juice is about 48° Tw., and it may range from 41° to 51° Tw.: the standard quality contains 64 oz. of nominal citric acid per gallon, equal to 66·87 oz. of crystallized citric acid, and the extreme range is from 56·6 to 72·6 oz.

Besides the free acid there is combined acid in the saline state present, which is found to average about 10 per cent. of the free acid; the method of ascertaining the proportion of this combined acid is fully detailed in the paper. We may remark that for the calico printer's use, although it is desirable to have all the acids in the free state in lime juice, yet the combined acid exerts a resisting power not much inferior to the free, provided it be citric acid. To ascertain the amount of organic acid not citric, Mr. Warrington employs a process which pre-

supposes that these acids yield soluble lime salts, while the citrate of lime is insoluble. It would be desirable to have some further and more exact information upon the nature of the foreign organic acids likely to be contained in lime juice; for purposes of sophistication it would not be difficult to find some organic acids which give insoluble lime salts. However, by this process it is found that there may exist as much as eleven per cent. of the total acidity due to organic acids not citric, in some samples of Sicilian lime juice; while a sample of English pressed lemon juice shewed that 99·6 per cent. of the total acidity was really citric acid. The examination of the other acids is being carried on by Dr. Armstrong, but Mr. Warrington indicates malic, aconitic, formic, and probably acetic and propionic acids as existing in lime juice.

Mr. Warrington does not enter into a description of the manufacture of citric acid from lemon juice, and we may here give some results of our experience in this matter, directly applicable to calico printing. About the year 1853-4 the supply of lime juice was of a very inferior quality, and the price became very high. The acidity fell, though the specific gravity was maintained, and while ordinary good lime juice of the year before, marking from 48° to 54° Tw., yielded to the standard soda test from 30 to 36 per cent. of its weight of crystallized citric acid, we have notes of samples of a similar density which only indicated 18 per cent. Not only was the effective acidity reduced, but there was something in all the lime juice of those years which made it impossible to get good whites by means of it, so that for a time there were no covered or pad purples in the market of first-rate quality. Citric acid was purchased to use instead of lime juice, but the supply was limited, and the price became higher; a gallon of thickened acid strong enough to resist chocolate covers, and made from a mixture of citric acid crystals and lime juice, cost about seventeen shillings. In this difficulty it was determined to attempt the purification of the lime juice on the works, and after much labour, with perfectly satisfactory results, the process of adding chalk to the diluted lime juice to make citrate of lime, the decomposition of the citrate of lime by sulphuric

acid, and decolorization of the brown acid by animal charcoal, was found a process full of difficulty and loss, on account of vegetable matters going down with the citrate of lime, and adhering to it pertinaceously, producing a mass difficult to wash and decompose. But by applying the washed animal charcoal to the dilute lime juice in the cold, and keeping it in agitation at intervals for two or three days, and then drawing off the clear into a copper boiler and heating, it was found that it could be precipitated with chalk rapidly and effectually; the effervescence was within easy control, and the citrate of lime was nearly white, quite uniform, and very dense. This being washed and then decomposed by heating with a proper proportion of sulphuric acid, yielded at once a solution of nearly pure citric acid, very slightly coloured, and possessed of the highest resisting powers; so that there was no necessity for carrying the process any further, and it was worked until a better quality of lime juice was again obtainable. The cost of acid made from this liquor was about half of that made with citric acid crystals.

In the section upon tartaric acid, the materials are designated as lees, argol, and tartar.

"Lees is the solid matter collected from the bottoms of the fermenting vessels. Argol is the thin crystalline crust deposited on the sides of these vessels. Tartar is manufactured from the two former by a rough process of extraction with hot water and crystallization. Italy is the great producer of the tartar exported to England, a smaller quantity comes from France. Other European countries export no tartar, but lees and argol are obtainable from all wine-producing countries having easy communication with the sea. The quantity of tartar exported by a country depends not only on the extent of its home consumption, but very greatly on the fact whether the wine is plastered or not. If the wine is plastered, the lees contain tartrate of calcium, instead of acid tartrate of potassium, and consequently there is little material from which tartar can be made."

Analyses of various samples of lees shew that Italian and Greek, and some French lees contain a large amount of bitar-

trate of potassium and a small amount of tartrate of calcium, while in many French and all the Spanish lees the tartrate of calcium is greater in amount than the tartrate of potassium. Detailed analyses of the whole constituents of these various lees are given, the other principal substances being vegetable matter, water, sand, silica, phosphoric acid, and earths.

There are various methods of testing the value of argol and lees given in great detail, but the preferable method may be generally described in the author's words:—

"The tartaric acid present as bitartrate of potassium is determined from the acidity of the sample. Another portion of the tartar is calcined, and the neutralizing power of the ash determined. By subtracting from the neutralizing power of the burnt tartar, that due to the potassium bitartrate previously determined, the amount of base corresponding to neutral tartrates is ascertained."

This, however, is only a very general description, and for the numerous and valuable details and modified processes, reference must be made to the original paper.

In woollen dyeing argols are nearly always used, in conjunction with mordants more or less strongly acid, and it is probable that the tartrate of calcium may act nearly as efficiently as tartrate of potassium, but as it is an insoluble salt and can only be slowly attacked by alum or tin mordants, there must be a certain amount of risk of irregularity in using argols of an unknown and variable composition. The Italian argols, which are those mostly employed by dyers, are, however, when of good quality, very nearly the same as pure bitartrate of potassium for practical purposes, containing as high as 70 per cent. of tartaric acid, but the lower qualities, which show as low as 40 per cent., are very uncertain in their behaviour. Tartar is prepared from lees or argols, and may be looked upon as a preparation holding an intermediate place between argols and pure cream of tartar. Mr. Warrington's analyses shew that Messina and St. Antimo tartar contain respectively 76·65 and 74·00 per cent. of tartaric acid, while pure bitartrate of potassium contains 79·7 per cent. of tartaric acid.

2. On the direct formation of Methylaniline Purple upon Cotton.

UP to the present time, aniline black is the only useful colour which has been formed directly upon the cloth from the aniline products; its beauty and remarkable solidity have induced many chemists to try and produce some of the other aniline colours in a similar way, not without hope that if so produced they would be faster than they can be obtained by any known processes of applying the already fully formed colouring matter. The communication of Mr. Albert Dupuy to the Industrial Society of Mulhouse* upon the production of one of these colours, though it may not prove to be of any practical importance, is well worthy of attention as the first successful, though incomplete attempt in a direction where success would be of immense value. He observed that the method by which methylaniline purple *(Violet de Paris)* was obtained by the action of oxidizing agents, such as copper salts, chlorates, &c., had much analogy to the method of obtaining black from aniline, and he hoped that by substituting the methyl product and using the aniline black process he would obtain a purple; but only a grey without brilliancy was the result. This was explained by the knowledge that if the purple was ever formed it was at once in the presence of agents which would destroy it as soon as formed, if it had the same properties as the manufactured colour.

If, on the contrary, a neutral or basic chlorate of methylaniline (containing 3 to 4 per cent. of base) was printed and exposed for a length of time to a warm and moist atmosphere, a purple colour was developed, the quality of which depended upon the purity of the materials and the conditions of the experiment. But the formation of colour was very slow and irregular, requiring eight or ten days. By the addition of a small quantity of red prussiate, not more than one-quarter

* Bull., vol. xlv., p. 373.

to one-half per cent. to the colour, the purple was developed uniformly and completely in two or three days.

The colouring matter thus obtained directly upon the cloth possesses all the properties of Violet de Paris, allowing for the want of the purification to which the latter has been submitted. It is soluble in water, and if the cloth be exhausted with boiling water it leaves only a grey, which is a secondary product of the decomposition of the methylaniline, or the aniline which was in excess; but the affinity of the fibre permits the purple to be washed with cold water, and even to resist warm soaping. The author concludes by saying that although the process has no probable industrial application, it is adding one colour more to those which may be said to belong to the aniline black type, and that there is hope of extending this method of fixing directly other coloured derivatives of the hydrocarbons.

3. On the Application of Eosine in Calico Printing.

BY M. J. DEPIERRE.

THE new colouring matter called Eosine was discovered in 1871, but it has only recently become a commercial product. It is the potassium salt of an acid belonging to a series of compounds discovered by Baeyer.*

This chemist shewed that anhydrous phthalic acid combined with different phenols, giving rise to compounds—the phthalines—the production of which is accompanied by the elimination of a molecule of water. Various phenols give phthalines, as ordinary phenol, pyrogallic acid, pyrocatechine, resorcine, &c. Mellitic and oxalic acid, and other acids analogous to phthalic acid, give compounds which are analogues of the phthalines.

* Berichte der Chemische Gesselschaft von Berlin, viii., pp. 46—162. Moniteur Scientifique, 3me Series, v., pp. 291—355—395.

Resorcine, which is obtained by acting on assafætida with caustic potash, when acted upon by phthalic acid produces fluoresceine, and this latter under the influence of hydrogenizing agents is transformed into fluorescine with fixation of four equivalents of hydrogen.

When bromine is added to a solution of fluoresceine it immediately forms a combination, and the addition of water precipitates a reddish-coloured substance, which is soluble in alkalies, yielding a characteristic yellowish-red colour. This bromine derivative is tetrabromated fluoresceine, which combined with potash yields Eosine.

Eosine occurs as a reddish-brown powder, with metallic reflection; when evaporated from its aqueous solution it has an appearance exactly resembling uncrystallized fuchsine. The water solution is strongly fluorescent; by transmitted light it has a yellowish-pink colour, and by reflected light it is green.

This substance is soluble in water, ethylic and methylic alcohols, alkalies and alkaline carbonates, glycerine and soaps; it is insoluble in ether, phenic acid, aniline, oil, or benzine. It is very soluble in water; 100 parts of cold water dissolving 40 parts Eosine, and boiling water dissolves 45·4 parts; its aqueous solution smells strongly of bromine when boiled. It does not dissolve so largely in commercial alcohol, requiring 11 parts of it to dissolve 1 part of Eosine. It is a very powerful colouring matter; 1 part in 250,000 of water gives a fine pink colour, and one part in a thousand million times its weight of water gives a pink tint discernible in a thickness of a few centimetres.

Eosine, which, as we have said, is a potassium salt, is decomposed by most acids which give an orange-red floculent precipitate, especially in strong solutions; it is decomposed by acetic acid, but the liquid remains of a pink colour on account of the slight solubility of Eosine in that acid.

Nearly all the soluble metallic salts give lakes with Eosine; the brightest are those of tin, alumina, and lead, which are of a fine red with a yellowish hue. Zinc gives a more yellow lake; silver and mercury give purple lakes; and copper a brownish-red lake.

These lakes are somewhat soluble in water, especially in calcareous water, which probably decomposes them, reproducing Eosine with a lime basis.

This new colouring matter dyes silk, and wool, and all animal matters easily, by simply immersing them in a water solution of the colour. The characteristic yellow reflection of Eosine is not permanent upon silk and only visible in light shades. Dyeing in cold solutions gives brighter shades than dyeing in hot.

Eosine at its first appearance cost 1,000 francs the kilogramme, at present (1875) its price is much reduced ; it gives pinks and aurora shades of great beauty. Notwithstanding its high price it can be economically applied in silk and woollen printing, for its great power enables it to give a very good pink when used in the proportion of one part to one thousand of thickening (70 grains or about $\frac{1}{6}$ oz. to the gallon.) It is printed upon silk by simply thickening with gum water and fixing in the ordinary way. Upon wool it is employed either by printing or dyeing.

All the attempts to obtain a fast colour from it upon cotton have failed. It does not dye or fix with the usual mordants, as tin, tannin, alumina, iron, glycerine, and arsenic, or caseine ; it fixes with albumen, but loses its beauty whether dyed by means of it or applied as a steam colour. If cotton be padded with a solution of Eosine slightly thickened with gum, and then passed into a solution of acetate of lead and some other metallic salts, it forms very bright lakes which might be serviceable for some styles such as linings.

The lakes thickened with albumen give but dull colours ; if the lakes are dissolved in ammonia, thickened, and then printed upon cloth prepared in different ways the resulting colours are loose and wash off.

Eosine can however be fixed in various manners upon cotton, but whatever method be employed, if the colours are left in running water of a calcareous nature, the colour is almost totally washed off.

The various ways by which the colour can be temporarily fixed are as follows :

(1) Arsenite of alumina added to the thickened solution of Eosine and printed upon cloth prepared with tin, steamed and washed.

(2) Mix a solution of Eosine with its equivalent of acetate of lead, acetate of tin, or acetate of alumina thickened; print upon calico either prepared with tin or oiled, steam and wash. Upon oiled calico the shades are bluish.

(3) The best method is to prepare the calico with solution of glue or gelatine, print on a mixture of Eosine with three times its weight of tannin, steam and wash.

This brilliant colour, though not so fugitive as saffranine, will probably only have a very limited application upon cotton on account of its inability to resist the action of light, for if its name of Eosine (morning dawn, aurora) happily expresses the shade of colour it yields, it no less truly characterises its evanescence.—*Bulletin de la Societé Industrielle de Rouen, 3, Année, p. 163.*

4. Upon Straining Colours by Atmospheric Pressure.

[The practical results obtained by this system of straining colour, as described in the papers of Rosenstiehl and Glanzmann, seem to justify the insertion of their memoirs at length; Mr. Rosenstiehl's observations have been translated nearly literally, and Mr. Glanzmann's with but slight condensation. The originals will be found in the Bull. de Mulhouse, xliii., p. 430, and in the Bull. de Rouen for June, 1875, p. 121. The plate is a reproduction of M. Glanzmann's drawing illustrating his paper. It is perhaps advisable to note that the method of straining colours by hand on the continent is quite different to the English method; the straining cloth has never been received with favour abroad, and the colours are all passed through sieves, the thicker colours being worked through by the rubbing of the hand or a brush; the colour thus strained or sieved is fine enough for the best printing, but the process is painfully slow, with a moderately thick colour it would take two men to keep a machine supplied; when

brushes are used the presence of bristles under the doctor is often a trouble to the printer. The idea of straining by means of a vacuum is at least twenty years old, and was tried in Manchester and given up long ago, and though in the following pages it is described as being quite successful, it should be remembered that the continental printers never, as far as our experience goes, work colours so tough and stiff as those common in England, and it is very doubtful if a pressure of 15 lbs. per inch would force a colour of 2½ to 3 lbs. of flour per gallon through fine wire gauze.—*Ed.*]

M. Rosenstiehl writes as follows: As often as I have seen workmen straining colours used in printing, by pressing those thick and viscous liquids with a brush against the strainer, I could not help regretting that this labour, purely manual, and frequently unhealthy, was done by hand, and not by a machine.

Many apparatuses have been devised to meet this end, some causing the colour to be pressed through a straining cloth or wire gauze by means of a piston, the basis of others being centrifugal force. These apparatuses have drawbacks which limit their application, and they are rarely used. So much time is wasted in cleaning them out, in order to strain a different colour, that they are justly condemned, and can only be usefully employed for straining large quantities of the same kind of colour.

The machine that is required in our industry is one that will rapidly strain colours, and will require no longer time to clean it than is necessary in the case of the ordinary sieve. The apparatus to which I wish to draw the attention of the Industrial Society, I consider as the first step towards this desirable object; it was constructed under my directions, and has been in use since the month of September last (1872) at the works of Thierry-Mieg and Co.

In this apparatus the colour is forced through the strainer, not by a piston or hand, but by atmospheric pressure, which acts upon the whole section as an imaginary piston, without impeding access to the strainer.

It is only necessary to indicate the principle of this machine in order that all who are acquainted with physical phenomena may comprehend its general arrangement. A vacuum is re-

quired to be made under the strainer, and to gain time it must be done quickly. The apparatus is composed of two portions easy to separate; the upper moveable part contains the straining cloth, which for that reason I shall call the sieve carrier, and covers like a lid the lower part, which is the vessel into which the colour will be drawn, I call it the aspirator; the two portions are connected by a joint, thus forming a space hermetically closed, and communicating with the exterior air only through the meshes of the strainer.

The joint should be of simple construction and little liable to injury, without needing special manipulation to secure it, for example without needing a screw.

The sieve cloth, through the meshes of which the colour is to pass, should be made in such a manner as to be easily removed, cleaned, and replaced, and also should be able to support the pressure of the atmosphere without bursting.

These are the general conditions of the problem ; I proceed to show how they can be fulfilled.

The sieve carrier is made of five circular pieces, in the following order, commencing from the top.

(1) A hopper by which the colour is poured into the machine ; it is of copper, tinned inside, and has an iron piece by which it is connected with the other pieces.

(2) A bronze ring, turned in the lathe, on which rests the strainer properly so called.

(3) A trellis of flattened brass wire about one-tenth of an inch wide, having meshes seven-tenths of an inch across; the trellis is intended to support the straining cloth or gauze and to prevent its rupture by atmospheric pressure. It forms a diaphragm in the interior of the sieve carrier which in this place has a diameter of 12 inches.

(4) A wide-mouthed funnel tinned inside, placed under the trellis in order to guide the colour in its fall, as it comes through the sieve, and prevent it from soiling the inside of the apparatus.

(5) A tinned copper connecting piece, having a diameter at the top equal to that of the hopper, and at the lower end to that of the aspirator, 12 inches. It is joined to the hopper by a bolt, which at the same time fastens all the intermediate pieces.

The lower part of this joining piece is an essential part of the joint, it is a steel ring turned in a lathe, fixed to the copper by rivets buried in solder. The whole of the sieve-carrier, which can be raised in one piece, weighs upwards of sixty pounds. It is the pressure exercised by this weight resting on the aspirator which forms the air-tight joint.

The strainer, properly so called, is made by stretching wire cloth over a bronze ring, turned in a lathe and fitting without friction into the sieve carrier; the portions of the ring coming into contact with the wire cloth are carefully rounded so as to prevent cutting. A supply of these rings is kept near the machine for the different finenesses of wire gauze. When the bronze ring is in position the wire cloth lies immediately upon the trellis in such a manner as not to suffer any stretch by the pressure, which would diminish its durability.

Finally, since it is highly important to be able to remove quickly the ring which supports the cloth to clean it or change it for another, it is provided with two small handles.

The aspirator is a cylindrical vessel of sheet iron, 22 inches in height, open at the top, which is furnished with a wide rim cast in metal, in which is cut a circular groove, in which the steel ring of the sieve carrier fits without friction. The bottom of this groove is provided with a ring of vulcanized india-rubber cemented to it by a solution of india-rubber in benzine.

By means of this groove and india-rubber ring the joint is completed by simple contact, without any screwing, and is further assisted by the pressure of the atmosphere, which adds to the weight of the sieve carrier. The aspirator has on the side a tap, which allows a vacuum to be made in it. To simplify the working, this vessel is fixed and does not directly receive the strained colour, which falls into a vessel of tinned copper, which fits easily into the aspirator, two handles permitting it to be raised with ease; its capacity is 17 gallons.

Having described the apparatus, it remains to shew how the vacuum is obtained. I had the choice of many methods. I could have chosen the filter-pump apparatus, recommended for laboratories by Bunsen, and by Scheurer-Kestner for industrial establishments; but that requires a reservoir placed at

least 33 feet from the ground, a condition I could not provide. Again, I could have employed the air pump, used in sugar manufacture to make the vacuum in the boiling apparatus, but that system requires a special arrangement which, perhaps, might be judged too costly for the end aimed at. Following the advice of our colleague, M. W. Grosseteste, I used the vacuum of the condenser of an engine of 25 horse-power, a great advantage, as it did not require any special apparatus, and experience has shewn to what limits it can be utilised without injuring the working of the engine. The air chamber of the condenser was bored, and a small tap one-eighth of an inch diameter was placed in it; a leaden pipe of small diameter was attached to this cock, and this was connected with a reservoir of sheet-iron, which in this instance was more than 200 feet distant, at the side of the straining machine. A vacuum gauge placed near the condenser, and a manometer near the reservoir allows the different degrees of pressure to be noted during the operation. The column of mercury generally shews from 24 to 27 inches vacuum. This degree of rarefaction is abundant for all purposes.

The reservoir is a sheet-iron cylinder of 52 gallons capacity, bored in three places, which are provided with taps. One placed on the top communicates with the condenser; the second with the straining machine; the third is placed in the lower part of the reservoir, it allows the water which collects to be drawn off. This vacuum reservoir is for the purpose of preventing too sudden variations of pressure in the condenser, and it allows an instantaneous vacuum to be formed under the sieve carrier. It could have been larger, but to lessen the expense of fitting up, I employed an apparatus already existing and not in use. The condensing pump makes a vacuum in ten minutes; but so as not to interfere with the working of the engine when commencing, the tap connected with the condenser should only be partially opened; when the pressure inside reaches about 12 inches it may be entirely opened. When the engine is working, the communications are left open so as to keep permanent vacuum in the reservoir, and the apparatus is thus always ready for use.

At the side of the straining machine is a water tap, under which is a tripod for washing the sieve on, and the sieve carrier also, if necessary.

I will suppose a straining finished, and another in preparation; while the strainer is being washed, the column of mercury rises from 16 to 26 inches. An empty vessel is placed in the aspirator, which is covered by the sieve carrier, and a sieve is put in; two men prepare for the hopper a maximum quantity of 17 gallons of colour; as soon as the sieve cloth is covered, the tap connecting the condenser and reservoir is shut; the tap which makes the communication between the reservoir and aspirator is opened and immediately shut again; the colour then flows with such rapidity into the lower vessel, that the workmen can scarcely pour it into the hopper quickly enough. It requires, in fact, more time to empty the colour into the sieve than for the colour to pass through the sieve. When all the colour has passed through and the sieve is empty, the air rushes with great force into the interior, and it is for this reason that the tap which communicates with the reservoir should always be kept shut, otherwise it becomes filled with air, and power is needlessly wasted. While air has entered the apparatus, the sieve and sieve carrier are taken out and washed under the tap; the tub full of colour is removed, and an empty tub substituted. While these things are being done, the vacuum has been re-established, and the machine is again ready for use. Many months experience has shewn me what can be expected from this machine; I again repeat that it sieves rapidly. I will now state its defects. It is almost useless for colours thickened with gum or albumen. These have the inconvenience of filling the cloth with grains of sand, skins, and other insoluble matters. But this inconvenience is a small affair, as these colours are generally liquid enough to allow of them being sieved by hand. Again, a hot colour, cannot be sieved, under the feeble pressure in the aspirator it enters into ebullition, and sometimes so violently that the colour tub overflows, and the air pipes get choked up.

This last defect, inherent to the very principle of the machine, is little felt as hot colour is rarely used.

On the other hand, on printworks there is a large consumption of colour thickened by starch, flour, and their commercial derivatives, also by gum tragacanth and caseine, all very thick and difficult to sieve by hand. These colours sieve with the greatest ease in this machine, and that is its real utility. It is always necessary that the wire cloth should be clean; and, for example, a colour uneven, or badly mixed, full of thickening not well stirred in, or containing skins from drying up by exposure to the air, the precaution must be taken of previously removing the skin, or of separating it by a second sieve of larger meshes, placed in the hopper stretched over a ring a little larger than that of the real sieve. The conical form of the hopper renders this arrangement easy. By this means the colour is forced to go through two sieves, it is twice sieved by one operation and neither of the sieves are choked up by the lumps which are broken up by the first sieve.

The advantages of the machine lie in the simplicity of its construction and the rapidity of its working, which is really effected by the steam engine. These qualities have made it a favourite apparatus which workmen will not readily part with. To shew to what extent this machine is a practical one I will cite an example: the machine was put in its place and I had scarcely begun some preliminary trials when I was called away for several weeks; I had previously intended to continue these trials later on. I was surprised on my return to see the workmen using it with great ease; the foreman who had assisted me in the trials had seized the ideas and during my absence had taught the men; for anyone who understands the habits of mind of our workmen this is the greatest compliment to my apparatus.

5. *On a Modification of Rosenstiehl's Straining Apparatus.*

By M. R. GLANZMANN.

(With a Drawing to Scale.)

M. G. WITZ suggested that the vacuum could be best obtained by the condensation of steam, the experiments upon this modification were made at the works of Mr. Henry Stackler and have proved perfectly satisfactory.

Here is a description of the modified apparatus, and there is added a detailed drawing of all the parts. *(See Plate.)*

The principal parts are as in Rosenstiehl's arrangement, a reservoir and an aspirator; but instead of connecting the reservoir with the condenser of the steam engine, which might often give rise to serious inconvenience, it is fitted up so as to be filled with steam, which is afterwards condensed by jets of cold water. This part may be called the condenser, it is made of rivetted boiler plate, and has a capacity of about 66 gallons. There are four taps arranged on its exterior one above the other. The first and highest is connected with a cold water supply, and is continued internally with a pipe extending horizontally and bored with holes. The second tap is connected with the steam supply; the third communicates with the aspirator to make a vacuum under the strainer and the fourth is a blow-off tap, and it must have a diameter equal to a three-quarter inch pipe at the least.

The condenser is supplied with a vacuum gauge. The aspirator is constructed very similar to that of Rosenstiehl's; it is a jacket of cast-iron, 26 inches diameter and 20 inches in depth, and can hold an empty tub or mug which may contain 13 or 14 gallons of colour.

The cover of the aspirator, which holds the hopper and sieve, is cast with a projection on its circumference which is fitted accurately to the groove in the aspirator, at the bottom of the groove is an india-rubber ring, and the bottom of the

groove and the corresponding projection are turned true by the lathe.

The copper hopper, fixed to the cover, is 9 inches high, 20 inches in diameter at the widest part, and 12 inches at the lower part. At the bottom of it is fixed a stout piece of wire gauze, with wide meshes, to support the fine strainer; this latter is tightly stretched over a moveable copper ring and can be changed as required. Upon this is a second copper ring with a more open wire gauze which prepares the colour to pass the fine strainer by breaking up lumps and the little skins which may be in it. The copper rings have a deep recess in their lower part, as seen on the plate, by which the sieving material is secured by means of brass wire.

Near the aspirator there is a washing-off cistern, the whole top part is placed on the timber supports, and a jet of water guided by a flexible tube can be brought to bear on the sieves.

To work the apparatus the first step is to place the tub or mug which is to contain the strained colour into the jacket of the aspirator and then the cover is placed carefully on. The weight of the cover resting upon the india-rubber ring makes an air-tight joint; but to be certain of this there are some precautions to be observed, the neglect of which will impede or entirely prevent the action of the apparatus. The projecting rib and the exterior of the groove must be perfectly clean, and, moreover, must be finally wiped with a sponge to completely remove adhering water, which prevents an air-tight junction. Impurities of a mechanical nature in the water must be avoided, for a single grain of sand in the groove spoils the joint and permits air to pass into the aspirator, so that it gets filled with air without a drop of colour passing through the strainer.

The colour is next poured into the hopper, and now the vacuum is to be obtained.

All the taps being closed, the operation is commenced by opening first the blow-off tap, and then the steam tap. The water in the condenser is expelled by the pressure of the steam, and as soon as steam appears at the blow-off pipe the

steam tap is shut, and the blow-off tap left open a moment to let off the excess of steam and then closed, this last precaution is important. The water tap is next opened; for four or five seconds the vacuum gauge shews no change, but after this interval, the vacuum is formed rapidly, and in the space of twenty or thirty seconds, the gauge indicates a vacuum of 26 to 28 inches of mercury, if the operation has been well conducted. The water tap is now shut, and the tap connected with the aspirator is opened. For thick colours it is fully opened, but for thin colours only partially, in order that the colour may not go through the strainer more quickly than it can be supplied by the hopper.

With a condenser of a capacity of 66 gallons, thin colour can be strained by intercepting the operation to the amount of from 26 to 32 gallons; but with thick colour, not more than 13 to 16 gallons can be strained by one exhaustion, because when the rarefaction is reduced to 12 or 15 inches in the condenser the thick colours do not go through, while thin colours pass down to a vacuum of 4 inches.

The great advantage is that the separate straining operations can follow one another very rapidly, for example, every five or six minutes for 13 gallons of starch or paste colour.

In extensive works where large quantities of different colours are required, two aspirators could be worked by a single condenser, or two covers with strainers could be provided, having one always clean and ready.

By this arrangement a single apparatus would be sufficient for the largest establishments, seeing that it is possible to strain 110 gallons of paste colour per hour, making eight or ten changes for different colours.

The cost of steam is insignificant, and the saving of sieves is so considerable that in most places it would in one year pay for the apparatus. A machine working daily for four months rendered only two sieves unserviceable of the value of three francs.

The apparatus is easy to work, there must be some considerable neglect or defect to prevent it operating.

We have only to praise the services which this ingenious

and useful machine renders to us daily, and it is very unlikely that we shall ever go back to the old system. All the former straining utensils have been abandoned, or are only used to strain those colours which must be worked hot.

This paper is followed by a report upon it by M. G. Witz, who corroborates the statements made by M. Glanzmann, but states that five or six minutes are required altogether to strain 12 gallons of very thick paste colour through a fine brass cloth, No. 80, when it had been previously strained through a coarser gauze by the same apparatus. Two such strainings of the same colour occupying ten to twelve minutes. He does not recommend the combination of the coarse and fine gauze in one straining operation, because the operation is much slower and not so perfect.

Very thick British gum-water strains much more quickly than starch paste, if the filling of the meshes of the strainer with crusts and undissolved gum is avoided.

He gives the following as the time occupied in the successive operations of working the apparatus:

Passing in of steam and expulsion of air and water.....	1½ min.
Stopping steam and waiting to stop blow-off tap	½ „
Introduction of water for condensing and obtaining a vacuum of 24 to 26 inches, about	¾ „
Straining of 11 gallons very thick paste colour, about...	¾ „
Taking out strained colour and remounting to start again, about	2 „

To prevent injury to the colour from drops of water forming on the interior of the iron cover, it is suggested to cover this with copper or to give it a conical form.

6. *COLLECTED RECEIPTS.*

BLACK COLOURS FOR PRINTING.

No. 1. Black for Delaine.—*Communicated. French.*

1 gallon logwood precipitate (below)—1 gallon water—½ pint acetic acid—1½ lbs. starch—2½ lbs. gum substitute—1 lb. alum—½ lb. salammoniac—½ lb. extract of indigo.

No. 2. Logwood Precipitate for Black.

4 gallons logwood liquor at 10° Tw.—1½ lbs. sulphate of copper—½ gallon water, dissolved and mix, then add ½ gallon water containing 3 oz. bichromate of potash and 6 oz. crystals of soda—1 gallon water. Collect the precipitate and drain to 1½ gallons.

No. 3. Black for Delaine.—*Communicated. French.*

3 quarts water—1 quart logwood liquor at 30° Tw.—1¼ lbs. starch—1 lb. gum substitute—3 oz. alum, boil, and when nearly cool add 1½ lbs. nitrate of iron—½ lb. acetate of iron—10 oz. neutral extract of indigo. Works best when one or two days old.

No. 4. Black for Blue Grounds. Delaine.—*Communicated. French.*

1 gallon logwood precipitate (see No. 2)—1 lb. alum dissolved in ½ gallon water—5 lbs. gum substitute—½ pint acetic acid—6 oz. salammoniac—6 oz. extract of indigo.

No. 5. Black for Wool; Block.—*Communicated. French.*

8 lbs. gum substitute.—½ gallon logwood liquor at 30° Tw.—5 quarts water—½ pint peachwood liquor at 30° Tw.—½ gallon red liquor at 16° Tw.; when cold, 1 pint nitrate of copper—32 oz. nitrate of iron—1 pint iron liquor.

No. 6. Black for Delaine.—*Communicated. English.*

8 pints logwood liquor at 8° Tw.—1 pint wood acid—1½ pints bark liquor, 10°—2½ oz. extract of indigo—¼ oz. bichromate—2 lbs. flour—8 oz. British gum—boil, cool, and add 4 oz. salammoniac—½ pint muriate of iron at 80°—1 pint nitrate of iron at 80°.

No. 7. Black for Delaine.—*Communicated. English.*

8 pints logwood liquor at 8°—2 lbs. flour—8 oz. gum—½ pint muriate of iron at 80°—1 pint nitrate of iron at 80°.

No. 8. Black.—*Communicated. English.*

3 gallons logwood liquor at 12°—3 lbs. starch, boil and cool to 90° F. and add 1 quart nitrate of iron at 84°.

No. 9. Black for Rainbowing.—*Communicated. English.*

3 gallons logwood liquor at 12°—12 lbs. gum substitute—1 quart nitrate of iron at 84°.

No. 10. Black for Delaine.—*Communicated. English.*

9 gallons logwood liquor at 12°—3 gallons gall liquor at 9°—16½ lbs. flour—3 lbs. starch—3 lbs. gum—1½ lbs. calcined green copperas; boil, and add immediately 7 half-pints iron liquor—cool to 100° F. and add 5 half-pints nitrate of iron at 84°—3 pints extract of indigo—1 pint muriate of iron at 60°.

No. 11. Black for Delaine.—*Communicated. English.*

24 lbs. flour—2 lbs. British gum—7 gallons logwood liquor at 10°—2½ gallons gall liquor at 9°—2 quarts wood acid at 4°—3 pints red liquor at 18°; boil 15 minutes, cool, and add 5 half-pints extract of indigo—6 pints nitrate of iron at 84°—3 half-pints muriate of iron at 60°.

No. 12. Black for Delaine.—*Communicated. English.*

2 gallons logwood liquor at 16°—2 lbs. starch—4½ lbs. gum substitute; boil, cool to 100° F., and add ½ lb. alum, when cold add 3 pints nitrate of iron at 84°—1 lb. acetate or extract of indigo.

No. 13. Black for Delaine.—*Communicated. American.*

19 gallons logwood liquor at 12°—32 lbs. starch—5 lbs. gum substitute; boil, and cool to 150° F. and add 1¼ lb. chlorate of potash; cool to 100° F. and add 8 lbs. alum—28 lbs. red prussiate of potash—2¼ lbs. ground oxalic acid—1½ gallons sulphate of indigo.

No. 14. Gum Black for Delaine.—*Communicated. American.*

10 gallons logwood liquor at 12°—50 lbs. gum substitute—dissolve warm in 3½ lbs. alum—1½ lbs. chlorate of potash—8 oz. oxalic acid—then in 6 gallons of logwood liquor, dissolve 10 lbs. red prussiate of potash—5 quarts extract of indigo—mix.

No. 15. Black for Delaine.—*Communicated. American.*

~~15~~ 45 gallons logwood liquor at 12°—90 lbs. starch—10 lbs. gum substitute; boil, cool a little, and add 5 lbs. chlorate of potash—cool down to 100° F. and add 10 lbs. alum—30 lbs. red prussiate of potash—1½ lb. oxalic acid—4 gallons extract of indigo.

No. 16. Black for Blotches, Delaine.—*Communicated. American.*

2 measures of No. 14 black—1 measure of No. 15 black.

No. 17. Black for Delaine.—*Communicated. American.*

8 gallons logwood liquor at 18°—13 lbs. starch; boil and add 3 gallons tragacanth gum water at 6 oz. per gallon—cool—2½ lbs. chlorate of potash—6 gallons iron liquor—8 gallons neutral extract of indigo—2 gallons acetate of copper at 15°—2 gallons muriate of iron at 36°.

No. 18. Acetates of Iron and Copper for No. 17 Black.

3½ lbs. brown acetate of lead—3 lbs. sulphate of iron.—1 gallon hot water. Use at full strength.

110 lbs. sulphate of copper—110 lbs. brown acetate of lead—30 gallons of water. Reduce to strength required.

No. 19. Steam Black for Calico.—*Colour Maker's Companion.*

3 gallons logwood liquor at 12°—1 gallon red liquor at 16° 1 gallon iron liquor at 30°—1 gallon acetic acid at 8°—7½ lbs. flour—3 lbs. British gum.

No. 20. Black for Silk.—*Quarto. Anonymous.*

4½ pints logwood liquor at 7°—6 oz. acetate of copper at 40°—9 oz. red liquor at 18°—10 oz. starch; boil, cool, and add 4 oz. nitrate of iron.

No. 21. Black for all Wool.—*Quarto. Anonymous.*

8½ quarts logwood liquor at 6°—2¼ lbs. starch; boil, and while hot add 4 oz. extract of indigo—5 oz. oxalic acid—24 oz. neutralized nitrate of iron, made by adding 1 lb. acetate of lead to 3 lbs. nitrate of iron.

No. 22. Black Calico or Delaine.—*Unknown.*

6 gallons logwood liquor at 12°—7 lbs. starch—7 lbs. gum substitute—1½ gallons acetic acid—2 gallons thick tragacanth jelly; boil well, and when quite cold add 2 lbs. red prussiate dissolved in 1 gallon water—1½ quarts muriate of iron at 70°—6 quarts acetate of iron (see No. 19)—4 quarts acetate of chromium.

No. 23. Acetate of Chromium for Black.—*Unknown.*

1 gallon boiling water—4 lbs. bichromate of potash—8 lbs. muriatic acid—28 oz. sugar. To each gallon add 1 gallon acetate of lead liquor at 4 lbs. per gallon.

No. 24. Black for Delaine.—*Quarto. Anonymous.*

2½ gallons logwood liquor at 6°—36 oz. starch; boil and add 4 oz. extract of indigo— 4 oz. oxalic acid—24 oz. nitrate of iron—1 lb. acetate of lead.

No. 25. Black for all Wool; Blotch; Block.—*Quarto. Anonymous.*

4½ quarts logwood liquor at 6°—4½ pints peachwood liquor at 6°—18 oz. starch; boil, and while warm add 6 oz.

sulphate of copper—4 oz. sulphate of iron—6 oz. extract of indigo—12 oz. nitrate of iron.

No. 26. Black for all Wool; Merino.—*Quarto. Anonymous.*

6½ quarts logwood liquor at 8½°—4½ pints archil at 10° —36 oz. starch—14 oz. gall liquor at 8°; boil, and add 2 oz. sulphate of copper—12 oz. extract of indigo—1 lb. nitrate of iron.

No. 27. Black for Delaine; Blotch.—*Quarto. Anonymous.*

3½ gallons logwood liquor at 7°—1¾ gallons brazil wood liquor at 7°—divide the liquors into two equal portions, and boil one with 2¾ lbs. gum substitute, and the other with 2¾ lbs. starch—mix, and add 12 oz. sulphate of copper—4 oz. sulphate of iron—18 oz. extract of indigo—12 oz. nitrate of iron.

No. 28. Black for Delaine.—*Communicated. English.*

6 gallons logwood liquor—3 quarts wood acid—3 quarts bark liquor at 14°—12 lbs. flour—3 lbs. British gum—boil, and add ½ lb. extract of indigo—1 oz. bichromate of potash, and when cold 1½ lbs. salammoniac—3 pints muriate of iron—3 pints nitrate of iron.

No. 29. Black for Calico; Chromed.—*Communicated. Russian.*

2½ gallons logwood liquor at 16°—1¾ gallons red liquor at 16°—1½ gallons catechu liquor at 14°—¾ gallon water—2 oz. acetate of copper—7½ lbs. starch—3 lbs. olive oil—2 gallons of protonitrate of iron, made by taking 4 gallons water —42 lbs. nitrate of lead—36 lbs. sulphate of iron.

No. 30. Black for Delaine.—*Communicated. Russian.*

3½ gallons logwood liquor at 16°—3 pints archil at 24°—1 gallon water—½ gallon red liquor—6 lbs. starch—7 lbs. gum substitute—1 pint oil—boil and cool—1 lb. salammoniac ½ lb. nitrate copper at 80°—1 quart acetate or extract of indigo 18°—4 lbs. protonitrate of iron (as above) at 50°.

No. 31. Acetate of Indigo.—*Communicated. Russian.*

2 lbs. ground indigo—6 lbs. strongest sulphuric acid—6 lbs. fuming sulphuric acid—leave 24 hours—15 lbs. acetate of lead dissolved in 2½ gallons water—use the clear brought to required strength.

No. 32. Black for all Wool.—*Communicated. Russian.*

3¼ gallons logwood liquor at 15°—½ gallon archil 22°—1 gallon water—½ gallon red liquor 16°—5½ lbs. starch—6½ lbs. gum substitute—1½ lbs. stearine or tallow—¾ lb. salammoniac—boil, cool, and add 4 oz. nitrate copper at 80°—6 lbs. protonitrate of iron (No. 29).

No. 33. Black for all Wool; Blotch.—*Communicated. Russian.*

3½ gallons logwood liquor at 15°—2½ gallons water—5½ lbs. starch—8½ lbs. gum substitute—¾ lb. oil—¾ lb. salammoniac—boil, cool, and add 4 oz. nitrate of copper—6 lbs. protonitrate of iron (No. 29).

No. 34. Black for Blotch, Delaine, or Wool.—*Communicated. Russian.*

13 gallons logwood liquor 15°—48 lbs. dark British gum—1 lb. chloride of copper—4 lbs. chloride of iron—8 lbs. nitrate of iron—4 lbs. extract of indigo.

No. 35. Black for Delaines; Block.—*Communicated. Russian.*

1 gallon logwood liquor at 15°—¾ lb. alum—3 lbs. gum—10 oz. red prussiate of potash—½ gallon of lime juice at 48°.

No. 36. Black for Calico.—*Persoz.*

1 gallon logwood liquor at 8°—1¼ lbs. starch—boil, and while hot add 6 oz. sulphate of iron—3 oz. oil—when cold add 12 oz. nitrate of iron.

No. 37. Black for Calico.—*Persoz.*

1 gallon logwood liquor at 8°—1 lb. starch—2½ lbs. dark British gum—1 pint nitrate of iron neutralized by acetate of

lead—boil; thicken separately 1 gallon gall liquor at 8°—1 lb. starch—2½ lbs. dark British gum—1 pint nitrate of iron—mix the two together.

No. 38. Black for Calico.—*Persoz.*

1 gallon water—3 pints logwood liquor at 30°—3 lbs. starch—boil, and add 24 oz. wood acid at 7°—3 pints iron liquor at 20°—18 oz. oxalic acid.

No. 39. Spermaceti Black for Calico.—*Persoz. English.*

1 gallon logwood at 8°—1 quart iron liquor at 20°—1 quart red liquor—1 quart acetic acid at 11°—2 lbs. starch—boil and add 1 pint oil—1 pint turpentine—½ lb. spermaceti.

No. 40. Spermaceti Black.—*Persoz. English.*

1½ gallon logwood liquor at 14°—½ gallon iron liquor at 13°—1 pint red liquor—½ gallon oil—½ lb. spermaceti—4 lbs. starch—½ gallon acetic acid—½ gallon turpentine.

No. 41. Black for all Wool; Block.—*Persoz.*

1 gallon logwood liquor at 30°—3 quarts ammoniacal cochineal at 1 lb. per gallon—1 quart acetate of indigo solution at 2°—dissolve in the liquors ½ lb. sulphate of copper—½ lb. alum—½ lb. oxalic acid—thicken with 6 lbs. dark British gum, and add 3¼ lbs. nitrate of iron at 84° Tw.

No. 42. Black for all Wool; Block.—*Persoz.*

1 gallon logwood liquor 8°—10 oz. starch—1½ lbs. calcined farina—5 oz. alum—boil, cool, and add 1¼ lbs. protonitrate of iron (No. 29)—½ lb. extract of indigo—½ lb. acetate indigo at 15°—½ lb. archil at 18°—let stand two days before using.

No. 43. Black for Wool or Wool and Silk.—*Persoz.*

1 gallon boiling water—½ gallon peachwood liquor at 23°—1 gallon logwood liquor 38°—add gradually ¾ lb. bichromate of potash dissolved in ½ gallon water—thicken with 3¼ lbs. starch and 5 lbs. dark British gum—while hot, add 1¼ lbs. sal-

ammoniac—2¼ lbs. acetate of copper—cool and add 1¼ lbs. oxalic acid—6 oz. turpentine—3¾ lbs. protonitrate of iron at 84°—3¼ lbs. acetate of indigo.

No. 44. Black for Silk or Wool; Blotch.—*Persoz.*

1 gallon hot water—1 gallon logwood liquor 38°—add gradually 10 oz. bichromate of potash dissolved in 1 gallon of hot water—1 lb. salammoniac—2½ lbs. acetate of copper—14 oz. starch—2 lbs. gum substitute—boil and add 2½ lbs. oxalic acid—½ gallon molasses—3 lbs. protonitrate of iron at 84°.

No. 45. Black for Wool; Block.—*Persoz.*

1 gallon logwood liquor at 12°—2½ pints of archil at 18°—½ lb. extract of indigo—1¾ lbs. starch—boil, cool, and add 6 oz. alum—3 oz. lard—1½ lbs. nitrate of iron at 110°—14 oz. acetate of indigo at 15°.

No. 46. Black for Wool; Roller or Plate.—*Persoz.*

1 gallon mixed gall and logwood liquor made from 7 measures of logwood liquor at 10 lbs. wood per gallon, and 3 measures gall liquor at 4 lbs. galls per gallon—1¾ lbs. starch—¼ lb. extract of indigo—10 oz. sulphate of iron—1 lb. nitrate of iron at 110°.

No. 47. Black for Wool; Block.—*Persoz.*

1 gallon logwood liquor at 10°—½ gallon sapan liquor at 5°—2¾ lbs. starch—boil and add ½ lb. sulphate of copper—5 oz. sulphate of iron—½ lb. sulphate of indigo—1 lb. nitrate of iron 84°.

No. 48. Black for Wool; Blotch.—*Persoz.*

1 gallon logwood liquor, 5°—½ gallon sapan liquor, 5°—18 oz. starch—boil and add ½ lb. sulphate of copper, cool and add 1 lb. nitrate of iron at 110°—½ lb. sulphate of indigo.

No. 49. Black for Wool; Machine.—*Persoz.*

1 gallon logwood liquor at 14°—10 oz. starch—1¾ lb. gum

substitute; boil and add ¼ lb. alum—1½ lb. nitrate of iron at 104°—½ lb. acetate of indigo, 14°; leave 24 hours before using.

No. 50. Black for Wool; Machine.—*Persoz.*

1 gallon logwood liquor at 14°—¾ lb. starch—2 lbs. gum substitute—¼ lb. alum—1½ lb. nitrate of iron at 104°—½ lb. acetate of indigo.

No. 51. Black for Delaine.—*Persoz.*

1 gallon logwood liquor at 10 lbs. wood per gallon—½ gallon sapan liquor at 5°—2 lbs. starch—5 oz. sulphate of iron—½ lb. sulphate of indigo—1½ oz. nitrate of iron at 110°.

No. 52. Black for Delaine.—*Persoz.*

1 gallon logwood liquor at 14°—1¼ lb. flour; boil and add 3 oz. alum—3 oz. sulphate of copper, and when cold 1 lb. protonitrate of iron at 110°—3 oz. fat dissolved in turpentine.

No. 53. Black for Wool and Delaine.—*Persoz.*

1 gallon logwood liquor at 14°—1½ lb. flour—while hot add 3 oz. alum—2 oz. fat or oil, and when cold, 1¼ lb. protonitrate of iron.

No. 54. Black for Delaine; Blotch.—*Persoz.*

1 gallon logwood liquor at 14°—½ lb. alum—3 oz. extract of indigo—1 lb. starch—1¼ lb. protonitrate of iron when cold.

No. 55. Black for Delaine; Blotch.—*Persoz.*

1 gallon logwood liquor—5 pints bark liquor, 18°—1 lb. starch—1 lb. gum substitute; boil and add ½ lb. sulphate of iron—½ lb. nitrate of copper at 72°—1 lb. nitrate iron at 110°.

No. 56. Black for Delaine; Blotch.—*Persoz.*

1 gallon logwood liquor at 8°—10 oz. starch—2½ lbs. gum substitute; while warm add ¼ lb. alum—3 oz. extract of indigo—1 lb. protonitrate of iron at 110°—3 oz. oil.

No. 57. Black for Silk.—*Persoz.*

1 gallon logwood liquor at 14°—10 oz. starch—1½ lb. gum substitute; boil, cool, and add 10 oz. crystals nitrate of copper —½ lb. nitrate of iron.

No. 58. Black for Silk.—*Persoz.*

1½ gallons of logwood liquor at 5°—¼ lb. gall nuts; boil down to 1 gallon and take the clear—1¼ lbs. starch—1½ oz. alum—5 oz. sulphate of copper—1½ oz. sulphate of iron—3 oz. nitrate of iron at 110°—3 oz. fat.

No. 59. Black for Silk; Blotch.—*Persoz.*

1 gallon of gall and logwood liquor as in No. 58—3 lbs. gum—7 oz. sulphate of copper—2 oz. alum—½ lb. nitrate of iron at 108°.

No. 60. Black; Calico, for Washing off.—*Communicated. Russian.*

4 gallons iron liquor—3 quarts vinegar—2 gallons logwood liquor at 12°—¾ lb. acetate of copper—6 lbs. starch—3 lbs. gum substitute—½ lb. oil.

No. 61. Black for Warwick's Green.—*Communicated. Russian.*

1 gallon logwood liquor at 13°—1 quart strong red liquor—1 quart vinegar—3 quarts iron liquor at 15°—2 lbs. starch—8 oz. spermaceti—½ pint oil—1 pint turpentine.

No. 62. Black for Chroming.—*Communicated. Russian.*

1 gallon logwood liquor at 13°—½ gallon red liquor at 12° —½ gallon catechu liquor at 2½ lbs. per gallon—3 oz. acetate of copper—2½ lbs. starch—1 pint oil—6 lbs. proto-nitrate of iron.

No. 63. Black for Padding for Logwood.—*Communicated. Russian.*

90 gallons red liquor at 10°—18 gallons acetate of iron at 10°—12 gallons water.

No. 64. Black for Calico.—*Communicated. Russian.*

3 gallons logwood liquor at 13°—2 gallons red liquor at 13°—1½ gallons catechu liquor—½ lb. acetate of copper—11 lbs. starch—½ lb. oil—6 lbs. protonitrate of iron at 52°.

No. 65. Black Outline for Delaines.—*Communicated. Russian.*

4 gallons logwood liquor at 15°—4½ lbs. starch—6 lbs. gum substitute—½ lb. tallow or other fat—1 lb. alum—2 lbs. acetate of copper below; boil and add—9 oz. acetate of indigo—6 lbs. neutral nitrate of iron.

No. 66. Acetate of Copper for No. 65.

1 gallon boiling water—2¼ lbs. sulphate of copper—2¼ lbs. acetate of lead.

No. 67. Acetate of Indigo for No. 65.

½ lb. indigo in powder—2 lbs. fuming sulphuric acid; leave forty-eight hours, and add 6 lbs. of acetate of lead dissolved in 1½ gallons of hot water.

No. 68. Black Spermaceti for Turkey Red.
Communicated. English.

5 quarts logwood liquor at 12°—6 quarts red liquor at 16°—2 quarts acetic acid at 8°—3½ oz. yellow prussiate of potash—28 oz. starch; boil, and when cooled to 130°, add 1 pint olive oil—1 pint turpentine—10 oz. spermaceti heated together, and lastly 1 pint nitrate of iron at 80°.

No. 69. Black for Turkey Red.—*Communicated. English.*

1 gallon logwood liquor at 4°—2 lbs. prussiate of potash—1 quart tragacanth gum water—2 lbs. flour—2 quarts iron liquor at 30°; boil, cool to 110°, and add ½ pint nitrate of iron at 80°.

No. 70. Black for Garancine. Block; for Handkerchiefs.
Communicated. Russian.

3½ gallons iron liquor at 11°—¼ lb. sulphate of copper—3½ lb. starch—¼ lb. verdegris.

No. 71. Black for Muslins. Steam. *Communicated. American.*

Prepare the cloth by padding in a hot solution of 2 lb. alum and 14 oz. soda crystals in 1 gallon of water, let stand one night and wash off—15 gallons logwood liquor at 12°—10 gallons water—22 lb. starch; boil, cool to 100° F., and add 1¼ gallons caustic soda at 70°—14 oz. red prussiate of potash.

[*To be continued.*]

7. *Upon a Purple-red Colouring Matter from Cyanogen.*

BY GASTON BONG.

THE red colour which is produced by adding solution of cyanide of potassium to an acid solution of a salt of copper has been noticed by several observers. It is very unstable in the solution where it is formed, being changed by acids, alkalies, cyanide of potassium, and even spontaneously, into a yellow substance. It is carried down with insoluble cyanides, as when acid is added to the solution the cyanide of copper is precipitated, and with it the colouring matter; if this precipitate be treated with sulphuretted hydrogen, it is decomposed and the substance set free. It combines with iron in a similar manner to the cyanides, masking the usual properties of the metal, and forms a stable compound which has been examined by the author. It is prepared as follows:—

Cyanide of potassium is added to an acid solution of copper salt until the red colour first developed is destroyed; a solution of iron salt is then added, which causes an abundant precipitation of Prussian blue, and the supernatant liquid has a deep purple-red colour. To separate the colouring matter from the alkali diluted acid is added, and it is carried down with the cyanide of copper; the whole precipitate, including the Prussian blue, is now boiled with a solution of carbonate of ammonia, in which the substance is soluble. Some cyanide of copper is dissolved at the same time, to separate which the

solution, is again precipitated by acid, and the precipitate treated with sulphureted hydrogen. The colouring matter still contains some ferrocyanic acid, which can be removed after neutralization by means of acetate of lead.

The colouring matter crystallizes in confused crystals; the precipitate formed in its solution by acetate of copper when dried at 212° gave upon analysis—

Carbon	24·31
Nitrogen	28·04
Hydrogen	1·88
Iron	13·66
Copper	17·67
Oxygen	14·44
	100·00

These numbers indicate the formula Fe Cy H_4 O_4 Cu.

T his substance is precipitated by zinc, mercury, and silver salts giving beautiful pink or purple precipitates of remarkable brilliancy, which are soluble in alkalies. Iron salts and lead salts give no precipitate without addition of ammonia, which causes a violet-blue precipitate. The purple-red precipitates, when treated by sulphuretted hydrogen, yield an acid liquid, which undergoes decomposition in the air, especially if warmed, with production of Prussian blue. Neutralized with alkali the acid liquid gives a compound stable in air of a purple colour, very soluble in water, less soluble in alcohol, and insoluble in ether; it has remarkably strong colouring powers.

The colouring matter forms combinations with the prussiates which are very stable, withstanding the action of sulphuric acid, concentrated alkalies, and boiling dilute acids, but are immediately decomposed by chlorine and nitric acid.

If this colouring matter could be produced cheaply, it is probable that its stable nature and strong colouring powers would find profitable employment in industry. It does not dye fibrous matters without metallic mordants; when mordanted they are easily dyed in weak acid solutions.—*Muster Zeitung*, No. 40, 1875.

8. *Sulphur as a Mordant for Aniline Green.*

THE report lately made by Messrs. Schaeffer and Vaucher upon this mordant, necessitates a reference to Mr. C. Lauth's previous papers, which date respectively 15th June, 1872, and 16th April, 1873, and the whole may be found in the August number of the Bulletin of the Industrial Society of Mulhouse for 1875.

The first paper of Mr. Lauth was in a sealed packet deposited on the date given; he says in it that aniline green, which is usually obtained by the action of methyl upon rosaniline, was employed largely in silk and cotton dyeing. Up to that time it had not been much used in woollen dyeing for want of a good method of applying it. He discovered in November, 1871, that if wool was boiled in a mixture of hyposulphite of soda and a salt of zinc it acquired an affinity for aniline green, either alone or combined with picric acid. Some pieces were dyed by this process at Paris, but it was found that the mordanting was very uneven. The first intention was to fix sulphide of zinc upon the wool, this being known to act as a mordant in several cases, and the hyposulphite of soda seemed a proper agent for the purpose, and in fact it was ascertained that zinc was fixed upon the wool.

Upon closer examination he was assured that it was not the sulphide of zinc which was acting as the mordant, and the zinc salt was really useless except for its acidity, for hyposulphite of soda and sulphuric acid alone mordanted the wool better than any other preparation. As sulphur and sulphurous acid are the only results of the action of these bodies, one of these two must be the mordant. He found out that it was the sulphur, and demonstrated that sulphur intimately fixed on wool or combined with it was an excellent mordant for aniline green, and that recently precipitated sulphur was dyed by aniline green; and that shades of greater beauty and intensity were produced than it had been possible to obtain previously.

He believes that this is the first time that sulphur was shewn to be a mordant, and it appeared not inappropriate to recall the fact that in the making of aldehyde green the sulphur in the nascent state acts a very important part, and that there seemed to be some analogy between the two facts.

The specimen was dyed as follows :—

Crystallized aniline green, Poirriers	0·2	grammes.
Water	600	„
Picric acid	0·07	„
Acetate of zinc	0·60	„
Hyposulphite of soda	0·60	„

The wool was mordanted with—

Water	600	grammes.
Hyposulphite	3	„
Sulphuric acid	2	„

In the paper of 16th April, 1873, Mr. Lauth describes some modifications which were found necessary in practice. The sulphur gave the wool a peculiar feel; it became soft, lost its elasticity, and was sensibly contracted. To prevent this it is necessary to add a certain amount of alum or salt of zinc, which counteracts effectively this action of the sulphur. It is important that the wool should be quite free from metals, the least trace of which blackens the wool; a treatment with hydrochloric acid avoids this danger.

For dyeing bluish greens no addition is required to the water for dyeing, but for yellower shades obtained by means of picric acid, for example, good results are obtained by using acetate of zinc with the picric acid; the acetate of zinc is slowly decomposed, setting free sufficient acid to develop the yellow; when the yellow is risen, acetate of soda is added, and the green dyes. With acetate of zinc and acetate of soda the dyer can obtain at will all shades, yellowish and bluish, without at all emptying the vessel.

It would be wrong to suppose that any variety of sulphur deposited upon wool would serve as a mordant. Thus, a solution of flowers of sulphur in sulphuret of carbon, or a deposition of sulphur from a poly-sulphide, by means of acid, would only give poor results. The sulphur mordant is insoluble sul-

phur, electro-positive sulphur arising from the decomposition of hyposulphites. The following experiment proves it: when mordanted wool is exhausted with sulphuret of carbon it does not in the least lose its property of attracting aniline green, and on the contrary the wool prepared with this solution (even in a concentrated state) of sulphur in sulphuret of carbon, has no more affinity for the colour than wool which has not been submitted to any preparation.

Messrs. Schaeffer and Vaucher refer to the usual process of dyeing with green on wool, by first using an alkaline liquid, followed by an acid, and state that the result is inferior to Lauth's process. In most manufactories Lauth's process has been modified, but the principle is the same, and it is an operation requiring much care, and it is scarcely necessary to state that whatever vessels are employed must be free from copper or other metals which give coloured sulphurets.

To obtain good results it is important that no more than the necessary amount of sulphur should be deposited upon the wool, when an excess of hyposulphite is used the amount of sulphur fixed is naturally increased, but the shades obtained are dull, the wool contracts and requires a special feel; with proper proportions any desired depth can be obtained.

They found that to avoid unevenness in dyeing, it was preferable to boil the wool for fifteen minutes in the hyposulphite before adding the sulphuric acid; when the process is well conducted the liquor remains quite clear. When the sulphur has been deposited, the wool is washed and then dyed, as described by M. Lauth. The reporters believe they have proved that the sulphuret of zinc plays an important part in Lauth's process, especially in the dyeing, for nearly all the trials which were mordanted in the presence of zinc salts were superior in brightness to those mordanted with sulphur alone, and dyed without addition of a salt of zinc. The zinc salt is useful not only in preventing the softening of the wool in the mordanting, and in yielding acid in the dyeing, to permit the yellow developing, but it gives rise also to a small quantity of sulphuret of zinc, which is

essential for obtaining lively shades. Moreover, they analyzed some samples of merino which had been dyed by this process, and found a perceptible quantity of sulphuret of zinc fixed upon the cloth. They conclude by congratulating the inventor upon the excellent results obtained, and assert that he has proved his priority in a discovery which promises useful applications in printing as well as in dyeing.

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9. British and Foreign Patents, from the Commissioners of Patents Journal, November 16th to December 14th, 1875, inclusive.

Singeing, Shearing, etc.

4009. AUGUSTE HYACINTHE BLANCHE, of Boulevard Saint-Denis, No. 1, at Paris, manufacturer, for an invention of "Improved machinery or apparatus for singeing woven fabrics."—Dated 18th November, 1875.—Provisional protection has been granted for this patent.

107,368. HUGOT, for "Emery or other hard cylinders or bodies for removing the felt from dried fabrics."—Dated 1st May, 1875.—French patent.

107,838. MANGIN and MONNOT, for "Improvements in shearing machines."—Dated 27th April, 1875.—French patent.

38,112. J. MONKS, a patent of improvement for "Improvements in shaving or shearing machines, &c."—Dated 27th October, 1875.—(Original patent, 7th May, 1875.)—Belgian patent.—See also French patent, No. 107,935; and English patent, 6th November, 1874.

Bleaching.

3954. THOMAS FLETCHER, of Newton, Hyde, in the county of Chester, for an invention of "Improvements in apparatus employed for bleaching cotton or other fibrous substances or fabrics."—Dated 13th November, 1875.—Provisional protection has been granted for this patent.

2918.—ALEXANDER MELVILLE CLARK, of 53, Chancery Lane,

in the county of Middlesex, patent agent, "An improvement in bleaching vegetable fibrous substances."—A communication to him from abroad by Charles Louis Joseph Coinsin-Bordat, of Paris, France.—Notice to proceed has been given.

107,185. SCHULTZ, of Rouen, for "Improvements in bleaching cotton fabrics."—Dated 1st April, 1875.—French patent; probably the same as the English patent No. 499, to Thomas Holliday, which see.

99,066. MICHEL, for "Improvements in firing bucking-apparatus, &c."—Dated 7th April, 1875.—Certificate of addition to French patent.

107,701. LECLERC, of Paris, for "A liquid called 'Panama spirit,' for cleaning and scouring fabrics."—Dated 21st April, 1875.—French patent.

107,280. PLANEAU, for "A cold process for obtaining concentrated bleaching liquid."—Dated 17th March, 1875.—French patent.

107,906. ROUSSEAU, of Paris, for "Bleaching and decolouring animal substances, silk, wool, hair, feathers, and down, by using ozone and oxygenated water, obtained by electricity."—Dated 1st May, 1875.—French patent.

108,018. COINSIN-BORDAT, for "A process of bleaching vegetable substances."—Dated 13th May, 1875.—French patent.

Drying.

4141. C. HAUBOLD, of Chemnitz, for "Improvements in centrifugal drying machines."—5 years.—Dated 17th August, 1875.—Saxon patent.

106,993. BIEN, of Sedan, for "A machine for drying cloth rolled on an horizontal cylinder."—Dated 25th March, 1875.—French patent.

100,288. MOISON, for "A machine for drying stuffs, thread, and textile substances."—Dated 11th May, 1875.—Certificate of addition to French patent.

Dyeing, Printing, and Staining.

3095. THOMAS HENRY REES, of Hexford Villa, New Barnet,

in the county of Hertford, "An improved method of producing raised or sunken designs on sheet metal."—Notice to proceed has been given.

4177. MARK FRENCH ANDERSON, Licentiate Royal College of Physicians, Edinburgh, and Member of the Royal College of Surgeons, England, of 15, Priory Row, in the city of Coventry, and ALEXANDER ROTHERHAM, silk dyer, of Spon Street, in the city of Coventry, for an invention of "Improvements in dyeing silk and cotton, and in preparing silk and cotton for the manufacture of ribbons and for other purposes."—Dated 2nd December, 1875.

87,540. GRISON, for "Dyeing cloth and other material with mixed animal and vegetable substances."—Dated 10th May, 1875.—Certificate of addition to French patent.

105,528. GRISON, for "Dyeing stuff for fulling."—Dated 10th May, 1875.—Certificate of addition to French patent.

107,243. LEROCHER and SON, for "Obtaining stripes of different colour on stuffs dyed in pieces."—Dated 5th April, 1875.—French patent.

107,781. VAUTIER, for "Obtaining dyed stripes of various colours on presspoint and gauze."—Dated 8th May, 1875.—French patent.

107,146. PETITDIDIER, for "Dyeing silk fabrics."—Dated 10th March, 1875.—Probably the same as the English patent, No. 1094, 25th March, 1875, to the same name.—French patent.

108,034. MILLE, of Amiens, for "A dyeing machine with a continuous alternate motion."—Dated 11th May, 1875.

108,156. DUCOSTE, of Bordeaux, for "Colouring benzine and and mineral volatile oils for dyeing."—Dated 7th June, 1875.

4137. F. BARTELS and Dr. FREISE, of Gottingen, for "A new dyeing process."—5 years.—Dated 31st August, 1875.—Saxon patent.

168,991. JAMES HARLEY, of Lowell, Mass., for "Dyeing and calico printing."—Application filed 30th September, 1875.—American patent.

108,013. ANDRÉ and GANTILLON, for "A photo-galvano-plastic process for engraving plates and rollers for printing stuffs."—Dated 11th May, 1875,—French patent.

The following Patents have become void.

3545. AUGUSTE CHIFFRAY, of Maromme, department of Seine Inférieure, in the republic of France, merchant, for an invention of "An improved system of printing at the same time one or more colours on both sides of a cloth, and to produce simultaneously some ribs squaring with those colours."—Dated 26th November, 1872.

3616. JOHN CARTER RAMSDEN, of Smith House, Lightcliffe, in the parish of Halifax, in the county of York, manufacturer, and JAMES MARSLAND TANKARD, of Bowling Hall, Bradford, in the county aforesaid, worsted spinner, for an invention of "A new and improved method of and apparatus for staining or dyeing velvets and all other woven fabrics and for producing designs and figures thereon."—Dated 30th November, 1872.

3620. JOHN CARTER RAMSDEN, of Smith House, Lightcliffe, in the parish of Halifax, in the County of York, manufacturer, and JAMES MARSLAND TANKARD, of Bowling Hall, Bradford, in the county aforesaid, worsted spinner, for an invention of "New and improved methods or processes of and apparatus for staining or dyeing fibrous filaments when in the raw or when in a partly prepared state."—Dated 2nd December, 1872.

Colouring Matters.

2713. JOHN AUCHINVOLE, of Glasgow, in the county of Lanark, North Britain, merchant, for "Improvements in recovering surplus indigo from textile materials or fabrics."—A communication to him from abroad by Camille Bouhon, residing at Ensival, in Belgium.—Notice to proceed has been given.

4138. ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, in the county of Middlesex, patent agent, for an inven-

tion of "Improved processes for the manufacture of artificial purpurine and other colouring matters, together with the application of such products."—A communication to him from abroad by William Jules Samuel Grawitz, of Paris, France.—Dated 29th November, 1875.

4208. GEORGE HILL UNDERWOOD, of Manchester, in the county of Lancaster, for an invention of "Improvements in the treatment of indigo for dyeing and printing.—Dated 6th December, 1875.

78. J. NOWAK, of Carolinenthal for "Obtaining the fine dye quercitrine from the raw quercitron-bark."—3 years.—(Secret.)—Dated 6th June, 1875.—Austrian patent.

105,130. GRAWITZ, for "Producing aniline black on tissues, &c."—Dated 29th April, 1875.—French patent.

Notice of Application has been given for Leave to bring in a Bill to continue and confirm &c., in Parliament, Session, 1876.

1802. SMITH'S Patent for "Improvements in the extraction of indigo and other similar substances from plants containing such substances."—Dated 15th June, 1872.

Water Purification.

2521. CHARLTON JAMES WOLLASTON, of 65, Westbourne Park Road, in the county of Middlesex, for "Improvements in the purification and decolorization of dye waters and waters which have been employed in washing lead minerals."—Notice to proceed has been given.

105,988. HENRY, for "A continuous apparatus for removing lime from water for industrial purposes."—Dated 25th March, 1875.—French patent.

Steaming.

117. C. THIERRY-MIEG, of Paris, for "Improvements in steaming, dyed, painted, or printed fabrics, being a new method of fixing and developing colours on tissues."—1 year.—Dated 24th May, 1875.—Italian patent.

109. C. THIERRY-MIEG, of Paris, for "Fixing colours on tissues, or improvements in steaming dyed or printed fabrics."—1 year.—(Secret.)—Dated 11th June, 1875.—Austrian patent.—Probably the same as the English patent to CLARK, No. 1587, 29th April, 1875, which see; also patented in France.

106,687. THIERRY-MIEG, for "Improvements in steaming prints."—Dated 26th April, 1875.—Certificate of addition to French patent.

107,890. CORDILLOT and MATHER, for "Improvements in apparatus for steaming prints."—Dated 1st May, 1875.—French patent.—(English patent, 9th February, 1875.)

Silk Treatment.

107,171. GILLET and Son, for "Means of increasing the gloss and softness to the touch of dyed silks."—Dated 19th March, 1875.—French patent.

102,560. FABRE, for "A machine for singeing silk stuff."—Dated 23rd March, 1875.—French patent.

169,377. WM. H. SEAMAN, of New York, N.Y., for "Processes for testing the purity of dye in black silk thread or fabrics."—Application filed 4th August, 1875.—American patent.

Brief.—"The silk to be tested is immersed in a liquid consisting of a saturated solution of oxalic acid, to which a portion of hydrochloric acid and camphor may be added. The dye is discharged from the fabric or thread in a degree proportionate to its purity, leaving the material paler in colour. The depth of colour in liquid and the colour of material after immersion are indicative of the purity of the dye."

Claim.—"The process of treating black silk thread and fabric by immersion in a chemical liquid of which oxalic acid is the base, as herein described, for the purpose of ascertaining the purity of the dye, as set forth."

Yarns, Hanks, &c.

3379. ROBERT FERGUSSON, of the city of Manchester, thread manufacturer, for "Improvements in machinery or apparatus for applying size and colour to yarns or threads."—Notice to proceed has been given.

3979. GEORGE PATON, of the firm of Paton, Cook, and

Company, of Glengarnock, in the county of Ayr, North Britain, for an invention of "Improvements in dyeing and dressing or sizing and otherwise preparing warp yarns, and in apparatus therefor."—Dated 16th November, 1875.—Provisional protection has been granted.

168,932. JAS. SHORT, of New Brunswick, N.J., for "Yarn-printing machines."—Application filed 13th March, 1875. —American patent.

Brief.—"The yarn is wound upon the drum, when the car carrying the printing-wheel is automatically moved transversely to it."

Patent which has become Void.

3597. JOHN WILKINSON, the younger, SAMUEL FILLINGHAM, and JAMES PARDOE, all of St. Helen's Mills, Leeds, in the county of York, and WILLIAM GLOVER, of Balne Lane Mills, Wakefield, in the said county, Manager, for an invention of "Improvements in machinery or apparatus for scouring, preparing for printing, bleaching, cleansing, and drying worsted, woollen, or other yarns, and for beaming or winding the yarns on to bobbins."—Dated 29th November, 1872.

Treatments of Wool.

2480. EDWARD THOMAS HUGHES, of the firm of Hughes and Son, patent agents, 123, Chancery Lane, London, "Improvements in machinery or apparatus for washing and scouring wool."—A communication to him from abroad by Victor Weiss, of Langensalza, Prussia.—Notice to proceed has been given.

2587. JOSEPH JEFFERSON, CORNELIUS JEFFERSON, LAZARUS JEFFERSON, and MORDECAI JEFFERSON, all of Bradford, in the county of York, machine makers and iron and brass founders, "Improvements in machinery for washing wool and other fibres."—Notice to proceed has been given.

4088. EDWIN POWLEY ALEXANDER, of 14, Southampton Buildings, in the county of Middlesex, consulting engineer and patent agent, for an invention of "A new or im-

proved mode or method of and apparatus for effecting the carbonization of vegetable materials contained in wool, woollen rags, or other animal substances."—A communication to him from abroad, by Daniel Michel, of Paris, in the republic of France, woollen waste manufacturer.—Dated 25th November, 1875.

4168. ALFRED FORD, of 19, Blandford Square, in the county of Middlesex, gentleman, for an invention of "Improvements in the method of cleansing wool and of recovering the products.—Dated 2nd December, 1875.

4211.—WILLIAM SHAW NICHOLS, of Globe Mills, Manningham, Bradford, in the county of York, engineer, for an invention of "Improvements in machinery or apparatus for scouring or washing wool or other fibres."—Dated 6th December, 1875.

102,319. CAMINADI, sen. SON, for "Apparatus and chemical agents for trying and sifting woollen rags, disaggregating vegetable substances, cleansing wool, and dyeing, &c."—Dated 24th February, 1875.—French patent.

107,045. RAULIN, of Paris, for "A chemical process of destroying vegetable substances in wool by means of liquids and gases, and especially of hydrochloric acid."—Dated 1st March, 1875.—French patent.

107,115. VAN HAECHT, for "Utilizing the magma or residues of wool-suds."—Dated 5th March, 1875.—French patent.

107,297. DAUDIER, sen. and jun., for "Cleansing stuffs by means of an oleic agent."—Dated 18th, March, 1875.—French patent.

107,297. DAUDIER, sen. and jun., for "Oleic cleansing of wool."—Dated 12th April, 1875.—Certificate of addition to preceding patent.

107,317, RAULIN, of Paris, for "Treatment of wool when liquids and gases are used chemically for cleansing."—Dated 18th March, 1875.—French patent.

107,366. GROSSELIN, sen. and jun., of Sedan, for "A double-action machine for teasing and smoothing woollen and cotton stuff."—Dated 28th April, 1875.—French patent.

107,560. CHAUDET, of Rouen, for "A combination of known machines for cleansing wool."—Dated 10th May, 1875." French patent.

107,615. TROTRY-LATOUCHE, Brothers, for "A machine for unburring wool."—Dated 10th April, 1875.—French patent.

108,021.—DAUDIER, sen. and jun., for "Cleaning wool by dry steam."—Dated 11th May, 1875.—French patent.

108,153. CLOUGH, for "Improvements in apparatus employed for washing and cleansing wool and other fibres."—Dated 24th May, 1873.—(English patent, 30th November, 1874.) —French patent.

Paper, &c.

4134. JAMES HUMMERSTON, of Leeds, in the county of York, for an invention of "Improvements in machinery for printing on paper, floor-cloths, and woollen or other woven or felted fabrics."—Dated 29th November, 1875.

107,329. DESHAYS, of Rouen, for "A machine for bronzing and powdering printed and wall paper."—Dated 23rd April, 1875.—French patent.

107,527. CHOULIAC, of Paris, for "A guide-ruler for printing oil-cloth."—Dated 7th April, 1875.—French patent.

Finishing Processes.

3889. JAMES WALKER TATTERSFIELD, of the firm of George Tattersfield and Co., of Dewsbury, in the county of York, for the invention of "Improvements in machinery or apparatus for finishing woven fabrics."—Provisional protection has been granted.

4062. JAMES SMITH, of Oldham, in the county of Lancaster, for an invention of "Improvements in apparatus for plaiting fabrics."—Dated 23rd November, 1875.—Provisional protection has been granted.

4243. DANIEL NICKOLS, of Manchester, in the county of Lancaster, engineer, for an invention of "Improvements in machinery for plaiting fabrics."—Dated 8th December, 1875.

4108. To THOMAS BENJAMIN WILLANS, of Vale Mills, Rochdale, in the county of Lancaster, for the invention of "Improvements in finishing woollen fabrics and in apparatus therefor."—Provisional protection has been granted.

104,423. TORLOTIN, for "Size for thread and tissues."—Dated 13th March, 1875.—French patent.

107,055. BECK, sen., Son, for "Modifications in the construction of machines employed for glossing stuffs."—Dated 19th March, 1875.—French patent.

107,423. BERTIER, for "A machine for bronzing gilt and silvered paper, for smothing fancy paper, and for glossing tissues.—Dated 26th March, 1875.—French patent.

107,434. FROMM, for "An apparatus for damping fabrics for printing and dressing."—Dated 26th March, 1875.—French patent.

107,435. GARNIER, for "A process for dressing tissues."—Dated 27th March, 1875.—French patent.

107,445. MARCADIER, for "A tenter for tissues."—Dated 30th March, 1875.—French patent.

107,477. MARTIN, of Lyons, for "Improvements in machine for dressing stuff."—Dated 27th April, 1875.—French patent.

107,544. PIERRON and DEHAITRE, for "An apparatus for damping fabrics for dressing."—Dated 5th April, 1875.—French patent.

107,763. FOURNIER, of Sedan, for "A carriage for tentering cloth."—Dated 18th May, 1875.—French patent.

169,054. LEOPOLD STERNBERGER, of Philadelphia, Pa., for "Starching machines."—Application filed 10th July, 1875.—American patent.

Brief.—"Two rollers revolve in a suitable frame, the lower one being longer than the upper one, and having a groove at each end. The journals of the rollers have their bearings outside of the frame."

107,938. PALMER, for "Improvements in apparatus for tentering, drawing, drying, and finishing cloth and other stuff."—Dated 3rd May, 1875.—French patent.

108,010. RHODES, SCHILLITO, and SPEED, for "Improvements in finishing woollen, yarn, and other filamentous substances."—Dated 11th May, 1875.—French patent.

108,027. JURIE, of Paris, for "A mechanical and capillary process of finishing or sizing tissues."—Dated 12th May, 1875.—French patent.

3836. WILLIAM WALTON URQUHART and JOSEPH LINDSAY, of Dundee, in the county of Forfar, North Britain, engineers, for an invention of "Improvements in machinery or apparatus for calendering, mangling, or finishing woven fabrics."—Dated 18th December, 1872.—The stamp duty of £50 has been paid upon this patent.

Abstracts from complete Specifications of Patents.

[These abstracts are confined to patents for which application was made in the year 1875; the full titles of all patents connected with colouring sealed in the year 1875 will be found in the next number of the Textile Colourist. These abstracts will be continued as the specifications appear, and it is further intended to give condensed abstracts of patents dating from 1866, unless the Commissioners of Patents should publish a third volume of Abridgements.]

Bleaching.—Schultz's patent, No. 499, communicated to Holliday, is for bleaching cotton goods without the use of caustic lime. The fabric to be bleached, after being wetted, is submitted to the action of a weak solution of an acid, say hydrochloric acid at 2° Beaumé (about 3½° Twaddle). It is then afterwards washed with water and boiled in a liquor containing soap, preferably resin soap, and then in some cases again boiled with soda or potash and washed. The fabric is submitted to the action of chloride of lime and sours in the ordinary way. "By these means," says the patentee,

"the use of lime is rendered unnecessary, and the formation of lime soap is thereby avoided, but the various after processes herein referred to may be considerably varied."

Bleaching.—Wirth's communication from Van Baerle, No. 1382, is for bleaching various fibrous substances, as "flax, hemp, jute, cotton as fibre, yarn, cloth or in the crude state." The process, which is described in rather imperfect English, consists in leaving the articles to steep in a cold solution of silicate of soda; if the strength of the silicate be 1° B. three days' steeping is required, but if the strength be 5° B. twenty-four hours' time suffices. After steeping, the excess of silicate is pressed out, the material washed with cold water, and placed in a weak solution of chloride of lime or bleaching powder. The patentee declares "it will be seen that the thus treated material bleaches much quicker, and is rendered more beautiful without that the fibre is attached (*sic*) as much as with the processes hitherto known."

Designs.—Guerin's communication to Clark, No. 707, is for enlarging or reducing designs. The design to be enlarged is drawn on a circular sheet of india-rubber, thickened around its circumference to form a beaded edge, which is firmly clamped between two metal rings, forming a circular frame. The point in the apparatus is in uniformly stretching the india-rubber sheet, by which correct reductions or enlargements can be obtained.

Steaming.—Cordillot and Mathers' patent for steaming, No. 479, is applicable to that class of colours which do not require high steam, and it is of what may be called the semi-continuous sort. The steaming chamber is fixed, with a curved steam-chest roof, and the drawing shews six waggons in it, running on rails, having their entrance and exit on opposite sides. The goods to be steamed are fed into the chamber over a feed roller, and two small guide rollers, at full width, the piece traverses the chamber two or three times, and is then deposited as it may fall into one of the waggons; when the waggon is full both end doors are opened, and by introducing another waggon the full one is propelled a step further and the filling is resumed in another, and so on until

the first waggon has been sufficiently long in the steam, when it is expelled by the exit door, an empty one being introduced at the entrance door, and so on. The point here is, that it is found that some styles can be safely steamed in a heap (alizarine styles), provided they are thoroughly hot before heaping and not too densely heaped, and these conditions are fulfilled by passing the goods through a considerable space in a steam atmosphere before they fall into the waggon, and not having the waggons too large. The danger from drops of condensed water is guarded against by having all the rollers heated, &c.: provision is made for saturating the steam with moisture before it enters the closed chamber.

Felted Fabrics.—Tavernier and Matheson's patent, No. 361, is for a method of obtaining mixed colours by combining naturally dark coloured wool with light coloured wool, and when felted dyed in any suitable manner. Supposing it is dyed red, then the black or dark coloured wools not being affected by the red dye, remain black or dark coloured, and the light coloured wool becomes red, forming a black and red mixture without the necessity of two separate dyeings before felting, as was hitherto the case.

Finishing.—Gartside and Bradbury's patent, No. 2492 refers to what is sometimes known as the Irish beetle, that is, where the cloth or fabric to be finished is wound on a roller or cylinder, and it relates to the fallers and "consists in various improved arrangements and combinations of wrought-iron or Bessemer steel and anti-concussion materials, in order to prevent the excessive wear and tear of the fallers, and to enable them to resist the usual breaking action caused by the incessant concussion when in use." The construction of the improved faller cannot be explained without drawings further than to say, that it is composed of two wrought-iron (or Bessemer steel) straps, welded or cast at the bottom, and forming an angle-joint at top, these are filled in with wooden blocks, and between the bent-in end of the tops of the bars, and the upper clamp there is a piece of leather, india-rubber, or other anti-concussion material.

Floor-cloth Printing.—Nairn's patent, No. 35, is for pre-

paring floor-cloths for printing, and consists in an arrangement of apparatus to facilitate the trowelling, or applying paint to the surface of the cloth, and the subsequent rubbing and drying of such cloth. The cloth is drawn off a roller through colour, and passes under a straight-edge, or doctor, which causes it to receive an even coating of the pigment, the cloth is then carried forward by endless chains provided with clips and hooks. When dried, the cloths are rubbed down with pumice-stone or other suitable rubbers, either by hand or machinery. Details can only be described in conjunction with the drawings.

Flocking.—Rhodes' patent, No. 16, is for an apparatus by which a more uniform distribution of the flocks is obtained in the "milling machine;" the "confining spout" is made shorter, and the distance from it to the "throat" enclosed so as to keep the fabric warm; there are also various modifications in the distributing apparatus.

Finishing.—Laycock's patent, No. 572.—No full specification was lodged of this patent, and it is therefore void; the patentee employed the milling machine for stiffening and staining; for stiffening he employed flour, which may be thrown on to the material either in the dry or wet state.

Colouring Matter.—Holliday's patent, No. 1031, is for obtaining colouring matter by heating chlorinated or brominated anthrachinon with strong sulphuric acid, until the compound obtained is soluble in water. "One part of chlorinated or brominated anthrachinon, or a mixture of them is heated in an enamelled iron or other suitable vessel with about four times its weight of fuming sulphuric acid for two or three hours, at a temperature of about 250° C., until a little taken out and added to water shews no precipitate. After letting the mixture cool, it is poured into about forty times its weight of water, then neutralized with lime and boiled. The clear liquor is separated, and carbonate of soda or potash added to it till no more lime precipitates, it is then filtered or decanted, and the filtrate evaporated to about 20° Baumé. The product obtained is then mixed with about one and a half times its weight of dry caustic soda in a pan, in which it is agitated and

heated to a temperature from 190° to 215° Centigrade for three or four days, or until such time as it is judged by frequently taking out samples therefrom, that the greatest quantity of colouring matter has been formed. The mass is then dissolved in water and precipitated by an acid, such as sulphuric and muriatic, and then filtered; and the precipitate, after being well washed with water, constitutes a colouring matter suitable for dyeing and printing."

Silk Dyeing.—Petitdidier, in his patent, No. 1064, states that silk tissue loses its elasticity and crispness if moistened with water, and he proposes to banish water from silk dyeing altogether, employing instead either alcohol, benzine, spirit of turpentine, sulphuret of carbon, ether, or wood spirit, as the vehicle for dyeing. As the mineral mordants formerly used in silk dyeing will not dissolve in these fluids, he takes a mordant composed of 6 lbs. resin and 3½ oz. stearic acid dissolved in about 7 pints of benzine. The silk is padded in the dyestuff, steamed, and then washed off three times in benzine.

Oxidized Fatty Matters.—Gatty's patent, No. 124, is for preparing fatty matters to use instead of oil in Turkey-red dyeing, and the fatty matters produced are called oxidized fatty acids. Soap is dissolved in water, and solution of chloride of lime added until the fatty matter is precipitated; 10 to 12 gallons of chloride of lime, at 12° Twaddle, are sufficient for one hundredweight of good soap. After some hours the precipitate is colleeted on a filter, and then boiled with muriatic acid; the liberated fatty acids are washed with water, and are fit for application as a substitute for oil in "different processes of dyeing and printing Turkey-reds and other colours on cotton fabrics and yarns, in which fatty acids are combined with alumina as is well understood by dyers and printers."

Indigo as Steam Colour.—Holliday's patent, No 498, is for a steam colour from reduced indigo and oxide of tin. The indigo is reduced to indigo white by any of the known processes, the paste is then mixed with gum and oxide of tin, the quantity of the latter depending upon the percentage of pure indigo present; for 10 parts pure indigo in the paste

add 1 part oxide of tin and gum water to shade required. Salts of tin with alkali may also be used, but the oxide of tin produced by precipitating tin crystals with carbonate of soda is preferred. After printing, the cloth is steamed for a sufficient length of time, and washed and treated as may be required by colours associated with it. The patentee concludes, "what I claim is the fixing of indigo on cotton and other fabrics by the action of steam on a combination or mixture of oxide of tin and indigo white, substantially, as described."

Bronzing.—Thackrah's patent, No. 608, is more directly applicable to those fabrics having a piled or fibrous surface, and which have been previously dyed in the ordinary manner. The process consists in first treating with a solution of tannic acid, then a bath of picric acid, thirdly in a bath composed of nitrate of tin and muriate of copper, and lastly " boiled in a solution of aniline of sufficient strength to give body or tone to the colour which, when dry, presents a metallic or bronzed appearance."

Purification of Colouring Matters.—Versmann's patent, No. 1038, is for the use of bisulphide of carbon or petroleum spirit of sp. gr. 700 to 720, for extracting phosphine from the crude aniline dye, commonly called the melt, or from any bye-products, residues, or refuse, resulting from the manufacture of rosaniline. The patentee does not claim any particular form of apparatus for treating the melt, but gives a description of one which may be used without confining himself to that particular form, and employs the liquids under ordinary circumstances, or under pressure with or without the aid of heat. He states that these fluids separate the phosphine and some of the resinous impurities of the melt, but do not dissolve any sensible quantity of red colouring matters, which have to be separated from the original material in the usual manner.

Finishing.—Mitchell's patent, No. 1019, is for stretching calico in length, and is intended to compensate for the taking up of the warp in weaving. The improved machine consists chiefly of two or more series of roughened rollers, over and under which the cloth is caused to pass, and as the second

series of rollers is driven rather faster than the first, and the third (if more than two) rather faster than the second, and so on, the cloth is pulled and stretched in the direction of its length as it passes through the machine.

Finishing.—Stark's patent, No. 370, for breadthening and drying woven fabrics, does not seem to have any novelty in the parts, being accomplished by well known methods, but there is a combination of the grooved rollers and the drying machine which seems new and ingenious, and which is said to render the breadthening more effective and permanent than when not used in conjunction. The description and drawings claim and shew the use of "counterpart circularly grooved rollers, the ridges of which enter more or less into each other's grooves" placed in the frames of the drying tins; or the grooved rollers may be themselves hollow and heated by steam. The point of the whole is that the breadthening takes effect on the fabric when it is in the proper state of moisture, neither too wet nor too dry, and the subsequent complete drying prevents it going back.

MISCELLANEOUS.

Defects of the Printing Machine.—In a report made to the Industrial Society of Mulhouse, 9th June, 1875, M. Camille Koechlin makes the following observations: When cloth passes between a lapped cylinder and an engraved metal roller charged with colour, it receives by the pressure an imprint of the single colour. If cloth thus impressed passes on without any intermediate drying a second time between similar cylinders, in order to receive another colour, this second passage crushes the colour from the first roller, and produces what is called *laminage* (lamination or splitting).

This lamination is not confined to the effect of a simple crushing or forcing the colour into the fibre at the expense of

the tissue, but at the same time there is a division of the colour between the surface of the metal and the cloth, and the plain parts of the second roller take colour from the cloth, and are actually printed with an impression of the first roller. What becomes of this colour, torn, so to speak, from the cloth? The revolution of the roller carries it into the colour box; and there what is not rubbed off by the furnisher is caught by the doctor, and in reality mixes with the colour which ought to be free from it. In order to appreciate the importance of this fact, suppose the first colour is black and the second pink, the black on the cloth marks off upon the pink roller in a continuous manner, so that after a while the pink is so injured as to be no further usable.

This defect occurs not only in the case of visible colours, but is felt in other cases less perceptible to sight, where the compositions are of a nature to coagulate one another, cause precipitations, or otherwise neutralize or destroy one another, and is repeated for every roller of the pattern, however many there may be.

In the present arrangement of machines, printing several colours, there are therefore two serious inconveniences; the crushing and consequent impoverishing of an impression and the mixing of different colours.

To guard against the loss of effect by crushing, it is necessary to make the colours stronger than they would otherwise be required, and this to an extent of 50 per cent.

To palliate the injury of colours by one working into the other, they should be arranged in the order of their sensitiveness, but this is not always practicable, and for several years past recourse has been had to the intervention of plain rollers upon which the cloth could mark off its excess of colour one or more times.

These intermediate cylinders, called gum-rollers (in French water-rollers), practically diminish the size of the machine by taking the place of engraved rollers.

Their adoption consequently necessitates the use of larger machines. The gum or water-roller may be made of any non-oxidizable metal provided it is of the same size as the

engraved rollers it is required to work with. These rollers were used in 1864, at Koechlin Frères, by M. Assenmacher.

Although the present printing machine is the most advantageous in every respect for quickness and accuracy of impression, the inconveniences above-noted are so serious, and the remedies so costly and imperfect, that the Society has instituted a prize, with the sole aim of removing them, at the risk of seeming to ask for a perfection which is impossible and absurd to expect.

Mordant, or Preparation for Indigo Dyeing.—In the "*Moniteur de la Teinture*," pp. 201, 254, and 261, allusion is made to a secret process of preparing wool and cotton for indigo dyeing, by which 18 per cent. of indigo can be saved, and the dyeing performed in less time than ordinary. The mordant is called "Mordant Schmidt," and the discoverer wishes to dispose of his process to dyers at the rate of £40 sterling per vat, or he will sell his mordant at the price of 7½ francs the kilogramme. He states that supposing indigo to cost 20 francs the kilo., say 6s. 6d. the pound, there will be a saving of more than £4 sterling in dyeing 900 lbs. weight of wool, which can be accomplished in one day in one vat. The specimens of loose wool and of calico in the "Moniteur" shew a darker shade in the prepared than on the unprepared specimens, such as might be produced by copper salts, or manganese salts employed by the old methods, and which were at one time thought to require less indigo in dyeing.

Heavy Black.—An advertiser in the *Färber Zeitung* desires to communicate among other receipts the newest process of dyeing silk black to any weight up to 350 per cent. of the raw material.

Marking Ink for Bleachers.—The following is from the *Muster Zeitung*, No. 42, p. 335: one part by weight of cinnabar or vermilion, and one-eighth part of sulphate of iron are intimately mixed, and then ground up with linseed oil; this is the marking composition with which the unbleached goods are stamped. This ink (it is stated) remains unchanged through all chemical bleaching operations.

Caviar as a Substitute for Albumen.—An esteemed Russian

correspondent writes to us that the common yellow yolk caviar (ikra) is now being extensively used as a substitute or assistant for blood albumen. This caviar costs from 80 copecks to 1 rouble for a pood, in the raw state, that is less than one penny per pound, it is ground into a thick paste and used in conjunction with blood albumen in printing; for pigment orange, 2 measures of caviar and 1 measure of blood albumen solution; for pigment green, 2 measures of blood albumen to 1 measure caviar; for aniline purples, equal measures. It works well in the machine and withstands all necessary soaping, in fact, there is no difference between the mixture and pure blood albumen as regards the fastness of the colours. We may add that the possibility of applying the roe of fish as a substitute for albumen had not escaped the attention of chemists, and Leucht obtained the reward of a gold medal from the Industrial Society of Mulhouse, for a paper upon the subject; Cordillot also, in 1863, examined a product sent by Bernard (Bull. de Mulh., xxxiv., 48.) Leucht's paper may be seen in the same journal (xxx., p. 306,) or an abstract in "Le Technoligiste," xxii., 22. It was, however, never brought into general use until Mr. W. Mc.Callum, of Shouya, applied it last May, in the shape of caviar; he uses 15 cwt. per month, and it is employed on every works in Russia. An attempt is being made to monopolize the discovery, by a patent, in Russia, which it is hoped will be frustrated.

REVIEWS.

La Teinture Moderne, par Max Singer (Mordern Dyeing, by Max Singer). Paris: Lacroix, 1875.

THIS is a bulky volume of 800 pages; and, as the writer declares himself upon the title-page to be the author of a work upon practical dyeing, and to have formerly been

manager of several dyeworks, it was not unreasonable to expect that we should find in it, we will not say anything new, but at least some original writing and practical treatment of the subject of the work. We regret to say that our notice of this book will be confined to the unprofitable and ungracious, but still necessary task of shewing that there is nothing original from the beginning to the end of the volume, that it might have been written by a man who had never been inside of a dyeworks, and that a considerable portion of the matter has only the most distant connection with the art of dyeing.

On the last page of the work the author recommends his readers to peruse the treatises of Dumas, Grison, Van Laer, Girardin, Schützenberger, and one or two other authors, and states that he has himself derived much assistance from these writers in completing his book. This is a saving postscript, which partly disarms criticism by tardy acknowledgment, but it only faintly represents and suggests what is the true state of affairs, and that is that almost the whole book is copied word for word from the writings of these and other authors. It is true that in the Preface the author says he has sought in modern books for anything of interest to the dyer, and that perhaps the matter will not seem new to those who are acquainted with the literature of the subject; but when a practical dyer undertakes to write a book upon dyeing, it should be somehing more than a mere transfer of unchanged matter from well-known books, and should have something of the man himself in it; if Mr. Max Singer be a practical dyer, it can only be said that he has kept himself carefully outside of his book.

The author plunges boldly into the subject, and commences with a delightful abruptness upon logwood; this is better than a good many writers upon dyeing who prepare us for the art by half-learned disquisitions upon the specific gravity of gases, or the absorptive powers of boxwood charcoal for ammonia; 154 pages are taken up by the description of dyestuffs, the sources from which drawn will be shewn afterwards.

The next part of the book is upon the chemical agents

employed in dyeing, and fills 310 pages, the applicability of this matter to dyeing will be best illustrated by stating that there are 14 pages upon the manufacture of alum from schists, clay, cryolite, &c.; 17 pages upon the manufacture of soda-ash; 13 pages upon the extraction of sulphur from its ores, and preparation of flowers of sulphur; 41 pages upon the manufacture of artificial ultramarine; 13 pages on the manufacture of nitric acid, and a large part given to the extraction of tin, zinc, antimony, and mercury from their ores, preparation of calomel, composition of manganese ores, &c.; and all without any originality of treatment, and with hardly any reference to dyeing.

Then follows 100 pages upon the products derived from coal, with here and there a few threads of dyed worsted gummed on the page, without the remotest allusion to them in the text, nor any statement that they represent shades to be obtained from the colouring matters of which the manufacture is described with formal verbosity.

There then follow 50 pages upon the adulteration of drugs and dyestuffs, which it is acknowledged are taken from Bolley's work, translated by Gautier, and of which nothing more need therefore be said.

Then come 40 pages of a bald and meagre history of dyeing, and at length we come to practical dyeing, which concludes the book, and occupies 114 pages. We do not accuse M. Max Singer of plagiarism, because at the foot of each process there is a single word as *Dumas*, *Girardin*, *Grison*, which is an acknowledgment of the authorship of the matter; we have referred to all these writers, and find that they have been copied word for word by Max Singer without any attempt at condensation or adaptation. It is little creditable to a practical dyer writing upon his own art that he should transfer without change, and without remark, 22 pages more or less upon mordanting and dyeing from such a book as Girardin's Leçons de Chemie, which is an elementary treatise upon the science as well known to French as say Miller's Chemistry is to English readers. The remainder of the 114 pages is taken with similar fidelity from other authors, and

nowhere in them can we find anything which has not been long, some of it forty years, in print.

The section on dyeing materials is to be found every word in Dumas, Schützenberger, and Girardin, with such changes as *Caesalpina echinata* into *Caesalpina echinatos;* the bulk of the section on chemical agents is not taken from any of the books mentioned by the author but may be found in Barreswill and Girard's "Chemie Industrielle" and other books; we do not mean found in general terms, but word for word as in the following extract:

Max Singer, 1875; p. 171.

Dès longtemps, l'ancienne Académie des sciences avait fondé un prix de 2,400 fr. pour la conversion du chlorure de sodium en carbonate de soude. Le premier, le P. Malherbe, en 1777, avait cru posséder la solution industrielle du problème; il proposait de convertir d'abord le sel en sulfate de soude, puis de chauffer celui-ci avec du charbon et du fer. Etc., etc.

Dictionnaire de Chemie Industrielle, 1861; i., p. 213.

Dès longtemps, l'ancienne Académie des sciences avait fondé un prix de 2,400 fr. pour la conversion du chlorure de sodium en carbonate de soude. Le premier le P. Malherbe, en 1777, avait cru posséder la solution industrielle du problème; il proposait de convertir d'abord le sel en sulfate de soude, puis de chauffer celui-ci avec du charbon et du fer. Etc., etc.

And so on for many pages. In the section upon the derivatives of coal the same process of transcription has been adopted (with a too brief acknowledgment), as may be found upon comparing p. 511 of Max Singer with Gautier's translation of Bolley and Kopp, upon the derivatives of coal-tar, p. 161, and following pages.

If we could have found anything at all in this book which is not in older books, we should have been glad to give Mr. Max Singer the proper credit; we have found nothing but an unskilful putting together of old materials by a process which is unworthy even of the name of compilation.

The Dyers' Hand Book, by F. J. Bird.—Manchester: John Heywood. London: Simpkin, Marshall, and Co. 1875.

If the author of this work had confined himself to garment dyeing, we should have simply recommended his production to the useful class of garment dyers, as a cheap and practical collection of receipts and processes; but he has been more ambitious, has been tempted out of his depth, and has not been above conveying the matter of other authors into his book without mentioning their names. The article on bleaching, p. 12, is taken from Crookes, p. 48; and on following pages he has copied verbatim from the same author, who had previously taken his matter from the "Dictionary of Calico Printing," p. 26, and all without any acknowledgment. There is one sentence, however, given by both Bird and Crookes, which is not in their original: "the soap is that made from prepared resin, and having the specific effect of improving the whites during the subsequent process of dyeing." This is, of course, pure nonsense; prepared resin is resin soap and it has nothing to do with improving whites during dyeing. It would, perhaps, scarcely be fair to minutely criticise the language of the receipts and processes given; many of them are perfectly good; we feel quite sure Mr. Bird could dye better colours than the illustrations contained in his book, and have no doubt that altogether it will be very welcome to a large class of readers.

THE TEXTILE COLOURIST.

No. 2.—FEBRUARY, 1876.

1. On the Dip-blue Styles of Calico Prints.

BY MR. G. H. UNDERWOOD.

THE indigo dip-blue style in calico printing is that style in which indigo is the only or chief colouring matter upon the calico, and is obtained by the process of dipping or submerging the cloth in an extended state into the dyeing vat; when a design or pattern is required it is in most cases previously printed upon the cloth with a resisting composition.

There are various classes of work in this style, but they all depend upon the vat for the indigo with which they are coloured. The styles to be treated of are the following:—

Sky blue.
Azure.
Azure, discharge style.
Navy blue and white, small patterns and bafts.
Navy two blues, small patterns and bafts.
Greek styles: blue, orange, and white.
Blocked styles: blue, orange, and yellow.
Fancies: Blue and green.
Blue, white, and green.
Two blues and green.
Blue and yellow.
Blue, white, and yellow.
Two blues and yellow.
French two blues and white; block work or cylinder.
Two blues, green, and yellow.
Swiss Chintzes: Two blue, red, yellow, green, and white.

Red cross-over and blue; red (madder), chocolate, and white.
Green and yellow, with berries, bark, or lead yellow.

Arrangement, setting, and working of the vats.—In a well arranged dyehouse each set is allowed ten vats at the least; nine for dipping in, and one lime vat. The vats are made of either wood, stone, or iron, and have a capacity of about 830 gallons, their size being nearly as follows: 6 feet 6 inches deep; 6 feet 6 inches long; and 3 feet 6 inches in breadth; each set of vats is supplied with a rake, a muddler, and a skimmer.

The rake is a shaft of ash wood 9 feet long; the head of the rake being made of iron plate, 12 inches by 6 inches. This rake is used for raking the vats up at night when the day's work is done; also for raking up the lime vats when necessary.

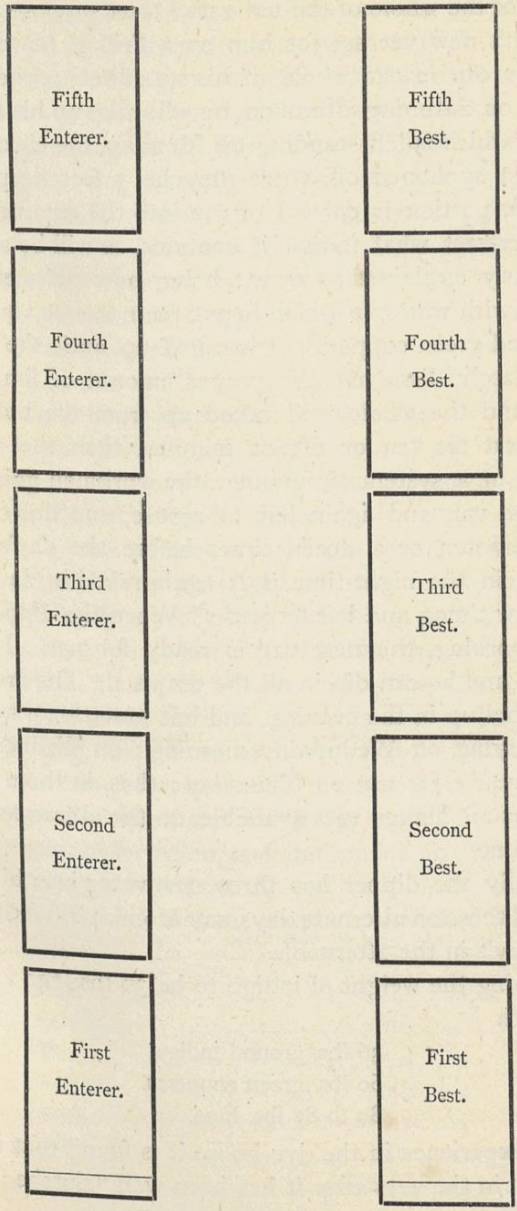
The muddler is a rake similar to the preceding, the shaft of which is only about 7 feet long, and the head, which is of wood, 10 inches by 6 inches. Its use, as the name implies, is confined to muddling or stirring the vats whilst in the process of dipping, especially the entering vats, because of the rapid precipitation of indigo in them by their absorption of oxygen from the pieces entered, and from the air.

The skimmer is used for skimming off the florry or scum that rises in the top of the vats, especially the weaker ones, were this not done the pieces when entered would take this scum on their surface into the vat and produce an unevenness of shade when the goods were finished.

In the arrangement of a blue dyehouse there ought to be every facility for obtaining a sufficient supply of water, and with every convenience for supplying the vats; below the bottom of the vats soughs or drains ought to be laid from each set running into one main channel, and then into a large pit or well in which the bottoms of the spent vats can undergo some subsequent treatment for the recovery of the small quantity of indigo remaining in them, details of which will be found further on.

The vats are best arranged in the dyehouse in sets of ten, with one vat extra, which is used as a lime vat, making a

total of eleven vats in each set. The dyeing vats are laid down and named as follows:—



Such an arrangement enables the dipper to have always nine vats for working with, for three days in the week he has the use of the whole of the ten vats ; thus, suppose the dipper to have a new vat set for him on a Friday, he will then on Saturday dip in the whole of his set of vats ; when finished dipping on Saturday afternoon, he will rake up his first entering vat which is left standing till Monday, the clear liquor in it is then syphoned off, there may be 3 feet deep of clear, the thick portion is carried or run into the recovering pit or vat to extract what indigo it contains, as will be afterwards particularly explained ; the vat being now quite emptied, is filled up with water, in which is put the necessary quantity of indigo and green copperas, it is raked up until the copperas is completely dissolved, the proper amount of lime is next added, and the whole well raked up from the bottom, and left at rest for ten or fifteen minutes, then the raking is repeated in a systematic manner, the workman going slowly round the vat, and again left to repose, and this can be repeated say ten or a dozen times before the day's work is finished ; in the night-time it is again raked up in the same way a few times, and left to settle. When the dipper arrives in the morning, the new vat is ready for use. It is now Tuesday, and he can dip in all the ten vats. The first enterer vat is raked up in the evening, and left to settle for syphoning and emptying on Wednesday morning ; on Wednesday it is set and ready for use on Thursday ; thus, in three days the dipper has all his ten vats available, on the alternate days he has but nine.

Generally the dipper has three new vats given him in the week, and these on alternate days, say Monday's, Wednesday's, and Friday's in the afternoon.

Supposing the weight of indigo to be 36 lbs., the vat would be set with

36 lbs. ground indigo.
60 lbs. green copperas.
80 to 87 lbs. lime.

From experience in the dye-house it is found that the lime works best in the vats after it has been well "slutched," and it

is therefore recommended to use slutched lime, not only in setting the vats, but also in freshening them up during working. A good dipper always endeavours to keep up the strength of his best vat, and works it very little in the earlier part of the day, relying more upon his back vats, and when these become exhausted or knocked down (as it is said) by constant dipping during the day, he has his best vat comparitively fresh, and consequently finishes his last frames with greater ease. This manner of working the vats contributes considerably to the economy of indigo. A dipper should always enter his frame in his first enterer, and then pass it regularly up the set until it acquires the requisite shade; this rule should be enforced except at starting in the morning, when it is allowable to fill three vats off hand, but after this, the rule should be insisted upon. The reason is obvious, for in all Navy and Baft styles, and even in very light orange patterns the goods may be entered dry in the first enterer, these styles not requiring liming in the lime vat, and as the first enterer is the weakest vat of the series, and dry cloth absorbing more liquor than wet or limed cloth, it absorbs also proportionably more indigo, and so the vat is reduced in strength, until it is all but exhausted of the indigo which it held in solution, an object which should always be aimed at.

The strength of an entering vat, when it is no longer available for dyeing, should not exceed 1½ to 2 lbs. of indigo if the workman has properly managed and fed his vats.

The following shews the weight of indigo in each vat as deduced from observation and judgment in the practical dyeing: it is supposed that the vats have been each set with 36 lbs. of indigo, and that the dipper has worked all the vats well and systematically.

First enterer	2 lbs.	indigo.
Second „	3 lbs.	„
Third „	5 lbs.	„
Fourth „	7 lbs.	„
Fifth „	11 lbs.	„
Fifth best	16 lbs.	„
Fourth „	22 lbs.	„

Third best ..... 28 lbs. indigo.
Second „ ..... 32 lbs. „
First „ ..... 36 lbs. „

In the usual course of working, the vats require feeding or freshening up at the termination of each day's work; this should be done with great care and circumspection, and the duty devolves on the foreman of the dyehouse, who ought to see each vat raked up at the close of the day's work, and judge of the quantity of lime and copperas which should be added. In most cases it is not necessary to feed the first and second vats for the first three days of their working, after that time the indigo being "knocked down" (precipitated) by the process of dipping, it becomes requisite to freshen up the vats. The foreman judges by the appearance of the vats during the raking what quantity of lime and copperas should be added, and according as it is pronounced to be "fresh" or "sickly," so does he prescribe the quantity and the nature of the "feed." As vats decrease in strength, and pass into the class of enterers, a greater quantity of feed is necessary; in the case of the lower best vats, half a scope full of copperas liquor at 36° Tw., and an equal measure of well slutched lime is found sufficient, but when an enterer vat is found to be sickly (that is, when upon raking up it does not shew the thick dark blue veins, which shew themselves in healthy vats, the veins being of a lighter blue, and in very weak enterers edged with a slight blue film, and a total absence of blue bubbles and very few veins), as much as one and a half scopes full each of the copperas liquor and the lime may be added. Upon such addition the dipper must well rake up the vat, going round it several times, and bringing the bottoms well up each time.

The Lime Vat.—This vat is of the same dimensions as the dyeing vats, and it is set by throwing into it, when full of water, three or four hundredweights of lime, which is allowed to slack in the water, and when required for use it is raked up by the dipper. The successful working of the lime vat for orange styles is not so simple as might be supposed, for upon the proper management of the frame whilst in this vat depends in great measure the goodness of the work when

raised in the chrome-beck. The manner of working it is as follows, and the remarks apply chiefly to the orange styles. After the cloth is hooked upon the frame, it is placed in the vat, and then screwed up to the proper tension, not too tight, or the paste colour will "break;" nor yet too slack, or the piece will "flap," that is, touch in the middle of the flap. According to the strength of the pattern, the frame must be left a longer or shorter time in the lime vat, with the lime raked up accordingly; for very light orange patterns the dipper frequently omits the lime vat, and enters the frame into the first enterer, but this must only be when the first enterer is "hard." This is a dyehouse term indicating that the enterer contains a large quantity of lime, so much so, in fact, that it is sufficiently strong for light patterns without separately liming the cloth. When the pattern is of a very massive character, the lime vat is raked up well from the bottom, and the piece limed from seven to seven and a half minutes. In very large patterns there is another object to be kept in view besides the good quality of the orange, it is to ensure a good white; when there is a heavy body of white ground there is a great tendency for the white paste to slip or run, and it is necessary that the piece should be well limed before it gets into the enterer, so that the salts of copper may be completely precipitated on the cloth, and thus the tendency of the colour to run or slip is overcome. Although there may be a greater amount of orange colour upon the surface of the cloth constituting the pattern, it does not follow from that that it requires more liming, but on the contrary, less, when the body of the orange is less solid or compact, and the edges of the two lines or border of the pattern are closer together; such a pattern only requires about five minutes' liming in a moderately hard vat.

Further remarks upon defects arising from excessive or defective liming (or, as it is called, hard and soft liming) are deferred until the orange style has been fully described.

Skying.—The operation called skying is intended to give a uniform light-blue colour to the whole cloth; this is effected

by passing the cloth over rollers through the sky vats, taking care to keep it evenly stretched out so as to avoid "scrimps," and giving plenty of head room over the vats to ensure a perfect oxidation before it is banded up on the floor. For this operation one man and six or seven boys are required; the man sees to the wiring, etc., of the cloth, and the regulation of the vats, whilst the boys are employed in turning the rollers, opening and keeping out the scrimps, and banding up the pieces as they come over the airing frames. In working the vat it is necessary to have two sky frames, so that the weak vat can be further exhausted by passing the cloth first into the weak vat, and then into the stronger. When the weak vat requires exhausting in this manner, and the cloth goes through the last set or stronger vat, the rollers must go much quicker than if only one vat is employed, otherwise a much darker shade will be given than is required.

Cloth simply skied is seldom required in the trade, as the object of skying cloth is but preparatory to some other style in which a two blue, or a two blue and green, or a blue and green effect is required; these will be explained under their respective heads.

The management of a sky vat is very simple, the only care that is required is the proper feeding of the vat, and its good raking after the day's work is done.

A sky vat is generally set with from 60 to 70 lbs. of Bengal indigo, of good quality, averaging from 46 to 50 per cent. of pure indigo, about 100 to 120 lbs. of copperas, and about 160 to 170 lbs. of lime; after setting, the vat must be well raked, and left at rest for about eight or twelve hours before being worked. After the vat has been used for skying, so long as it is profitable to do so, the dipper in the adjoining set uses it as an enterer. The speed at which the frame works is always in proportion to the shade required.

Azure Style.—The azure style of blue printing is one in which a white figure on a light blue ground is produced. This is effected by first printing the cloth of the required pattern with the following paste, known as

Azure Paste.

8 lbs. light British gum.
8 lbs. dark „
12 quarts water.
4 lbs. soft soap.
10 lbs. sulphate of zinc.
3 gills nitrate copper.

This batch of colour makes 4¾ gallons.

Then drying from the machine and skying through the sky vat to the required shade. The following patch illustrates the style; after skying, the pieces are bowled up and washed and then made up for the market.

Indigo Blue: Azure Style.

Considerable care must be exercised in passing the cloth over the rollers through the sky vat so as to prevent "tailing" of the colour. In entering the sky vat the pattern or face of the cloth must be towards the bottom roller.

Discharge Azure Style.—The discharge style, in which the cloth is first skied a dark shade in the sky vat, is one in which a white figure or pattern appears on a blue ground, and is produced by the oxidation of the indigo by chromic acid liberated from bichromate of potash by an excess of oxalic acid printed upon the padded cloth.

The process is as follows:—The cloth is first dipped or

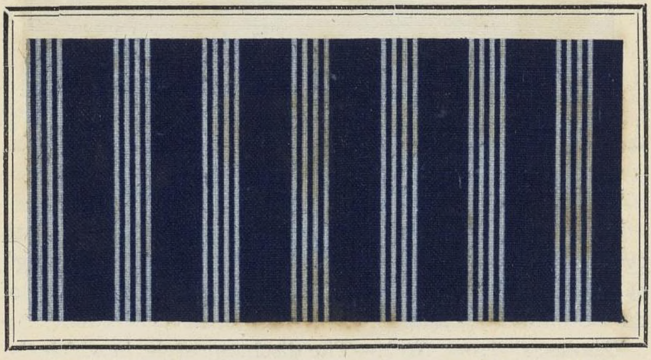
skied to the required shade, then bowled, soured, and washed, then padded with the following liquor:—

2 lbs. bichromate potash.
1 lb. pearlash.

These are dissolved in water and the liquor made to stand at 6° T. (it requires about 6 gallons of water to do so), the cloth is then padded through this liquor and dried over the drying machine; then the following discharge colour is printed on with the required pattern:—

1 gallon starch thickening.
2 lbs. oxalic acid.

When printed with the above colour, the cloth is hung a few hours in a warm room, or all night, it is then passed in warm water and cleared with very weak caustic soda. Of course the strength of the oxalic discharge colour employed always depends upon the depth of the blue to be discharged, and must be varied accordingly.



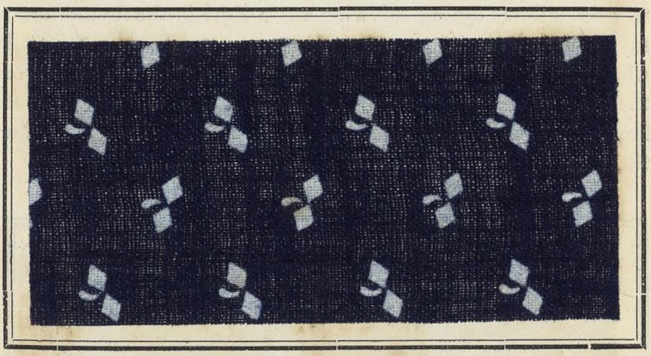
Indigo Blue: Discharge White.

Navy Blues. Small Patterns.—The navy blue style is simply a white figure upon a blue ground. The cloth is printed of the desired pattern with the following paste, and then dipped up to proper shade.

Navy Paste.

36 lbs. sulphate of copper.
8 lbs. brown sugar of lead.
38 lbs. flour.
1½ lbs. British gum.
1½ lbs. dark British gum.
10 gallons water.

Weight of 1 gallon of this paste is 15 lbs., and the above quantities measure 12½ gallons. After the cloth is printed, it is hooked and entered in the first enterer, and sent regularly up until the desired shade is acquired, it is then stripped, bowled, soured, and washed; dried and made up.



Navy Blue: Small White.

Navy Blue Bafts.—Navy blue baft is a similar style to the navy blues, the only difference being that this cloth is generally of a lower quality, and the patterns always larger. The cloth is first printed with the following paste, and then dipped.

No. 1 Navy Baft Paste.

32 lbs. sulphate of copper.
7 lbs. brown sugar of lead.
20 lbs. sulphate of lead.
21 lbs. flour.
7 lbs. calcined farina.
8 gallons of water.

Measures 10¾ gallons, weighs 163 lbs.

Another Baft Paste.

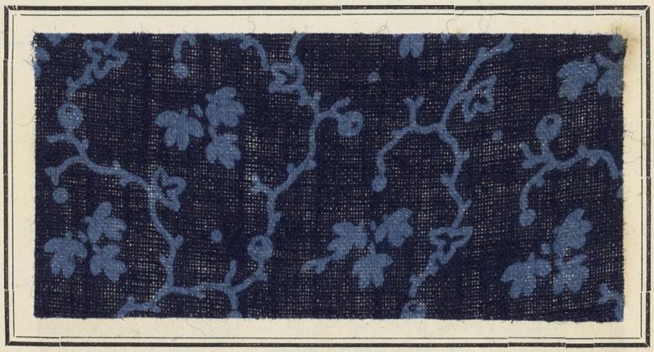
36 lbs. sulphate of copper.
8 lbs. brown sugar of lead.
30 lbs. flour.
3 lbs. dark British gum.
10 gallons water; boil, and add
3 quarts orange paste.

Measures 12¾ gallons, weighs 206 lbs. For large patterns of this style the printed cloth is limed some minutes, more or less, according to the strength of the pattern and the hardness of the enterers. If the pattern be not above the average size it will do without liming, allowing extra time in the first enterer, say that it remains in fifteen minutes, that is two dips, and when lifted up must be entered into the second enterer before the gum is quite off—even the largest patters will do without liming if the enterers are very hard, allowing a double dip in the first.

Navy Blue with Larger White.

Navy Two Blue Bafts are the same patterns as the preceding, except that there are two blues instead of blue and white. The cloth being skied either before dipping or afterwards; if skied before, it is always best to ensure good work

to print with the white paste, because the white paste is much more easily removed from the surface of the cloth, and having no lead in its composition, it leaves the blue clear and bright; but if skied after printing, and when the baft paste has been used as a resist, the dried cloth after bowling should be washed, then a few ends give in muriatic acid, again washed and winced, a few ends in weak caustic, which entirely removes the lead that remains in the cloth, and it then takes the sky vat evenly.



Navy Two Blues.

Blue, Orange, and White Style.—The cloth is printed with two resist pastes, one of which is called the "white colour," and the other the "orange colour." The white colour is always worked first in the machine, and it is necessary that it be always hot when put into the colour box, because of the large quantity of sulphate of copper that it contains, and its tendency to crystallize therein; besides this property, it "furnishes" much better when hot, and does not stick in the engraving.

Blue, Orange, and White, Medium Pattern.

The two following receipts are employed in this style:—

White Paste.

13 lbs. sulphate of copper.
2 lbs. sulphate of zinc.
9 quarts water.
3 quarts acetate of lime.
11 lbs. flour.
1 lb. dark British gum.
1 lb. gum substitute.
1 pint nitrate copper from 70° to 80° Tw.

Another White Paste.—*(Stronger).*

16 lbs. sulphate of copper.
3½ lbs. sulphate of zinc.
8 oz. glue.
10½ lbs. flour.
2 lbs. light British gum.
7 quarts acetate of lime.
9 quarts water.
1 quart nitrate copper.

Acetate of Lime.

4 gallons of acetic acid.
6 lbs. slacked lime (the dry hydrate of lime).

Orange Paste.

30 lbs. sulphate copper.
28 lbs. nitrate lead.
50 lbs. sulphate of lead.
21 lbs. flour.
3 lbs. farina.
6 gallons water.

Measures 40 quarts ; weighs 189 lbs.

Strong Orange.

3 gallons sub-acetate of lead.
4½ quarts sulphate of lead, thick.
12½ lbs. nitrate of lead.
30 lbs. sulphate of copper.
11½ lbs. best flour.
1½ lbs. dark British gum.
1 lb. light British gum.
2½ quarts water.

These quantities weigh about 123 lbs.

Sub-Acetate of Lead.

64 lbs. acetate of lead.
32 „ litharge.
16 gallons water.

One gallon of this Sub-Acetate weighs 13 lbs.

Blue, Orange, and White. Small Design.

After the cloth is printed, it is hooked and dipped, previously entered in the lime vat for the necessary length of time, and then screwed up (that is, the cloth is hooked slack, and then screwed up to the proper tension whilst in the vat); it is then entered in the first enterer, and passed up regularly until it has acquired the desired shade; a good quality of cloth requires longer dipping to acquire its shade than a low quality. When the desired shade is attained, the cloth is stripped from the frame, and immediately carried to the bowling machine, thrown into the pit, and completely immersed in it. This pit should always be acid, so that marking off may be prevented. Marking off is owing to the cloth lying too long in the water of the bowling pit, or on the ground before coming in contact with sulphuric acid. When the cloth is stripped from the frame, the lead of the pattern exists as oxide of lead, and is in a very soft and pulpy state, so soft indeed that the pattern will easily "mark off" on to any other portion of the cloth with which it comes into contact, and the longer the contact is allowed, the greater will be the marking off; as stated before, to prevent this, the bowling pit (or pit into which the cloth is thrown after stripping, previous to going through the washing machine) should be kept always acid with sulphuric acid, so that the oxide of lead may become sulphate of lead, and thus prevent the marking off in consequence of the hardening of the colour, and its being fixed in the cloth by its combination with sulphuric acid. The acidity of the bowling pit is the best possible preventative to "marking off" that I know of, and has done more to reduce "marking off" and "greening" than anything else that has been proposed. After the pieces have gone through the bowling machine, in which they are first bowled, soured, then washed in the same machine, they are banded up separately, taken to the raising becks, and there raised orange. For process of Raising, see further.*

[*To be continued.*]

* The printed specimens in this article do not purport to have been done by the processes, or with the receipts therein detailed. They are inserted to illustrate the different styles, and have been obtained from various houses.

2. Classified List of Letters Patent concerning Bleaching, Finishing, Dyeing, Printing, and Colouring matters, which passed the Great Seal in the year 1875.

Singe Plates and Singeing.

3812. WILLIAM SUMNER, of Salford, in the county of Lancaster, and ERIC HUGO WALDENSTROM, of the same place, engineers, for an invention of "Improvements in the manufacture of copper singe plates."—Dated 4th November, 1874.—*Specification published, price 4d.*

1537. GEORGE BRIGGS, of Cleckheaton, in the county of York, dyer and stover, and HORATIO STEAD, of Halifax, in the same county, machine maker, for an invention of "Improvements in the means or apparatus for singeing woven fabrics and yarn."—Dated 27th April, 1875.—*Specification published, price 4d. For abridgement see p. 96.*

Bleaching.

4087. THOMAS NIGHTINGALE PALMER, of Lansdowne Road, Galston, in the county of Middlesex, for an invention of "Improvements in bleaching wool, textile fabrics, and fibres."—A communication to him from abroad by Louis Prospère Hippolite Plantron Balma, of Reims, in the republic of France.—Dated 28th November, 1874.—*Specification published, price 4d.*

499. THOMAS HOLLIDAY, of Huddersfield, in the county of York, manufacturing chemist, for an invention of "Improvements in effecting the bleaching of cotton and other fabrics produced from vegetable fibres."—A communication to him from abroad by Alexandre Schultz, of Paris, in the republic of France.—Dated 10th February, 1875.—*Specification published, price 4d. For abridgement see p. 49.*

1382. FRANK WIRTH, of the firm of Wirth and Company, patent agency, Frankfort-on-the-Main, in the empire of Germany, for an invention of "Improvements in bleaching fabrics, yarns, fibres, paper pulp, and other articles."—A communication from Vincenz van Baerle, manufacturer, a person resident at Worms, in the empire of Germany.—Dated 15th April, 1875.—*Specification published, price 4d.* *For abridgement see p. 50.*

2812. THOMAS JAMES SMITH, of the firm of Robertson, Brooman, and Company, of 166, Fleet Street, in the city of London, patent agents, for an invention of "Improvements in bleaching silk and other fibres."—A communication to him from abroad by Cyprien Marie Tessié du Motay, of Paris, France.—Dated 10th August, 1875.

Printing.

2623. EDWARD LEE, of 99, High Holborn, in the county of Middlesex, lithographer, for an invention of "Improvements in the mode of producing designs or patterns on surfaces by the aid of stencil plates."—Dated 27th July, 1874.—*Specification published, price 4d.*

2921. GEORGE ASHLEY WILSON, of Liverpool, in the county of Lancaster, engineer, for an invention of "Improvements in and connected with rotary web printing machines."—Dated 26th August, 1874.—*Specification published, price 4d.*

1428. FREDERICK BENNETT, of the firm of John Bennett and Son, of Birch Vale, in the county of Derby, calico printers, for an invention of "Improvements in printing cloth or fabrics."—Dated 19th April, 1875.—*Specification published, price 4d.* *For abridgement see p. 96.*

Patterns and Designs.

4471. JOHN BRIGGS, of Lower Crumpsall, near Manchester, in the county of Lancaster, engraver to calico printers, RICHARD HUDSON, of Chorlton-cum-Hardy, near Manchester aforesaid, designer, and HENRY GRIMSHAW, of Manchester aforesaid, hatter, for an invention of "Im-

provements in ornamenting and transferring patterns to fabrics."—Dated 30th December, 1874.

707. ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, in the county of Middlesex, patent agent, for an invention of "Improved apparatus for enlarging and reducing designs, prints, and other delineations."—A communication to him from abroad by Victor Guérin, of Paris, France.—Dated 26th February, 1875.—*Specification published, price 1s. 10d. For abridgement see p. 50.*

1426. FREDERICK BENNETT, of the firm of John Bennett and Son, of Birch Vale in the county of Derby, calico printers, for an invention of "Improvements in producing patterns or designs in metals, on cloth, or fabrics."—Dated 19th April, 1875.—*Specification published, price 4d. For abridgement see p. 96.*

2161. HENRY EDWARD NEWTON, of the Office of Patents, 66, Chancery Lane, in the county of Middlesex, civil engineer, for an invention of "Improvements in ornamenting or producing patterns or designs of various kinds on fabrics, and in the apparatus to be used for such purposes."—A communication to him from abroad by Pierre Nos D'Argence, of Paris, in the republic of France, and François Delamare, of Paris aforesaid."—Dated 12th June, 1875.

Ageing, Steaming, and Fixing.

4236. JOHN THOM, of Birkacre, near Chorley, in the county of Lancaster, calico printer, for an invention of "Improvements in ageing printed fabrics, and in apparatus connected therewith."—Dated 9th December, 1874.—See also French patent, No. 108,139.—*Specification published, price 1s. 4d.*

479. HONORE FRANCOIS ADOLPHE CORDILLOT, of Sepouchoff, near Moscow, in the empire of Russia, calico printer, and WILLIAM MATHER, of the firm of Messieurs Mather and Platt, of Salford, in the county of Lancaster, engineer, for an invention of "Improvements in apparatus for steaming printed fabrics."—Dated 9th February, 1875.

—See also French patent, No. 107,890.—*Specification published, price 1s. 10d. For abridgement see p. 50.*

1303. JAMES SMITH, engineer to Messieurs Walter Crum and Company, of Thornliebank, in the county of Renfrew, North Britain, for an invention of "Improvements in apparatus for subjecting printed or other fabrics to the action of steam."—Dated 10th April, 1875.—*Specification published, price 1s. 6d. For abridgement see p. 97.*

1587. ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, in the county of Middlesex, patent agent, for an invention of "Improvements in developing and fixing colours on fabrics, and in apparatus for the same."—A communication to him from abroad by Charles Thierry-Mieg, of Paris, France.—Dated 29th April, 1875.—See also French patent, No. 106,687, and certificate of addition thereto. —*Specification published, price 4d. For abridgement see p. 98.*

2033. HORATIO STEAD, of Halifax, in the county of York, engineer, and BENNETT APPLEYARD, of Wakefield, in the same county, crabber and finisher, for an invention of "Improvements in machinery or apparatus for steaming woven fabrics."—Dated 2nd June, 1875.

Drying.

2766. JOHN STOTT, of the firm of John Stott and Brothers, of Wardle, near Rochdale, in the county of Lancaster, woollen manufacturers, and JOHN BARKER, of the firm of Jonathan Barker and Sons, of Todmorden, in the county of York, engineers, for an invention of "An improved machine or apparatus for drying textile fabrics."—Dated 10th August, 1874.—*Specification published, price 1s. 2d.*

3636. SAMUEL KNOWLES, of Tottington, near Bury, in the county of Lancaster, bleacher and calico printer, and JAMES KAY, of Bury aforesaid, engineer, for an invention of "Improvements in apparatus for drying yarns, woven fabrics, paper, and other materials."—Dated 22nd October, 1874.—*Specification published, price 8d.*

2290. THOMAS FLETCHER, of Newton, Hyde, in the county

of Chester, for an invention of "Improvements in the construction of valves to be applied to steam drying cylinders or rollers used in various machines."—Dated 23rd June, 1875.

Dyeing Apparatus and Processes.

2982. ALBERT SAUVÉE, of 22, Parliament Street, Westminster, in the county of Middlesex, civil engineer, for an invention of "Improvements in the apparatus used for dyeing materials, either woven, spun, or in skeins or hanks."—A communication to him from abroad by Monsieur César Corron, dyer, of Saint Etienne (Loire), France. —Dated 1st September, 1874.—*Specification published, price 8d.*

1094. JEAN BAPTISTE CHARLES HENRI PETITDIDIER, of St. Denis (France), dyer, for an invention of "An improved process of dyeing silk, woollen, cotton, and other fabrics."—Dated 25th March, 1875.—*Specification published, price 4d. For abridgement see p. 53.*

1294. JAMES WORRALL, of Manchester, in the county of Lancaster, dyer, for an invention of "Improvements in the mode of and apparatus for coloring pile fabrics."—Dated 9th April, 1875.—*Specification published, price 1s. 4d. For abridgement see p. 95.*

3214. GEORGE CANTRELL GIBBS, of Brentford, in the county of Middlesex, for an invention of "Improvements in machinery for or apparatus for dyeing and colouring felt, silk, and other textile or porous materials."—Dated 19th September, 1875.—*Specification published, price 8d.*

Aniline Black and Bronzing.

3632. ALEXANDER MELVILLE CLARK, of 53, Chancery-lane, in the county of Middlesex, patent agent, for an invention of "Improvements in dyeing threads, yarns, and fabrics aniline black."—A communication to him from abroad by William Jules Samuel Grawitz, of Paris, France.—Dated 21st October, 1874.—*Specification published, price 4d.*

1620. ALEXANDER MELVILLE CLARK, of 53, Chancery-lane,

in the county of Middlesex, patent agent, for an invention of "Improvements in the production of aniline black for printing and other purposes, and in dyeing aniline black." —A communication to him from abroad by William Jules Samuel Grawitz, of Paris, France.—Dated 1st May, 1875. —*Specification published, price 4d.* *For abridgement see p. 94.*

608. WILLIAM THACKRAH, of the firm of Thackrah and Company, of Dewsbury, in the county of York, woollen manufacturers, for an invention of "A new process for bronzing or giving a metallic appearance to textile fabrics."—Dated 19th February, 1875.—*Specification published, price 4d.* *For abridgement see p. 54.*

Alizarine, Aniline, Anthracene, Indigo, and other Colouring Matters.

2841. FELIX DE LALANDE, of Rue d'Enfer, 22, at Paris, civil engineer, for an invention of "Improvements in the treatment of alizarine for the production of different colours or hues therefrom in dyeing and printing."—Dated 18th August, 1874.—*Specification published, price 4d.*

3757. MAXIMILIAN ZINGLER, of 19, Buckland Crescent, Belsize Park, in the county of Middlesex, for an invention of "Improvements in treating aniline and other dyes to prepare them for use in dyeing, printing, and coloring." —Dated 30th October, 1874.—*Specification published, price 4d.*

4421. DAVID CLOVIS KNAB, chemist, of Saint Denis, in the department of the Seine, in the republic of France, for an invention of "Improvements in the manufacture of black for painting or printing, which is also applicable to discoloring sugar and for use as a disinfectant."—Dated 23rd December, 1874.—*Specification published, price 4d.*

4433. JOHN SCUDAMORE SELLON, of Hatton Garden, and ROBERT PINKNEY, of Bread Street Hill, both in the city of London, for an invention of "Improvements in dyeing and printing, and in improved compounds for such pur-

purposes.—Dated 24th December, 1874.—*Specification published, price 4d.*

124. FREDERICK ALBERT GATTY, of Accrington, in the county of Lancaster, manufacturing chemist, for an invention of "Improvements in preparing certain materials employed in printing and dyeing cotton fabrics and yarns."—Dated 13th January, 1875.—*Specification published, price 4d. For abridgement see p. 53.*

498. THOMAS HOLLIDAY, of Huddersfield, in the county of York, manufacturing chemist, for an invention of "Improvements in operating with indigo in the printing of cotton and other fabrics."—A communication to him from abroad by Alexandre Schultz, of Paris, in the republic of France.—Dated 10th February, 1875.—*Specification published, price 4d. For abridgement see p. 53.*

1031. THOMAS HOLLIDAY, of Huddersfield, in the county of York, manufacturing chemist, for an invention of "Improvements in the manufacture of colouring matter suitable for dyeing and printing."—Dated 20th March, 1875. —*Specification published, price 4d. For abridgement see p. 52.*

1038. FREDERICK VERSMANN, of 12, Brecknock Crescent, Camden Town, in the county of Middlesex, Ph.D., consulting and analytical chemist, for an invention of "Improvements in the manufacture of colouring matters."—Dated 20th March, 1875.—*Specification published, price 4d. For abridgement see p. 54.*

1604. ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, in the county of Middlesex, patent agent, for an invention of "An improved process for the manufacture of red sulphide of mercury."—A communication to him from abroad by William Jules Samuel Grawitz, of Paris, France.—Dated 30th April, 1875.—*Specification published, price 4d. For abridgement see p. 93.*

1712. CHRISTIAN HEINZERLING and GEORGE MCGOWAN, both at present residing in Glasgow, in the county of Lanark, North Britain, for an invention of "A new or improved process for oxidising anthracene, and improve-

ments in the colouring matter produced therefrom."—Dated 8th May, 1875.—*Specification published, price 4d. For abridgement see p. 93.*

2421.—JUSTUS WOLFF, of Wyke, near Bradford, consulting and engineering chemist, and RALPH BETLEY, of Wigan, analytical and consulting chemist, for an invention of "Improvements in the production of aniline dyes."—Dated 5th July, 1875.

2422. JUSTUS WOLFF, of Wyke, near Bradford, consulting and engineering chemist, and WILLIAM ASCROFT BYROM, of Wigan, solicitor, for an invention of "Improvements in obtaining aniline, and in the employment of the same or of compounds thereof."—Dated 5th July, 1875.

2448. JUSTUS WOLFF, of Wyke, near Bradford, consulting and engineering chemist, and RALPH BETLEY, of Wigan, analytical and consulting chemist, for an invention of "Improvements in the production of dyes from naptha-line and its derivatives."—Dated 7th July, 1875.

Felted Fabrics, Floor Cloths, Paper, &c.

16. BENJAMIN RHODES and THOMAS BROWN RHODES, both of Armley, near Leeds, in the County of York, for an invention of " Improvements in machinery for flocking woollen or other woven or felted fabrics."—Dated 1st January, 1875.—*Specification published, price 6d. For abridgement see p. 52.*

35. MICHAEL BARKER NAIRN, of Kirkaldy, Scotland, for an invention of " Improvements in machinery for preparing floor cloths for printing."—Dated 4th January, 1875.—*Specification published, price 2s. 4d. For abridgement see p. 51.*

361. LOUIS FERDINAND TAVERNIER and JOHN PYPER MATHESON, of the Perseverance Mills, Dewsbury Road, Leeds, in the county of York, patent coactile cloth manufacturers, for an invention of " Improvements in the manufacture of felted fabrics, and in the production of mixed colours in felted fabrics by cheap and simple

processes."—Dated 30th January, 1875.—*Specification published, price 4d. For abridgement see p. 51.*

1573. EDWIN SALT, of Darwen, in the county of Lancaster, engineer, for an invention of "Improvements in machinery or apparatus to be used for the manufacture, colouring, veneering, and enamelling of paper and paper cloth and such like materials."—Dated 29th April, 1875.

Yarns, Warps, Threads, Wool Washing.

2658. THOMAS DICKINS, ALBERT LANGLEY DICKINS, and HARVEY HEYWOOD, all of Middleton, in the county of Lancaster, dyers and printers, for an invention of "Improvements in machinery or apparatus used in dyeing yarns or threads of silk."—Dated 30th July, 1874.—*Specification published, price 10d.*

3364. GEORGE ROURKE BRYANT, of the firm of T. P. Pocock and Co., of Waterford Mills, Chippenham, Wilts, woollen manufacturers, for an invention of "Improved machinery for washing wool."—Dated 1st October, 1874.—*Specification published, price 1s. 4d.*

3603. JOHN CRAWFORD MUNN, of the firm of Munn and Hughes, of the city of Glasgow, in the county of Lanark, North Britain, for an invention of "Improvements in dyeing yarns for warps."—Dated 20th October, 1874.—*Specification published, price 4d.*

4095. JOHN CLOUGH, of the Manchester Road, Bradford, in the county of York, for an invention of "Improvements in apparatus employed in the washing and cleansing of wool and other fibres."—Dated 30th November, 1874.—*Specification published, price 8d.*

4179. CHARLES HOYLE, WILLIAM SHACKLETON, and WILLIAM PRESTON, of the firm of Messrs. Shackleton, Hoyle, and Company, of Keighley, in the county of York. machinists, for an invention of "Improvements in machinery for washing wool and other fibrous substances." Dated 4th December, 1874.—*Specification published, price 8d.*

1432. SAMUEL GIBSON RHODES, MICHAEL SHILLITO, and

JOHN IRELAND SPEED, of the firm of Shillito, Rhodes, and Co., yarn finishers, Leeds, in the county of York, for an invention of "Improvements in finishing yarn and threads, and in apparatus connected therewith.—Dated 20th April, 1875.—*Specification published, price 8d. For abridgement see p. 95.*

1868. JACOB BEHRENS, of Bradford, in the county of York, and of Manchester, in the county of Lancaster, merchant, for an invention of "Improvements in the treatment of wool either in the raw or in a manufactured condition."—A communication to him from abroad by Henrich Caro, of Mannheim, in the empire of Germany, Chemist.—Dated 21st May, 1875.

2215. SIDNEY EMSLEY, agent, of Bradford, and SAMUEL SMITH, machine maker, of Low Bridge Works, Keighley, both in the county of York, for an invention of "Improvements in drying and stretching fibrous materials in hanks, and in apparatus connected therewith.—Dated 16th June, 1875.

2866. MAXIMILIAN BAERLEIN, of Manchester, in the county of Lancaster, for an invention of "Improvements in the method of mordanting, dyeing, and sizing yarns."—Dated 14th August, 1875.

3166. DAVID PORTEOUS, of Whaley Bridge, in the county of Chester, manufacturer, and JOHN ORMEROD, of the same place, overlooker, for an invention of "Improvements in apparatus for sizing yarns or warps.—Dated 9th September, 1875.—*Specification published, price 10d.*

Gum Making.

3639. PAUL LOUIS MANBRE, of Valenciennes, in the republic of France, but temporarily of Penge, in the county of Surrey, brewer, for an invention of "Improvements in the process and apparatus for the conversion of starch and fecula into gum, compounds of gum and glucose, glucose, caramelized glucose, and other analogous products."—Dated 22nd October, 1874.

Finishing, Beetling, Stretching, Measuring, etc.

2415. WILLIAM MELLOR, mechanic, EUSTACE WIGZELL and JOSEPH POLLIT, engineers, all of Sowerby Bridge, in the county of York, for an invention of "Improvements in machinery for rigging, pressing, and cuttling fabrics."—Dated 9th July, 1874.—*Specification published, price 1s. 4d.*

2492. JOHN HENRY GARTSIDE and CHARLES TIMOTHY BRADBURY, of Buckton Vale, in the county of Chester, for an invention of "Improvements in machinery or apparatus for finishing woven fabrics."—Dated 16th July, 1874.—*Specification published, price 4d.*

2736. GEDEON GRIOT and LOUIS POLITO, merchants, of Boulevart Voltaire, Paris, France, for an invention of "Improvements in rendering textile substances water and damp proof."—Dated 7th August, 1874.—*Specification published, price 4d.*

2748. JOHN SMITH, of Collyhurst, in the city of Manchester, bleacher, dyer, and finisher, for an invention of "Improvements in beetling machines."—Dated 8th August, 1874.—*Specification published, price 10d.*

3752. LOUIS EDWIN BROADBENT, of Dewsbury, in the county of York, for an invention of "Improvements in machinery employed in weaving and finishing woollen, cotton, or other fabrics."—Dated 30th October, 1874.—*Specification published, price 2s.*

4131. GEORGE LOWRY, of Salford, in the county of Lancaster, machinist, for an invention of "Improvements in machinery for beetling fabrics or fibrous substances, for driving piles, and for stamping, boring, crushing, and hammering animal, vegetable, and mineral substances."—Dated 2nd December, 1874.—*Specification published, price 1s. 4d.*

158. JOHN HENRY GARTSIDE and CHARLES TIMOTHY BRADBURY, of Buckton Vale, in the county of Chester, for an invention of "Improvements in machinery or apparatus for finishing woven fabrics."—Dated 15th

January, 1875.—*Specification published, price 10d. For abridgement see p. 51.*

370. WILLIAM STARK, manager of bleach works to Messieurs John and Walter Crum and Company, of Thornliebank, in the county of Renfrew, North Britain, for an invention of "Improvements in apparatus for breadthening and drying woven or other web fabrics."—Dated 1st February, 1875.—*Specification published, price 1s. 4d. For abridgement see p. 55.*

572. PETER LAYCOCK, of Leeds, in the county of York, for an invention of "Improvements in the means and machinery employed for stiffening and staining woollen or other woven or felted fabrics."—Dated 17th February, 1875.—*Specification published, price 4d. For abridgement see p. 52.*

1019. JOHN MITCHELL and THOMAS MITCHELL, both of Rochdale, in the county of Lancaster, for an invention of "An improved machine for stretching calico or other woven fabrics."—Dated 19th March, 1875.—*Specification published, price 10d. For abridgement see p. 54.*

1457. ALFRED VINCENT NEWTON, of the Office for Patents, 66, Chancery Lane, in the county of Middlesex, mechanical draughtsman, for an invention of "Improvements in apparatus for tentering, straightening, drying, and finishing cloth and other fabrics."—A communication to him from abroad by Isaac Emerson Palmer, of Middletown, in the state of Connecticut, United States of America.—Dated 21st April, 1875.—*Specification published, price 1s. 8d. For abridgement see p. 96.*

1833. WILLIAM MATHER POLLOCK, of the Lounsdale Bleach Works, in the county of Renfrew, North Britain, for an invention of "Improvements in machinery for stentering or finishing woven fabrics."—Dated 18th May, 1875.

2661. WILLIAM ROBERT LAKE, of the firm of Haseltine, Lake, and Co., patent agents, Southampton Buildings, London, for an invention of "An improved method of measuring and indicating the quantity in a roll or package of cloth or other like material."—A communication

to him from abroad by Samuel Chancey Talcott, of Ashtalnla, Ohio, United States of America, gentleman.—Dated 27th July, 1875.

3. Abstracts from complete Specifications of Patents.

VERMILION.—Melville Clark's patent (communicated by Grawitz, of Paris), No. 1604, for the manufacture of red sulphide of mercury, claims the process of dissolving without the aid of heat, and whilst protected from the action of light, either binoxide of mercury, or the salts of binoxide of mercury in an aqueous solution of a soluble hyposulphite. When binoxide of mercury is employed, it is preferable to add to the liquor a small quantity of chloride of ammonium, or of a weak acid, to prevent the liquor becoming too alkaline. When the solution is complete, the temperature is gradually raised, whereupon sulphide of mercury (the red modification) is deposited, the tints of which vary from orange-red to crimson-red-violet. The precipitate after being washed is then brightened by washing with soda and nitric acid. It is stated that the colour obtained in the above manner resists the action of light, heat, or acids.

OXIDIZING ANTHRACENE.—Heinzerling's and Mc Gowan's patent, No. 1712, is for a new process of oxidizing anthracene for the purpose of converting it into alizarine. The anthracene is first purified by treatment with carbon disulphide, and then with bleaching powder and hydrochloric acid. The patentees describe two ways of subjecting the anthracene to treatment, the wet way and the dry way; in the wet way a compound is obtained which may either be at once treated with fuming sulphuric acid, or by the other well-known processes for the production of alizarine. In treating the anthracene in the dry way it is mixed with excess of bleaching powder and very little water, with or without the addition of

hydrochloric, or an equivalent acid. The mixture is heated gently for some time, and then raised to a higher temperature when anthraquinone sublimes. Alizarine may then be produced from the before mentioned products by any of the known methods. The alizarine so produced is treated either in solution or in the solid state with cyanide or sulpho-cyanide of potassium, which improves the colour.

ANILINE BLACK.—Melville Clark's patent for improvements in aniline black, No. 1620, communicated by Grawitz, of Paris, "relates to the production of aniline black by the concurrent reaction on aniline or its salts of certain metallic salts, and of certain chromates or bichromates, the oxidizing action of the latter being produced in a distinct operation which may either follow or precede the action of the metallic salts." The metallic salts are those, like iron, susceptible of two degrees of oxidation. The processes described in this patent seem irreconcilable with what knowledge we have of aniline black, and we shall simply give in the words of the specification the method of producing the black on textile fibres.

"I may employ either of the three following methods :—

(1.) I print with the aid of a suitable thickening, such as starch or gum tragacanth, a mixture consisting of, 1st, a salt of aniline ; 2nd, a salt of either of the metals before mentioned (iron, copper, manganese, cerium, aluminium, chromium, nickel, etc.) ; and, 3rd, a soluble bichromate or chromate. The colour is then devoloped in the drying room.

(2.) I print with a mixture of an organic salt of aniline, and a metallic chromate, which is readily decomposable, and I then steam.

(3.) I print with a mixture of salt of aniline and a salt of one of the metals before mentioned, and afterwards pass it through a weak neutral, or preferably, acid solution of a soluble chromate or bichromate.

The proportion of aniline mixture may vary from 5 to 10 per cent.

The best relative proportions of the aniline, the metallic salt, and the chromate or bichromate, are those of their chemical equivalents."

COLOURING PILE FABRICS.—Worrall's patent, No. 1294, is for a new method of obtaining a bloom on pile fabrics, and is particularly applicable to cotton velvets, velveteens, and cords, and consists essentially in the use of a machine for brushing up the pile which has been more or less crushed or laid by the padding or dyeing process. The machine was patented 3rd December, 1873, No. 3969, by Worrall, and is mainly an arrangement of cylindrical brushes and a series of chains of brushes working at right angles to the cylindrical brushes, and placed above a table bearing the fabric under treatment. Reference is also made to a dressing machine patented by Worrall and Lawrence, 8th June, 1861, No. 1458, which may be employed for the same end. These brushes are also employed to communicate colour to the pile while the body of the cloth may have been previously dyed another colour, for example, to produce a rich black velvet the fabric is dyed black in the ordinary manner and then a blue colour is applied to the pile; or the pile may be first dyed by means of the brushes in some dark colour, and the fabric subsequently dyed of a light shade, as blue, gold, green, etc. A pattern can be obtained upon this double-dyed fabric by cutting away parts of the black or other dark coloured surface pile by the shearing machine. The brushes are not necessarily made of bristles or similar fibres, but may be pads of velvet or flannel. Further details can only be understood with the aid of drawings of the machinery.

FINISHING YARNS AND THREADS.—This patent, No. 1432, to Rhodes and others, is for setting and giving lustre to yarn and threads in hanks and on bobbins, doing away with the present plan of washing and drying after gassing. It consists in nothing else than submitting the materials to the action of high-pressure steam for from five to fifteen minutes in a jacketed cylinder; the yarns, threads, or braid may be either dry or wetted, or the interior cylinder may contain water to moisten them; though steam at 60 lbs. is used, it is stated that the pressure on the inside of the cylinder is only 2 lbs. per square inch, but will incresase with the pressure of the steam employed, and in another place it is said that the the tem-

perature in the inside of the cylinder is about 250° F., but that pressure may be employed to produce a higher superheated temperature.

FINISHING CLOTH.—Palmer's patent, No. 1457, communicated to Newton, relates to a machine for the stentering and straightening of cloth and other fabrics, and cannot be explained apart from the drawings. The claims are fifteen in number.

SINGEING WOVEN FABRICS OR YARNS.—Briggs and Stead's patent, No. 1537, is for singeing, at one operation, fabrics or yarns composed of mixtures of animal and vegetable fibres, and it consists of combining in one apparatus gas singeing and plate singeing, that is to say, the fabrics or yarns pass first over flames of gas, which is said to burn off the animal fibres, and then over the copper plate, which burns off the vegetable fibres. There is no drawing, and the claim is "for the combination of gas jets and hot plates in one apparatus, arranged in such manner that the fabrics or yarns may be passed over both in continuation or succession."

METALLIC PRINTING.—Bennet's patent, No. 1426, is for an improved method of obtaining effects in those styles known as bronze brocade or gold patterns, which are at present produced by printing with block a varnish or some adhesive matter on the fabric, and then by means of another block dipped in the metallic powder, transferring a sufficient quantity of it to the adhesive matter. The improved method is by printing the adhesive matter with copper or surface roller, and then passing the cloth through a box containing the required metallic powder, which is caused to adhere to the adhesive matter by means of running the cloth under a roller which works in the metallic powder.

IMPROVEMENTS IN PRINTING FABRICS.—Bennet's patent for this purpose, No. 1428, refers to what are known as Swiss or blue chintzes. The title is somewhat misleading, it might perhaps be better described as a patent for a new style of print than an improvement in printing, and the specification is by no means clear or easy to understand. The blue chinzes are in this style to have a black ground, which is

obtained by printing with red and resist paste where yellow is to fall. The piece is then dyed light blue in the indigo vat, and afterwards the red and block yellow are dyed. This plan is said to save two blockings.

Another plan is to put on the black and resist paste by roller, dye light blue in the vat, dye red and block yellow.

A third plan is to put on the black ground and red by roller, block the resist paste, dye light blue in the vat, dye red and block yellow. The two latter methods save one blocking.

CONTINUOUS STEAMING APPARATUS.—Smith's patent, No. 1303, is for steaming in a continuous and uninterrupted manner. The steaming chamber is constructed of a rectangular form, and may be of brick or stone, with an arched brick ceiling carried on transverse girders, or constructed in some other way. The goods to be steamed are fed into the steaming chamber, and hang in long vertical loops or loose folds, on transverse horizontal rods, the ends of these rods rest on two parallel endless chains placed horizontally, and the links of which are formed with cavities or seats for the rods, and for keeping them at a regular distance apart. The endless chains are at one end passed round a pair of polygonal pulleys on a transverse horizontal shaft, which is driven at a suitable speed; and at the other end it passes round pullies on a shaft, the bearings of which are adjustable by screws, by means of which the chains can always be properly distended.

When the goods have been carried forward from the entering end to the exit end, the cloth is drawn up from the loop, the bar is released from the endless chain, and returned outside the machine to the entering end. The time occupied in the travelling from the entering to the withdrawing end can be varied according to the styles under treatment. The important details of the entering and withdrawing of the cloth cannot be described in an intelligible manner without the aid of drawings. The claims made are:—

1. The combining of a system of rods carrying vertical loops or folds of printed or other fabric, and moved progressively along a chamber with appliances for entering and

withdrawing the fabric; for steaming it; and for preventing injury by condensation.

2. The arrangement and combining together of mechanism for entering printed or other fabric into a steaming chamber, and for withdrawing the fabric from such a chamber when combined with progressively moving rods or equivalent mechanism in the chamber.

FIXING COLOURS BY STEAM AND HOT AIR.—Thierry-Mieg's patent, No. 1587, communicated to Melville Clark, is for a method of steaming which apparently involves some new principles. "The object of the improved method of this invention is to unite the advantages" of hot ageing and ordinary steaming, "and consists in combining the two processes by employing hot air and steam, either simultaneously or alternately. The treatment with steam is thus wholly or partially replaced by that with hot air, the operation being carried on in a chamber either entirely closed or ventilated. To this end hot air or steam is supplied to the chamber or vat by separate pipes, forming in the vat a mixture of heated air and steam, the temperature and proportions of which can be regulated as desired. The fixation of the colours may thus be readily controlled, means being provided for regulating the supply both of the steam and of the air, and also for regulating the ventilation of the vat. The operation may also be effected in a closed chamber, with or without the aid of steam."

"By the process of this invention, using a temperature of about 212° F., the colours may be fixed as perfectly as by the method now employed, and at much less cost, as 1 lb. of air at 212° absorbs twenty-five times less heat than the same weight of steam. The operation may also be performed at a still higher temperature without necessarily working under pressure, whereby novel effects may be obtained. The presence of the air, far from being injurious, assists in increasing the intensity of certain colours without impairing the others."

The economy of fuel is stated to be three-fourths or four-fifths of that now required. No particular apparatus for

heating the air is described, but there is a drawing of what may be described as a deep circular vat with a double bottom ; the goods lie upon the false bottom which is perforated, and the steam and air are introduced underneath : a steam coil between the true and false bottom gives the means of heating the air or steam as required.

HARLEY'S PATENT FOR COMBINING ANILINE COLOURS WITH MADDER COLOURS.—There are two American patents in the name of James Harley, Nos. 168,991 and 170,626, titles of which are given in this and the preceding number of the Textile Colourist. We have received specimens of prints purporting to be done by these or one of these patents from two independent sources. They are a five-colour pattern with black, orange, red, purple, and green, of the cashmere style, well covered ; the general effect is very good, full, and rich. The colours are all exceedingly loose, and greatly injured by a slight soaping. The specimens examined have not come from Mr. Harley direct, and may therefore not truly represent what can be done by his process.

IMPROVEMENTS IN DYEING.—This communication to Hughes from Hanover, No. 1764, is for the use of "mecaptane" in dyeing. There is not the slightest intimation of what "mecaptane" is, and the language of the provisional specification is obscure. The following words occur, "cautchuck," probably for catechu ; "common salts," "sesqui - ferrocyanate of potash," "arseniate of natron," "nigrosin," "alcalious salt," and other unusual or unique combinations. The invention received provisional protection only.

FINISHING THREADS.—Forster's patent, No. 1930, is for treating the thread with paraffin, stearine, spermaceti, wax, tar, or bitumen, dissolved in any of the unoxidizable solvents of such matters, by preference, coal oil, bisulphide of carbon, or ammonia. The object being to make the threads more easily workable, either in sewing machines or with hand sewing. Coal oil is the solvent preferred by the patentee.

SATURATING YARNS.—Reed's patent, No. 1811, was not completed. The idea is to convey the yarns into and out

of the vessel by a pair of endless webs which are led round a series of guide rollers, the yarns being between the two webs.

TREATMENT OF WOOL.—Behren's patent, No. 1868, a communication from Heinrich Caro, is for treating wool in a raw or manufactured state so as to diminish, or altogether destroy, what is known as shrinking, curling, or felting. This is said to be accomplished by causing the wool to absorb chlorine, for example in the following way:—One hundred parts of wool preferably scoured and bleached are soaked in 4000 parts water, and about 50 parts by weight of concentrated muriatic acid, or spirits of salts; after a thorough impregnation of the acid has taken place, a clear solution of bleaching powder, containing from 10 to 20 parts by weight of dry powder, is slowly run in the cistern containing the wool in such a manner that the chlorine is absorbed as fast as liberated, and there must be no smell of chlorine. The wool absorbs the chlorine without being injured in strength or colour, with the diminution or destruction of the curling, shrinking, or felting properties. Any perceptible excess of chlorine injures the wool, and must be carefully avoided. Ten parts of bleaching powder to 100 parts of wool are employed when the object is simply to diminish the shrinking properties; 20 parts when it is desired almost completely to deprive it of these properties; but even 30 or 40 parts can be advantageously employed in exceptional cases.

NEW METHOD OF MAKING GARANCINE.—We are indebted to the *Moniteur de la Teinture* for the following account of a French patent to M. Avon for garancine making. He takes the madder root and submits it to contact with vapour of hydrochloric acid, or to vapours of nitric acid, or to a mixture of these vapours. The operation is conducted in a close vessel at a temperature of about 176° F., and continues for four hours; pressure is needless, and the vessel is closed simply to prevent loss of the acid vapours. The duration of the operation, the temperature employed, and the degree of concentration of the acid vapours are modified according to the strength of product which it is desired to obtain.

When the roots have cooled down, they are put upon a

filter and submitted to a first washing; they are then ground to a paste, and the ground mass subjected to a fresh washing to remove all the acid. The pasty mass is pressed, dried, ground to powder, packed and delivered to the trade. The patentee does not confine himself to acting upon madder roots only, but operates in the same way upon other madder products.

USE OF BARYTA IN SILK BLEACHING AND DYEING.—Tessié du Motay's French patent, 17th August, 1874, No. 104,650, is for the use of caustic baryta as a substitute for soap in boiling off raw silk; and it appears to be proposed as a substitute for lime or alkalies in precipitating or fixing metallic oxides upon the same material.*

NEW INDIGO VAT WITH SOLUBLE STANNITES.—The following is the subject of a French patent granted to Descat Brothers and Selosse, and is abstracted from the *Moniteur de la Teinture*, p. 289. This process consists in applying the reducing properties of the protoxide of tin or stannous oxide when dissolved in an alkali or an alkaline earth to indigo dyeing. It is stated that the very marked reducing powers of the stannous oxide have been long known and used in printing, but have not been successfully employed in blue dyeing on account of the excessively caustic nature of the solution. The patentees have discovered that common salt, nitrate of potash, nitrate of soda, and generally other neutral salts which do not precipitate alkaline solution of tin, diminish in a sensible manner the causticity of the solution, and its destructive character, without depriving it of its alkalinity and appearing even to facilitate the solution of the stannous oxide. For the solution of tin, to which a sufficient quantity of one of these salts has been added, is not precipitated by addition of even a large quantity of water, and, moreover, the dark coloured anhydrous oxide of tin is much less liable to be precipitated by a prolonged ebullition. The solution of oxide of tin in alkali, and one of these salts is best made at a high temperature.

* Bull. de la Soc. Chem. de Paris, xxv., p. 481.

4. Japan Wax in Size.—Note upon the Inconveniences arising from the use of Japan Wax in Sizing Cloth intended for Printing.

BY M. CH. BENNER.

DURING the time of the scarcity of American cotton the weavers made trial of a multitude of substances to give body and strength to their warps, and frequently without giving thought to the difficulties which they would cause in bleaching. Some weavers found that a small quantity of Japan wax added to the size answered their purposes, the warp threads were not so liable to break in weaving, and the cloth felt well in the hand.

At this time a batch of cloth which I bleached gave stains which occurred three or four times in the length of a piece, they were perfectly invisible in the white, but took colour in the dye like a mixture of iron and alumina mordant. I cut out some of the stains, and having tested them with acidulated prussiate of potash, I was certain they were not due to a mordant, but to a fatty body. The shape of these stains resembled that of a drop of squozen colour, oblong, pear shaped, without shading off, the edges sharp and of a dimension of about 2 inches long, and 1¾ inches in width.

By floating the white pieces upon water I was able to discover the stains which dyed up in madder, by the differences of shade in the wet piece, and they were precisely of the same shape as those which were in the finished goods. My attention was aroused by finding that it was only the cloth from one weaving mill which shewed these stains, though in the one batch bleached there had been three different kinds of cloth. From this it was easy to conclude that some peculiar fatty matter, hitherto unmet with on grey calico, had been employed by the weaver, and that it was of a nature to resist my system of bleaching.

I separated all the pieces which took the water irregularly, and had them steeped in muriatic acid at 3° Tw. all night, washed and boiled in rosin soap, thinking that by this double operation I should have decomposed and dissolved out the fatty matter which had dyed in the madder.

Unfortunately it was not so, the pieces still dyed up with stains in madder, not quite so strongly as before, but they were quite visible.

I then examined the grey pieces of this lot for the parts stained with this fatty matter which could resist the madder bleach; by floating the pieces twice on water, and cutting out those parts which did not take the water, treating them with boiling alcohol, sulphuric ether, and benzine, I obtained a body of a waxy appearance.

To be certain of the conclusion that the stains were due to this wax, I applied to the end of a grey piece specimens of all the fatty matters which the trade of the place could supply for the use of weavers or printers. I learned then, for the first time, of the existence and use of Japan wax in sizing.

All the fatty matters which I applied to the cloth were saponified and completely disappeared in bleaching, except Japan wax, and the white and yellow bees' wax; for upon dyeing up the trial these three gave exactly the same kind of stains as those which caused the investigation to be made.

The manner in which these stains arose was as follows:— The box through which the warps passed to be sized was fed with hot size which gradually cooled; by cooling a portion of the wax separated from the size under the form of clots; these clots by the ascending movement of the warp through the size agglomerated into little balls, which, attaching themselves to the warp, and passing between the rollers, were compressed, and produced the elongated shape which I knew so well.

Visiting a short time ago a sizing establishment where the newest machinery was working splendidly, my attention was drawn to a stock of Japan wax which I perceived in the store room of the works. The sight of this material renewed in me the memory of all the troubles I had experienced from this

substance, and I impressed upon the manager of the place the necessity of replacing this wax by any other fatty or greasy matter which could possibly fulfil the intention of its use, and by no means to employ Japan wax for printers' cloth, because this body is not saponifiable by our method of bleaching, and even when it does not get separated from the size by cooling, it gives rise to defective bleaching, and that it was simply too bad to increase the difficulties the printer had with sizing by incorporating wax in it.

Bulletin of the Industrial Society of Rouen.

5. *Upon the Production of Aniline Black by Electrolysis.*

BY M. J. J. COQUILLION.

WHEN a concentrated solution of sulphate of aniline is submitted to the action of a couple of Bunsen's elements employing platinum electrodes, the positive electrode becomes coated with a purplish-blue pellicle, greenish in some parts. This had been previously observed by Letheby. If the experiment be prolonged for twelve or twenty-four hours, the positive pole becomes covered with a tolerably adherent black mass easily detatched from the wire. This substance after treatment with ether and alcohol is a black, amorphous substance, with a greenish reflection, and is insoluble in most fluids. With sulphuric acid on porcelain it acquires a greenish colour; alkalies restore its velvety black appearance. Nascent hydrogen has no action upon it, and if electrodes of gas carbon be employed the same substance is obtained.

Nitrate of aniline furnishes an analogous, but not precisely similar body, since it is turned of a maroon-brown by sulphuric acid. The hydrochlorate gives a granular body, and with this salt it is probable the oxidising action is complicated by the influence of chlorine.

The acetate yields a soft black substance, partly soluble in excess of the salt; the tartrate gives no colour.

From these experiments it may be concluded—(1) that it is possible to obtain aniline black without intervention of any metal, and (2) that various aniline salts are differently affected by nascent oxygen.*

In the *Comptes Rendus* of the 20th December, 1875, there is an extract from a communication of M. A. Rosenstiehl upon the above paper, which is as follows:—In the present state of science aniline black can only be obtained upon tissues in a practicable and regular manner by the action of a chlorate and a metallic substance; copper has been adopted for those blacks which become developed at a temperature of about 350°,† and iron for those which have to be steamed at a temperature of 212° F. If we were not bound by certain economical or technical conditions, aniline black could be obtained upon cloth without either chlorates or metallic salts, simply by means of active oxygen. It has also been long known that, apart from cloth, aniline black can be obtained without the intervention of any metal by means of chlorates. M. Coquillion's experiments shew further that the black can be obtained free without chlorates and without metals, and is an elegant demonstration of the action of active oxygen upon aniline salts; it is probable that by this method the black matters derived from aniline may be obtained in a state of purity which will enable us to ascertain their elementary composition; the great interest attached to this question has caused the Industrial Society of Mulhouse to include it in their list of prizes.

* Comptes Rendus, lxxxi., p. 408; p. 1,257.

† It is printed 350 degrees in the original, which is of course an error, it is probably 35 degrees centigrade which is meant, equal to 95° F.

6. *Improvements in Steaming.*

ONE of the great wants in calico printing for some time past has been a continuous steaming arrangement; the inconveniences of the common steaming chamber are so keenly felt that several inventors have lately turned their attention to this point. In the present number a brief account of Smith's apparatus is given, and also Thierry-Mieg's patent; two or three other patents bearing upon the same subject are upon the point of being completed. In our last number there was a paragraph upon Cordillot and Mather's patent; since that was written we have, through the kindness of Messrs. Ledeboer, Bros., and Co., of the Hodge Print Works, had the opportunity of seeing the arrangement at work. The patentees have, at our request, furnished us with a drawing of the apparatus, and we have much pleasure in laying before our readers a lithograph from the drawing, with the result of our inspection of the machine at work.

The method of working can be pretty well deduced from the drawing and references. The goods to be steamed are brought direct from the printing or ageing, and placed in lots in front of the apparatus, the first lot being connected with the second, and so on by a piece of "grey;" or simply by a stitch which can be readily drawn out. The steaming chamber is heated to the required temperature, and the steam turned in at a pressure of ⅓ lb. All the parts liable to induce condensation are heated to a higher temperature than the vapour in the chamber, and no drops can be formed along the path of the cloth.

When the required temperature has been obtained the attendant will observe through the window that the atmosphere in the chamber is clear, and he may at once proceed to enter the cloth.

Passing through the opening in the end of the chamber (whence also escape the steam and disengaged gases or

vapours), the piece is drawn over the copper cylinder heated by steam, and after running the length of the chamber a few times, it is deposited into the waggon, and there piles up and falls right and left until one lot has been run in. The attendant looks out for the "grey" connecting the lots together, and after a few folds have fallen into the waggon he stops the machine. The doors back and front are instantly opened (no fastenings being needed) and the full waggon at once glides quickly out, being followed by the one next to take its place, while an empty waggon is pushed in at the other end. The attendant in the meantime has drawn the stitching out of the "grey," which joins the lots in the waggons, and so liberated the contents of the waggon which was ejected from the chamber from the next waggon behind it. This operation of stopping the machine and taking out and putting in waggons occupies not more than one minute. The machine is again started, and the pieces deposited into the empty waggons as before. The waggons are rendered quite hot, being of metal, so that no condensation takes place, and they are lined with coarse "Hessian cloth." The waggon on emerging from the chamber is run to any convenient place in front of a plaiter and stripped quickly, whence it is sent back to the entering end of the chamber ready to take the place of the one before it when another full waggon is taken out.

We watched the arrangement working for more than two hours, and were somewhat astonished as well as pleased to see that prints could be steamed in as continuous a manner as they could be washed or dunged; and the obliging managing partner, Mr. Gibson, was quite satisfied with the efficiency of the steaming. The goods we saw passing through consisted of pigments, alizarines, and aniline blacks. There were no very heavy patterns, and the time allowed was somewhat under an hour. The pieces deposited in the waggons were thoroughly heated to the very centre, and there seems to be no doubt that as far as the temperature of the chamber goes the cloth is well steamed. We had anticipated difficulties from marking off by the cloth lying soft in folds; this had not been felt to any considerable extent in practice, and it was hoped

that by causing the piece to traverse the chamber once or twice more before being deposited in the waggons this defect would be cured.

We are inclined to think that for a certain number of styles which are very much in demand at present, Messrs. Cordillot and Mather have solved the problem of continuous steaming. It is very evident that there are many styles which could not be steamed by this arrangement without imminent risk or certainty of unevenness and marking off. The temperature can never rise above 212°, and generally must be some degrees lower than that temperature.

It will be seen that there is an arrangement for passing pieces right throught the steam chamber without going into the waggons. This arrangement is used to develope aniline blacks, which require no more than one and a half minutes in the steam.

7. *COLLECTED RECEIPTS.*

BLACK COLOURS FOR PRINTING (CONTINUED).

No. 72. Black for Block; Madder.—*Spirk.*

6½ gallons iron liquor at 14°—2½ gallons red liquor at 11° —½ pint logwood liquor at 20°—8½ lbs. starch—boil and add ½ pint gallipoli oil.

No. 73. Gum Black for Madder; Block.—*Spirk.*

2 gallons water—5 gallons iron liquor at 20°—1 quart acetic acid at 11°—1 quart logwood liquor at 30°—20 lbs. gum senegal.*

* The "Praktisches Handbuch" of the late Dr. Anthony Spirk contains many very good receipts, but typographical errors in the weights and measures are numerous. We have corrected them where they were apparent, but some may have escaped our observation.

No. 74. Black for Madder; Block.—*Spirk.*

3½ gallons iron liquor at 18°—4 gallons water—1 quart logwood liquor at 20°—4½ lbs. starch—4½ lbs. flour—3 pints oil.

No. 75. Black for Madder; Block.—*Spirk.*

5¾ gallons iron liquor at 13°—1 gallon water—½ gallon logwood liquor at 30°—8 lbs. starch—8 lbs. gum substitute.

No. 76. Black for Steam or Alizarine.—*Spirk.*

3 lbs. starch—3 lbs. light gum substitute—2 gallons logwood liquor at 30°—½ gallon gall liquor at 30°—1¾ gallons iron liquor at 20°—1 gallon acetic acid at 9°—½ lb. yellow prussiate—2 oz. chlorate of potash. Well boiled together, and before using, 4 lbs. nitrate of iron at 62°.

No. 77. Steam or Garancine Black.—*Spirk.*

2¼ gallons logwood liquor at 30°—2½ gallons acetic acid—8 lbs. starch—3½ gallons iron liquor at 14°—2 quarts oil.

No. 78. Washing off Black.—*Spirk.*

½ gallon logwood liquor at 30°—7 gallons water—15 lbs. starch—3 pints iron liquor at 14°—1 pint red liquor at 22°—1 lb. lard.

No. 79. Steam Black.—*Spirk.*

6 gallons oxidised logwood liquor at 8°—8½ lbs. starch—12 lbs. light British gum—8½ lbs. red prussiate—3 lbs. prussiate of tin—5 lbs. Tartaric acid—4 oz. nitrate of iron at 100°.

No. 80. Gum Black; Steam; Calico.—*Spirk.*

4½ gallons logwood liquor at 30°—1 gallon red liquor at 14°—1 gallon acetic acid at 11°—1 gallon iron liquor at 20°—1 quart oil—thicken with 25 lbs. gum senegal.

No. 81. Starch Steam Black.—*Spirk.*

4¼ gallons logwood liquor at 11°—1 gallon red liquor at 14°—1 gallon acetic acid at 11°—1 gallon iron liquor at 20°—1 quart oil—9 lbs. starch.

No. 82. Steam Black.—*Spirk.*

1½ lbs. starch—3 lbs. acetic acid at 11°—1 quart logwood liquor at 30°—½ pint fustic liquor at 30°—boil and add gradually a mixture of 4 oz. bichromate of potash—1 pint acetic acid at 11°—½ pint of muriatic acid; stir well and add 1 lb. light British gum.

No. 83. Steam Black for Chroming.—*Spirk.*

2¼ gallons logwood liquor at 30°—2½ gallons acetic acid at 11°—10 lbs. starch—3 lbs. calcined farina—1¼ gallons water—1¼ gallons red liquor at 16°—1¼ gallons iron liquor at 21°—¾ lb. lard—¾ lb. turpentine.

No. 84. Steam Black for Soaping.—*Spirk.*

3½ gallons logwood liquor at 14°—1 gallon water—½ gallon acetic acid at 11°—26 lbs. light British gum—boil and add 3½ gallons acetate of chromium at 25° and 2½ lbs. chlorate of potash dissolved in 1 quart of water.

No. 85. Acetate of Chromium for No. 92.—*Spirk.*

3 lbs. bichromate of potash—4 lbs. sulphuric acid at 170°—5 gallons water; dissolve and add in small portions 1 lb. of starch; when the reaction is over and the liquor cool add 11 lbs. of acetate of lead, and mix; use the clear.

No. 86. Steam Black for Delaine.—*Spirk.*

4 lbs. starch—20 lbs. soluble gum substitute—4½ lbs. extract of indigo—3½ gallons logwood liquor at 30°—3¾ gallons iron liquor at 21°—boil well.

No. 87. Steam Black for Delaine.—*Spirk.*

23 lbs. gum substitute—2½ gallons logwood liquor at 30°—2 gallons iron liquor at 21°—½ gallon acetic acid—4 lbs. carmine of indigo—1½ gallons bark liquor at 30°—boil and cool—7 lbs. nitrate of iron—1½ lbs. chlorate of potash.

No. 88. Steam Black for Wool.—*Spirk.*

3½ lbs. starch—4 gallons iron liquor, at 21°—1½ gallons

archil at 14°—3 pints bark liquor at 30°—3 pints extract of indigo—2 gallons logwood liquor at 30°—15 lbs. gum substitute.

No. 89. Steam Black for Dyed Grounds; Wool.—*Spirk.*

2 gallons logwood liquor at 30°—1½ gallons archil at 14°—1 pint bark liquor at 30°—3½ lbs. starch—2 quarts of acetate of lime at 22°—3 gallons iron liquor at 21°—4 lbs. extract of indigo—15 lbs. gum substitute—when somewhat cold, 2½ lbs. of oxalic acid—and when quite cold, 4 lbs. nitrate of iron at 74°.

No. 90. Topical Black.—*Parnell.*

1 gallon logwood liquor at 8°—4 oz. green copperas—1 pint per-nitrate of iron at 50°.

No. 91. Topical Black.—*Parnell.*

1 gallon logwood liquor at 8°—2 oz. copperas—1 pint per-nitrate of iron at 8°—1¼ lbs. starch.

No. 92. Steam Black.—*Parnell.*

1 pint red liquor at 18°—2 pints iron liquor at 24°—1 gallon logwood liquor at 8°—1¾ lbs. starch—1½ pints pyroligneous acid at 7°.

No. 93. Steam Black.—*Parnell.*

3½ pints peachwood liquor at 6°—7 pints logwood liquor at 6°—12 oz. starch—14 oz. British gum—3 oz. sulphate of copper—1 oz. green copperas—3 oz. of a neutral solution of per-nitrate of iron, made by mixing 1 lb. acetate of lead with 3 lbs. common acid nitrate of iron at 122°.

No. 94. Black for Madder.—*Higgin.*

4 gallons iron liquor at 24°—4 gallons pyroligneous acid—4 gallons water—24 lbs. flour—boil and add 1 pint oil.

No. 95. Black for Garancine.—*Higgin.*

7½ gallons water—3 gallons iron liquor at 24°—1½ gallons purple fixing liquor—24 lbs. flour—1 pint oil.

No. 96. Purple Fixing Liquor for No. 95.

2 gallons water—25 lbs. soda crystals—22½ lbs. arsenious acid—boil, and when dissolved add 50 gallons wood acid previously heated to 120° F., let stand a day or two till the tar of the acid is settled, and add 3 quarts muriatic acid.

No. 97. Black for Turkey Red.—*Higgin.*

7 gallons logwood liquor at 8°—1 gallon pyroligneous acid —10 lbs. starch—boil and add 2 lbs. 10 oz. copperas—boil again and cool—3½ pints nitrate of iron at 80°—1 gallon blue paste.

No. 98. Blue Paste for No. 97.

6 lbs. green copperas dissolved in 2 quarts water—4 lbs. prussiate dissolved in another 2 quarts water—mix and add 1 quart red liquor—1 quart nitric acid at 60°.

No. 99. Steam Black for Calico.—*Higgin.*

1 gallon logwood liquor at 12°—1 quart gall liquor at 9°— 1 quart mordant below—2 lbs. flour—6 oz. starch—boil ten minutes and add ½ pint nitrate of iron.

No. 100. Mordant for No. 99.

1 quart acetic acid—1½ quarts acetate of copper at 3°— 1½ quarts iron liquor at 24°—1 quart red liquor at 20°

No. 101. Black for Anilines and Pigments.—*Higgin.*

5 gallons logwood liquor at 12°—1 gallon bark liquor at 12°—1¼ gallons acetic acid at 8°—14 lbs. starch—3 lbs. delaine gum—boil and add 1¼ lbs. chlorate of potash dissolved in 5 quarts of hot water—cool and add 4 quarts of chromium mordant.

No. 102. Mordant for No. 101 Black.—*Higgin.*

6 gallons water—12 lbs. bichromate potash—16 lbs. sulphuric acid diluted with 3 quarts water—add by degrees 2 lbs. brown sugar, and when the effervescence has ceased add 19½ lbs.

nitrate of lead, 19½ lbs. acetate of lead dissolved in 1 gallon water—let settle, and use the clear.

No. 103. Spirit Black.—*Higgin.*

1 gallon logwood liquor at 8°—1 gallon water—10 oz. copperas—3 lbs. starch—boil and add ½ pint nitrate of iron at 8°.

No. 104. Aniline Black.—*Lightfoot's Original*, 1863.

1 gallon starch paste at 1 lb. starch per gallon—4 oz. chlorate of potash—8 oz. aniline—8 oz. muriatic acid—4 oz. chloride of copper at 88°—2 oz. salammoniac.

No. 105. Aniline Black.—*Cordillot's Patent*, 1863.

1700 parts starch paste—45 chlorate of potash—120 muriate of aniline—120 red prussiate of potash.

No. 106. Aniline Black.—*Lauth's Patent*, 1864.

1 gallon starch paste—16 oz. aniline salt—4 oz. sulphide of copper—4 oz. chlorate of potash.

No. 107. Aniline Black for small objects.—*Communicated. French.*

7½ lbs. starch—5 gallons water—boil and add 1¼ lb. chlorate of potash—1¼ lb. salammoniac—4 lbs. salammoniac —1½ lb. sulphide of copper.

No. 108. Aniline Black for Stripes or Blotch.

Communicated. Russian.

16 gallons water—17¼ lbs. salammoniac—17¼ lbs. chlorate of potash—36 lbs. aniline oil—64 lbs. starch—32 lbs. dark British gum—4 gallons water—2 gallons glycerine—boil and make up to 360 lbs. weight; equals 10 per cent. of aniline oil. Take 5 gallons of the above—6 lbs. sulphide of copper, and when required for use add 5½ lbs. muriatic acid at 30°—5½ lbs. water..

No. 109. Sulphide of Copper for No. 108.

20 lbs. caustic soda at 68°—3¾ lbs. flowers of sulphur—32 gallons of water in which previously dissolve 18½ lbs. sulphate of copper—drain to 40 lbs. paste.

No. 110. Aniline Black for Block.—*Spirk.*

2½ gallons hot starch paste—5 oz. acetate of copper—5 oz. chlorate of potash—2½ oz. salammoniac—when cold 12 oz. of muriate or nitrate of aniline.

No. 111. Aniline Black. Block or Roller.—*Spirk.*

1 gallon starch paste at 1½ lbs. per gallon—1 gallon tragacanth jelly at ¾ lb. per gallon—1 gallon light gum substitute water—12 oz. chlorate of potash—when quite cold add 18 oz. muriate of aniline—10 oz. sulphide of copper.

No. 112. Aniline Black with Tartaric Acid.—*Koechlin.*

20 lbs. starch—20 lbs. dark British gum—2¼ gallons aniline oil—2¼ gallons water—add 11 lbs. chlorate of potash and 11 lbs. salammoniac dissolved in 8 gallons water—boil, cool, and add 1 gallon sulphide of copper; before printing add to each gallon of the above 22 oz. of tartaric acid dissolved in 1 pint hot water.

No. 113. Black with Oxalate of Aniline.—*Spirk.*

1 gallon starch paste—1 gallon tragacanth jelly—1 gallon light British gum water—8 oz. chlorate of potash—1 lb. chloride of calcium—boil well and add when cool—1½ lbs. oxalate of aniline—3 oz. salammoniac—9 oz. sulphide of copper.

No. 114. Aniline Black with Tungstate of Chromium.—*Spirk.*

2 gallons water—3 lbs. starch—4 lbs. tungstate of chromium paste—boil well and add while lukewarm 6 oz. chlorate of potash—3 oz. salammoniac—2 lbs. muriate of aniline.

No. 115. Aniline Black with Disulphocyanide of Copper.
Higgin.

1 gallon water—1 lb. starch—1 lb. dark British gum—2 oz. of disulphocyanide paste—boil and add 8 oz. chlorate of potash—cool and add 1 lb. muriate of aniline.

No. 116. Aniline Black with Chlorate of Soda.—*Lightfoot.*

1 gallon chlorate paste (below)—3 lbs. muriate of aniline (below)—1 pint sulphide of copper.

No. 117. Chlorate Paste for No. 118.

10 gallons water—23 lbs. wheat starch—5½ lbs. salammoniac—4 lbs. chlorate of potash—2 gallons chlorate of soda (below)—boil and cool.

No. 118. Chlorate of Soda for No. 119.

3¼ gallons hot water—7¼ lbs. tartaric acid—1 gallon caustic soda at 70°—dissolve hot 12 lbs. chlorate of potash and add 7¼ lbs. tartaric acid dissolved in 6½ quarts water—reduce the clear to 28° Tw.

No. 119. Muriate of Aniline for No. 116.*

8 measures aniline oil—6 measures muriatic acid at 34° Tw.

No. 120. Aniline Black for Ageing or Steaming.—*Bardsley.*†

1 gallon water—2 lbs. aniline salt—2 oz. aniline oil—2 lbs. starch—8 oz. British gum—boil separately 1 gallon sodium chlorate—2 lbs. white starch—8 oz. British gum—8 oz. salammoniac—when cool mix and add 1 pint copper paste.

No. 121. Aniline Black with Chlorate of Ammonia.—*Dreyfus.*‡

3¾ gallons chlorate of ammonia—6 to 8 lbs. starch—6 to 8 lbs. British gum—boil well and cool—7 pints of neutral aniline salt at 8 lbs. per gallon—¾ to 1 pint sulphide of copper.

No. 122. Aniline Black.—*Pinkney's Patent.*

150 parts muriate of aniline or aniline salt—18½ parts salt of vanadium—20 parts chloride of nickel—100 to 150 parts chlorate of potash or soda—1200 parts water thickened with gum or gum substitute.

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* These four receipts from Ure's Dictionary.

† Chemical Review, December 1875, p. 44.

‡ Journal of Soc. Prom. Scientific Industry, i., p. 83.

WOOL DYEING WITH ANILINE PURPLE.—A correspondent of the *Muster Zeitung*, No. 1, p. 4, writes, It is well known that the dyer is frequently annoyed by unevenness and stains in dyeing wool with either iodine or methyl violet. Although as a general rule uneveness is attributable to want of care, or to great haste on the part of the dyer, yet some of it is owing to differences in the commercial products which require different treatments and times. He has found by many trials that all the aniline purples in trade, from whatever manufactory obtained, can be made to die evenly and in a uniform period of time by addition of sulphate of zinc, and salammoniac to the dye liquor. He has not discovered what the action of these salts is, but it is certain that the stains are much fewer, or it may be said, entirely absent. The method of dyeing consists in adding solution of the dye-stuff in portions to the bath, which is gradually heated, and containing already the above-named chemicals, and the wool dyed at boiling heat, being kept in continual movement all the time of dyeing.

VIOLET OR PURPLE ON LOOSE WOOL.—For 25 lbs. wool there will be required 2 oz. of methyl violet of the shade required, the clear solution is mixed with 1 lb. of sulphate of soda, boiled, cooled, and the wool entered and dyed at quick boil.—*Färber Zeitung.*

GREEN UPON WOOL FROM SOLUBLE METHYL OR IODINE GREEN.—We take the following from the *Muster Zeitung*, No. 1, p. 3. It would appear to be the practical application of Lauth's discovery of mordanting by hyposulphite of soda (see p. 36). For 10 lbs. of wool, prepare a bath with 2 lbs. hyposulphite of soda, 1 lb. alum, and ½ lb. sulphuric acid, heat it with the wool in up to 145° F., and work the wool for 1½ hours, raising the heat up to about 180°, take out and leave the wool for some hours. Rinse, and enter into the dye-bath, to which has been added the requisite amount of green, and also 3 oz. acetate of soda, 4 oz. borax, and, if necessary, a quarter to half-an-ounce of picric acid. Heat up from 120° F. to 180° F. in 1½ hours; rinse in a soap lather, and dry carefully.

A modification of this process consists in taking 1 lb. hyposulphite, ½ lb. of muriatic acid, warm up to 170° or 180°, enter the wool and keep it in 1¼ hours, leave twelve hours, wash, and dye as above.

Care must be taken that there is no metal in contact with the wool and the hyposulphite; the steam pipe must also be non-metallic.

CHESNUT AND BROWN ON WOOL FROM ANILINES.—Two new aniline colours are announced in the foreign journals under the name of purpuraline and aniline blue-black. Purpuraline produces browns and chocolates upon all fibres, and according to advertisements is destined to displace archil and its extracts, being cheaper, easier to use, and faster. The aniline blue-black is to be the supplanter of sulphate of indigo, giving dark colours when strong, and by dilution beautiful greys: it mixes perfectly with archil and other dye-stuffs; is soluble in water, and applicable to all sorts of fibrous matter. The purpuraline is advertised at about three shillings the pound, and the aniline blue-black at from eight to nine shillings. In the *Moniteur de la Teinture*, p. 284, there is a sample of dark chesnut on wool, obtained from Bismarck, darkened by addition of the aniline blue-black. The dyeing is commenced with sufficient of the latter colour to give a medium grey, it is then covered with the Bismarck. If too much blue-black be employed, the result will be the so-called bronze green. A combination of purpuraline and Bismarck gives reddish chocolates of various shades according to the proportions of the materials employed; and mixtures of the three colouring matters can be made to yield a variety of dark colours.

FAST RED ON WOOLLEN YARN FROM ALIZARINE.—For 10 lbs. of wool, boil 1½ hours with 1½ lbs. of sulphate of alumina, and ½ lb. of tartar; rinse, and dye with 6½ oz. of artificial alizarine paste, containing 10 per cent. dry alizarine, enter into the dye cold, and bring up to the boil. Fancy brown shades can be obtained by adding fustic and extract of indigo to the dye, along with a further amount of sulphate of alumina and bisulphate of soda.—*Färber Zeitung*, 1876, p. 20.

IMITATION INDIGO BLUE ON WOOL.—Boil 5 lbs. of woollen goods for forty-five minutes, with 1 lb. of tartar, 1½ oz. of bichromate of potash, 1½ oz. of sulphate of copper; leave to cool on the mordant, and dye for half an hour at boil in a fresh bath made from 2½ lbs. Domingo logwood, and 1½ oz. of sulphuric acid. This blue-black resists the sulphuric acid test, and is turned yellow by nitric acid.—*Färber Zeitung*, 1876, p. 20.

GREEN ON WOOL.—This is said to be a half-fast green, nearly a billiard green. For 17½ lbs. bleached woollen, mordant with 1¾ lbs. alum, and ½ lb. bichromate of potash, and boiled with 5 lbs. weld, again treated with weld, 12½ lbs. The blue part is given by the indigo vat.—*Muster Zeitung*.

CHROME BLACK UPON UNSPUN WOOL.—For 25 lbs. wool boil 1½ hours, with ½ lb. bichromate of potash, ½ lb. sulphate of copper, and ½ lb. sulphuric acid; take out, and dye in a liquor made from 10 lbs. logwood, and 2 lbs. fustic; one hour at boil. If the fustic be left out, or a lesser quantity taken, the black will be more or less bluish.—*Färber Zeitung*.

CRIMSON ON SILK.—The silk is boiled off with Marseilles soap, washed, and then for 5 lbs. weight of it left all night in a solution of 4 or 5 lbs. of alum. Rinsed and dyed with 1¼ lbs. cochineal, 6 ozs. tartar, 6 ozs. galls, and 6 ozs. of a tin mixture made from 4 parts salammoniac, 25 parts water, 25 parts nitric acid, 10 parts grain tin.

The cochineal and galls are boiled with the quantity of water requisite for dyeing, then the tartar and tin solution added, the whole cooled a little and the silk entered and kept at dyeing heat for an hour, left to cool in the liquid, and then washed off. The shade is clear; to make it heavier it must be again dyed in cochineal and red wood.—*Muster Zeitung*.

RED UPON COTTON FROM SAFFRANINE.—For 5 lbs. of cotton prepare it by boiling for an hour with ½ lb. of turmeric, lift and pass in sufficient cold water containing ½ lb. of oil of vitriol, lift and sumach for three hours and boil with 1 lb. of sumach. The cotton thus prepared is dyed at a hand heat with a clear solution of saffranine to shade.—*Färber Zeitung*.

NEW ACID ISOMERIC WITH ALIZARINE.—Schunck and

Roemer have communicated to the Berlin Chemical Society an account of a product accompanying artificial alizarine, furnished to them by Perkins' manufactory in London. When purified they examined the portion soluble in cold baryta water, hoping to find it to be mono-oxyanthrachinon, but they were disappointed, the analysis indicating the formula $C_{14} H_8 O_4$. It yields large crystals of considerable brilliancy and is isomeric but not identical with anthraflavic acid. It has no tinctorial power.—*Berichte d. D. Chem. Gesselschaft*, No. 19, p. 1628.

LIVING COCHINEAL.—Mr. W. Schönlank, of Berlin, has succeeded in bringing to that city a species of large cactus covered with living cochineal insects; this extreme rarity for that latitude may be inspected by visitors in the reptile house of the Zoological Gardens of Berlin, where it has apparently found suitable quarters.—*Färber Zeitung.*

MEDIUM AND LIGHT GREEN FOR SILK PRINTING.—One gallon of berry liquor at 4° Tw., 9 ozs. alum, 3 lbs. of a solution made from 1 gallon of hot water, 2¼ lbs. extract of indigo in paste, and 5 ozs. cream of tartar; thicken with say 3 lbs. of gum. For light shades reduce with gum water. For dark shades take 1 gallon of berry liquor at 4° Tw., 9 ozs. alum, 4¼ lbs. of the solution of extract of indigo and tartar given above. Thicken with dry gum; steam as usual.—*Muster Zeitung, No. 1, 1876.*

DEEP RED ON COTTON YARN.—For 10 lbs. of yarn, steep in a bath containing 1 lb. of catechu and 4 oz. of sulphate of copper, and heated to 170° F.; wring out and enter into a bichromate liquor containing 4 oz. bichromate and heated to 109° F.; then follow with tin mordant, about 4 oz. of crystals of tin, with a little muriatic acid in sufficient water; the dyeing is done with 3 lbs. of red wood at a temperature of 133° F. Addition of logwood makes the colour darker, turning to brown.—*Muster Zeitung, No. 1., 1876.*

8. British and Foreign Patents, from the Commissioners of Patents Journal, December 17th, 1875, to January 18th, 1876, inclusive.

Rollers, Engraving, Patterns, Designs.

4515. HENRY WILDE, of Manchester, in the county of Lancaster, Engineer, for an invention of "Improvements in the manufacture of metal rollers for printing calico and other textile fabrics, part of which is applicable to the refining of copper."—Dated 28th December, 1875.

4524. WILLIAM ROBERT LAKE, of the firm of Haseltine, Lake, & Co., Patent Agents, Southampton Buildings, London, for an invention of "Improvements in pantograph engraving machines."—A communication to him from abroad by John Hope, of Providence, Rhode Island, United States of America.—(Complete specification).—Dated 29th December, 1875.—Notice to proceed was given on the same date.

4541. CHARLES BATTY ANDREW, WILLIAM BURROWES, and GEORGE BERESFORD ATTKINS, of the city of Manchester, in the county of Lancaster, for an invention of "Improvements in producing patterns or designs in metals, on silk handkerchiefs, ladies' scarves, and silk piece goods."—Dated 30th December, 1875.

105,191. DESCOUBET and LEPRINCE, for "A machine for producing designs on tissues."—Dated 4th June, 1875.—French patent.

Singeing.

BLANCHE has given notice to proceed with his patent for singeing woven fabrics.—See this Journal, i., p. 39.

Ageing or Steaming.

2943. EDWARD JAMES JONES, of the firm of James Black & Co., Calico Printers, of Dalmonoch Works, in the county of Dumbarton, North Britain, has given notice to proceed in respect of the invention of "Improvements in apparatus for ageing or steaming woven or other web fabrics or yarns."

Apparatusses and Processes of Dyeing and Printing.

2845. RICHARD MARSDEN, JOHN DAY MARSDEN, and HENRY MARSDEN, of Dewsbury, in the county of York, have given notice to proceed in respect of the invention of "Improvements in machinery or apparatus for dyeing, washing, and scouring fabrics."

3005. WILLIAM FOTHERGIL BATHO, of the city of Westminster, Engineer, and JOHN TREADWAY HANSON, of "Thames Chambers," Adelphi, in the county of Middlesex, Architect, have given notice to proceed in respect of the invention of "Improved apparatus for printing and stamping wall paper or other substances for decorative purposes."

4177. ANDERSON and ROTHERHAM have received provisional protection for their patent improvements in dyeing silk and cotton.—See this Journal i., p. 41.

169,859. SAMUEL M. SMITH and CHAS. T. SMITH, of Bradford, England, for "A dyeing apparatus."—Application filed 31st July, 1875.—American patent.

Brief.—"The dye is admitted into a vertical revolving cylinder, whence it passes, by centrifugal force, through perforations filled with bristles, and between gauze disks, against the material to be speckled or covered with solid color."

170,307. ALEXANDRE SCHULTZ, of Paris, France, for "Processes of dyeing fabrics."—Application filed 10th September, 1875.—American Patent.—See English patent, No. 498, in this Journal, i., p. 53.

Brief.—"The fabric is printed with a mixture of indigo white, oxide of tin, and gum-senegal, and is then steamed to fix the color."

170,626. JAMES HARLEY, of Lowell, Mass., for "Dyeing and printing textile fabrics."—Application filed 27th November, 1875.—American patent.

Brief.—"Prints the aniline tints upon the fabric at the same time with the mordants, for the madder colors. The 'carrier' solutions of the aniline colors are such as resist the action of the dye-baths, and thus prevent blending and blearing."

Claim.—"1, the improved process herein described for dyeing in madder and garancine styles, in combination with aniline purples and violets, consisting in first fixing the latter upon the cloth with the mordants, and then passing the cloth through the dye-bath, whereby it is then dyed up in madder and indigo styles, substantially as specified. 2, the combination of aniline greens and purples upon cloth with mordants suitable for dyeing up in

madder colors, substantially as specified. 3, the new fabric herein described, having an aniline purple, substantially such as described, in combination with one or more madder colors. 4, the combination of aniline purple upon fabrics with mordants suitable for dyeing with garancine, alizarine, and similar dye-stuffs, substantially as set forth."

108,358. LAINÉ, PAILLARD, and Co., for "Black dyes for mixed fabrics."—Dated 10th June, 1875.—French patent.

104,113. GONIN, for "Fast dyes for cotton."—Dated 30th June, 1875.—French patent.

108,525. LE TELLIER and VERSTRAET, for "A pressure-roller for machines employed in printing fabrics and other articles."—Dated 23rd June, 1875.—French patent.

108,538. SELLON and PINKNEY, for "Improvements in dyeing and printing."—Dated 24th June, 1875.—French patent.

38,366. J. A. ROULÉ, of Andrimont-Verviers, for "A process for printing fabrics."—Dated 4th December, 1875.—Belgian patent.

46. THOMAS LEEMING and RICHARD RAY, both of Manchester, in the county of Lancaster, Lithographers, and FRANCIS GASCOIGNE LYNDE, of Kirkby Stephen, in the county of Westmoreland, Civil Engineer, for an invention of "Improvements in machinery for bronzing, colouring, or otherwise ornamenting paper and other materials."—Dated 4th January, 1873.

49. THOMAS AITKEN, of Manchester, in the county of Lancaster, for an invention of "Improvements in printing calico and other textile fabrics."—Dated 4th January, 1873.

The Stamp duty of £50 has been paid upon these two Patents.

Yarns, Hanks, &c.

3379. FERGUSSON'S patent for applying size and colour to yarns and threads has passed the great seal.—See this Journal, i., p. 44.

106,996. CAPRON & Co., for "A machine for drying yarn in skeins."—Dated 16th June, 1875.—French patent.

29. THE FLOSS-SILK SPINNING COMPANY, of Meina, for "A machine with automatic discharge for finishing thread."—3 years.—Dated 10th July, 1875.—Italian patent.

131. G. SERRA-GROPELLI, of Milan, for "Portable gas-stoves for drying silks and other textile substances, and also for titrating silk."—3 years.—Dated 17th September, 1875.—Italian patent.

103. G. DE RITTER and Co., of Görtz, for "A machine for cleaning and glazing yarn."—6 years.—Dated 26th August, 1875.—Italian.

The following Patents have become void.

3703. FREDERICK WILKINSON, of Manchester, in the county of Lancaster, Yarn Agent, for an invention of "Improvements in sizing, dressing, or preparing yarns or threads and woven fabrics of cotton and other fibrous materials, applicable also to colouring the said yarns or threads."—Dated 6th December, 1872.

3770. JOHN BULLOUGH, of Accrington, in the county of Lancaster, Machinist, for an invention of "Improvements in machinery for sizing and drying yarn, and in means or method of and apparatus for utilizing waste heat therefor."—Dated 12th December, 1872.

72. HENRY CARMICHAEL, of Leeds, in the county of York, Bleacher, for an invention of "An improved process and apparatus for bleaching, dyeing, and washing linen, cotton, and other yarns and fabrics."—Dated 7th January, 1873.

Colouring Matters.

4138. CLARK'S patent for artificial purpurine, a communication from Grawitz, has received provisional protection.—See this Journal, i., p. 42.

4296. ANDRÉ BRESSON, engineer, 10, Dacres Road, Forest Hill, Kent, for the invention of "An improved process for producing benzine, light oil, and anthracene from hydrocarbons."—This patent has received provisional protection.

4484. HORACE MOUNTFORD WILKINSON, of 2, Place des Barricades, in the city of Brussels, in the kingdom of Belgium, at present residing at 5, Charlotte Street, Portland Place, in the county of Middlesex, for an invention for "The manufacture of a new ink, applicable also for dyeing, colouring, and other purposes."—A communication to him from abroad by Camille Joly, of Rue d'Anderlecht, No. 3, Brussels.—Dated 24th December, 1875.

44. JUSTUS WOLFF, of Wyke, near Bradford, consulting and engineering chemist, and RALPH BETLEY, of Wigan, analytical and consulting chemist, for an invention of "Improvements in the production of colouring matters capable of being employed for the purposes of dyeing and printing."—Dated 4th January, 1876.

108,295. LEMOINE, of Paris, for "Applying the colouring properties

of dichroic and fluorescent substances, and especially of fluoresceine, for decorating purposes."—Dated 3rd June, 1875.—French patent.

20. A. GRAETZEL and H. C. C. PEGO, of Hanover, for "A process for obtaining a blue dye from wood-tar."—3 years.—Dated 27th November, 1875.—Belgian patent.

Water Purification.

2521. WOLLASTON'S patent for purifying and decolorizing dye waters, etc. (see this journal, i., p. 43) has passed the great seal.

Wool Treatments.

2480. EDWARD THOMAS HUGHES, of the firm of Hughes and Son, patent agents, 123, Chancery Lane, London, for an invention of "Improvements in machinery or apparatus for washing and scouring wool."—A communication to him from abroad by Victor Weiss, of Langensalza, Prussia.—Dated 9th July, 1875.—This patent has passed the great seal.

2587. JOSEPH JEFFERSON, CORNELIUS JEFFERSON, LAZARUS JEFFERSON, and MORDECAI JEFFERSON, all of Bradford, in the county of York, machine and iron and brass founders, for an invention of "Improvements in machinery for washing wool and other fibres."—Dated 20th July, 1875.—This patent has passed the great seal.

4088. ALEXANDER has given notice to proceed with his patent for the carbonization of vegetable matters in wool.—See this Journal, i., p. 45.

4211. NICHOLLS'S patent for apparatus for washing wool or other fibres has received provisional protection.—See this Journal, i., p. 46.

108,572. THE CHEMNITZ SAXON ENGINE-WORKS COMPANY, for "A machine for cleaning wool, cotton, flax, silk, and other vegetable and animal textile fibres."—Dated 29th June, 1875.—French patent.

38,237. V. WEISS, for an imported invention of "An automatic apparatus for scouring wool."—Dated 16th November, 1875.—(French patent, 5th July, 1875).—Belgian patent.

38,307. D. MICHEL, for an imported invention of "Charring vegetable matter in wool."—Dated 25th November, 1875.—Belgian patent.

Finishing Processes.

4243. NICKOLS' patent for machinery for plaiting fabrics has received provisional protection.—See this Journal, i., p. 47.

4454. WILLIAM KEMPE and ARTHUR KEMPE, both of Holbeck Mills, Leeds, in the county of York, for an invention of "Improvements in raising the nap upon cloths and fabrics, and in apparatus employed therein."—Dated 22nd December, 1875.

100,408. ENOULT, jun., for "A machine for glazing cloth."—Dated 21st June, 1875.—French patent.

108,275. VEYRON, of Voiron, for "An apparatus for polishing or smoothing tissues."—Dated 7th June, 1875.—French patent.

108,591. GANTILLON and Co., for "Using a new substance for dressing and dyeing tissues."—Dated 30th June, 1875.—French patent.

The following Patent has become Void.

3849. ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, in the county of Middlesex, patent agent, for an invention of "An improved calendar."—A communication to him from abroad by Jean Marc Louis Parisod, and Jean Eléonor Gustave Prochasson, both of Paris, France.—Dated 18th December, 1872.

9. *CORRESPONDENCE.*

MR. R. WARINGTON (not Warrington, as printed in the last number of this journal) writes to us that the abstractor of his paper on citric and tartaric acid has made some errors which arise from his having confounded lime juice with lemon juice, evidently considering them to be the same thing when they are different. For instance, it is said, p. 3, that "lime juice is principally imported from Sicily and South Italy," it should be lemon juice; lime juice comes from the West Indies; no Bergamot comes from the West Indies. This misapprehension runs throughout the citric acid part of the paper.

W. H. D., Lindley.—Whether the acetate of iron you refer to will answer your purpose or not is entirely a question for your own decision after trial made.

To the Editor of the Textile Colourist.

Manchester, January 18th, 1876.

Dear Sir,—Anyone who has watched the extension of the various manufactories on the continent for some years back, will have noticed that they have made much progress. I believe this is due to a great extent to the numerous technical journals published abroad, whereas in this country few such publications are found. I have therefore been glad to see that you are going to supply a real want, and a journal like that which you have started will do much good. I have read with great interest the first number, and have found much useful information in it. I should have liked to see more about the dyeing of yarns or cloth, of silk, wool, etc. It is true that in the first number you cannot fully develope the plan laid out, and which I believe to be a good one, but some small space might have been found for either of the branches omitted. I do not mean that you should give so called "practical receipts" for dyeing, copied from German or other journals, and which in most cases are not worth the paper on which they are written, but by describing the properties and preparation of the chemicals and dye wares mostly used, you will give information which will be very acceptable to those interested.

A feature that you intend introducing in your publication, namely, information that is valuable in the history of dyeing, calico printing, &c., and, as I understand it, of individual processes and styles or application of dyes, is a very valuable one. It is interesting at least, if not important, that the literature of processes be well known to those who apply them: in many cases such knowledge saves much time, which would otherwise be devoted to experiments and trials, the results of which are known already.

The articles are good, useful, and practical. I only make a reservation on the collected receipts: it is my opinion that the space you devote to these might be given to more useful matter. A collection of any amount of such receipts (and I could give you myself hundreds of them) is only of questionable interest. All printworks have many such receipts in their books, and after long practice the preference is given of course to those that give the best results. I have known many instances where a receipt gave a good result at one printworks, and was a perfect failure at another: the conditions of working have much to do with the success of a receipt. I am afraid I have already trespassed too much on your space, and I conclude by wishing you all the success which your well-meant efforts deserve.

Yours very truly,

CHARLES DREYFUS.

ERRATA:—p. 25, in No. 15, black for Delaine, instead of 16 gallons logwood liquor, read 48 gallons.

Page 53, nine lines from top, No. 1064 should be No. 1094.

THE TEXTILE COLOURIST.

No. 3.—MARCH, 1876.

1. *Vanadium in Dyeing and Calico Printing.*

THIS metal is at present exiciting some interest, and as it is not improbable it may hereafter play as important a part in dyeing and printing as chromium has done or is doing, we have thought it desirable to give a sketch of its history and properties so far as known.

Vanadium was actually discovered by Sefstrom in 1830, he found it as a constituent of a variety of Swedish iron which was remarkable for its ductility. Its name is from Vanadis, the designation of an ancient Scandinavian divinity; in what form it existed in the iron ore is not known. This metal is also found in Mexico, in a lead mine at Zimapan. A chemist, named Del Rio, analysed the Zimapan mineral so long ago as 1801, and announced that it contained a new metal, to which he gave the name Erythronium; shortly afterwards a French chemist, Collet-Descotils, declared that this supposed new metal was in reality only impure chromium, Del Rio does not seem to have had confidence in his own analytical skill, and either admitted, or did not oppose Collet-Descotils' statement, and our knowledge of a new metal was by this mistake or weakness thrown back for thirty years, for Wöhler proved clearly after Sefstrom's discovery, that the Zimapan mineral did contain vanadic, and not chromic, acid. Sefstrom placed his specimens at the disposition of the great Swedish chemist, Berzelius, who modestly says he had occasion to study the properties of this metal and its combinations, but in reality

made a most thorough and exact examination of them, the results of which have, in all fundamental points, been confirmed by recent research.* This metal occurs as vanadate of lead and vanadate of copper; it is found in small quantities in various iron ores, and slags from iron works, in impure pitchblende, probably as vanadate of lime, in hydrophite from Taberg to the amount of 0·1 per cent., and in the so-called vanadic bronze from Bracco, on the coast of Genoa, which contains 3·75 per cent. of the oxide.† Further, according to Berzelius, it has been found at Wanlochhead (?) in Scotland, in the cupreous schist of Mansfield, and in other places. Apjohn has found it in trap rocks, and Hodges reports its existence in iron ores from the county Antrim in Ireland.‡ Professor Roscoe obtained a sufficient supply for his admirable researches from the residues obtained in the extraction of cobalt from the cobalt-bed sandstone at Mottram St. Andrew's, in Cheshire.§

Notwithstanding the widely-diffused existence of the compounds of the metal, it has ranked amongst the rarest of all chemical products up to the present time, being found only as a curiosity in small quantity in the cabinets of laboratories, and commanding a very high price,‖ and it is entirely owing to the enterprise of a firm of metallurgical manufacturers in the neighbourhood of Manchester that it has become possible to apply vanadium in calico printing and dyeing.

Berzelius observed during his researches that the alkaline vanadates mixed with infusion of galls gave a species of ink which wrote of a black-blue colour which changed in contact

* Berzelius, Traité de Chemie, 2nd Ed., ii., p. 314.

† Gmelin's Handbook. English Translation, iv., p. 81. The statement that bronzite contains 34 per cent. vanadium is a typographical error, as may be seen upon comparing vol. iii., p. 404.

‡ Chem. Soc. J. [2], x., 1116. Chem. News, xxvi., 238, from Watts' Dictionary Art Vanadium, 2nd Suppl.

§ Chem. Soc. J., xxi., 326.

‖ See Editorial note in a contemporary for February, 1876, where it is said that "Vanadium in the metallic state costs £520 16s. 8d. per lb. avoirdupois." Perhaps no one has ever seen metallic Vanadium yet, but we are informed that the oxide and salts have been on sale for some time past in London at the rate of 63s. per oz. avoirdupois, and doubtless could be supplied at lower prices.

with air, the black-blue colour passing into green. The writing is durable and withstands the action of hydrochloric acid, of chlorine, or of alkalies, but is destroyed by successive treatments of chlorine and alkalies.* Dr. Ure early drew attention to this property of vanadate of ammonia, and on the score of cost remarks that the quantity of salt required is so small as to be of no importance when the vanadium comes to be more extensively extracted.† Dr. Ure says the writing is perfectly black, and does not hint at its becoming green as Berzelius does.

The next step in the history of vanadium may be dated 19th December, 1867, when Dr. Roscoe, Professor of Chemistry at the Owens College, Manchester, delivered the Bakerian Lecture before the Royal Society, entitled "Researches on Vanadium." In this lecture the true atomic weight and true constitution of the compounds of vanadium were shewn to be different from those received by chemists upon the authority of Berzelius and one or two other chemists, that which Berzelius supposed to be the metal vanadium was shewn to be an oxide, and what Berzelius took to be a terchloride was proved to be an oxy-chloride; hence the whole of the atomic weights and formula had to be corrected, the new researches shewing that the atomic weight is 51·3 and not 68·5, oxygen being 16, and that vanadic acid has the formula V_2O_5 and not VO_3 (O=8) as was supposed. We do not think it desirable to go further into the pure chemistry of the vanadium compounds as worked out in the remarkable researches of Professor Roscoe, but simply to draw attention to some observations he made which may have a bearing upon the technical applications of them. "In its power of uniting with oxygen, vanadium surpasses even uranium . . . the metal is so extremely difficult to separate from its last atom of oxygen that to this oxide the name vanadyl (VO) may appropriately be given." This oxide also called vanadium dioxide "possesses a grey metallic lustre, dissolves in acids without evolution of hydrogen, and yields a lavender-coloured solution

* Gmelin's Handbook, English Translations, xv., p. 466.

† Dictionary, 3rd Edition, 1846, and probably earlier editions.

which bleaches strongly." "If the dark red solution obtained by dissolving finely powdered vanadium pentoxide in strong boiling sulphuric acid be diluted with fifty times its weight of water and then digested with metallic zinc, the liquid rapidly changes colour, passing through all shades of blue and green, until, after lapse of some time, it assumes a permanent lavender or violet tint. The vanadium is then contained in solution in the lowest degree of oxidation ($V_2 O_2 = 134{\cdot}6$) as sulphate, and *this compound absorbs oxygen with such avidity as to bleach indigo and other vegetable colouring matters as quickly as chlorine itself, and acts far more powerfully than any other known reducing agent.*"*

It was the research of Professor Roscoe upon vanadium which led indirectly to the extraction of this metal from its ores in sufficient quantity to enable Mr. Pinkney to obtain it, and to lead in his hands to the discovery of its remarkable action upon mixtures of aniline salts and chlorates, and to employ it in the first instance for the production of aniline marking ink.

But in chronological order the next notice of vanadium is found to proceed from that indefatigable worker the late Mr. John Lightfoot, of Accrington. He published a thin octavo of thirty-six pages with a preface, dated May 1st, 1871, which, among other things, contained a short account of an experiment of his, made by placing bits of various metals upon moist aniline colour made from aniline salt and chlorate to ascertain their actions; to make the experiment complete he had procured specimens of every known metal, and we have before us now a letter of our lamented friend, dated 22nd September, 1871, inviting us to visit him at Lower House, and offering as an inducement the inspection of his collection of rare metals, which had cost him £150 to get together. Only four metals shewed any action, and of these he declared that vanadium was the most powerful in inducing the oxidation of the aniline. The nature of his experiment did not allow of any quantitative comparison between it and copper;

* Chem. Soc., J. xxi., p. 334.

but it is interesting to note that he speaks further on of the action of vanadium or of copper as being one that could be carried on with infinitesimal quantities, and that the use of relatively large proportions of copper sulphide in practice was merely a matter of convenience or security. He died not long afterwards.*

On the 16th October, 1871, Mr. Robert Pinkney took out a patent for the use of salts of vanadium or of uranium together, or in combination with salts of nickel, for producing aniline black by dyeing or printing,† and if we are rightly informed has actually for several years been using it on a tolerably large scale.

The next published document we find is a patent to Messrs. Sellon and Pinkney, for improvements in dyeing and printing,‡ dated 24th December, 1874, and the claims are for using vanadium salts in conjunction with vegetable and animal colouring matters, such as logwood and cochineal.

For some time past the proprietors of these patents have been experimenting upon the vanadium process with a view to its introduction on the large scale in the calico printing districts, and though they have met with such difficulties as always attend the introduction of a new and unknown material, and though it cannot be said yet that vanadium is a proved commercial success, it is known that it can accomplish most remarkable things, and that a large number of pieces have been printed with aniline black made from it.

In the number of the Bulletin of the Chemical Society of Paris for the 20th January, 1876, there is a paper by M. Antony Guyard upon the formation of aniline black by means

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* A resumé of Mr. Lightfoot's results may be found in the Bulletin of the Industrial Society of Mulhouse for May, 1871.

† See receipt No. 122, p. 115, Textile Colourist for February. This receipt was taken from the Bulletin of the Chemical Society of Paris, but it is wrong; the English patent gives 150 parts of muriate of aniline or aniline salt, and $\frac{1}{8}$ part of salt of vanadium or uranium. The French transcriber evidently supposed it to mean $\frac{1}{8}$ part of the weight of the aniline salt and wrote $18\frac{1}{2}$, but it really is $\frac{1}{8}$ of 1 part, that is for 150 parts aniline salt, $\frac{1}{8}$ part (or ·125) of vanadium salt, or 1 part to 1,200.

‡ See p. 86 last number of Textile Colourist for full title; also p. 122.

of aniline salts; this chemist has had considerable opportunities for making himself acquainted with the subject, for we believe that until lately he was in the employ of the Magnesium Metal Company, of Patricroft, near Manchester, who would appear to have possession of nearly all the manufactured vanadium salts that are at present in existence, and who, we believe, are also proprietors of the patents concerning its applications. M. Guyard shews that if a mixture of water, muriate of aniline, and a chlorate be made, and a small quantity of vanadous chloride added, the solution begins at once to darken, and in a few hours almost the whole of the aniline is transformed into aniline black. The vanadium is so powerful that 1 part of it can easily transform 1000 parts of muriate of aniline into aniline black, and that in practice 1 part of either the chloride, or the vanadate of ammonia can be successfully employed to 500 parts of the aniline salt. Experiments, however, upon a practical scale, have shewn that vanadium can act energetically in even smaller proportions than this, it seems almost incredible, but we are assured of its exactness that one twenty-thousandth part of the weight of a gallon of colour is sufficient to induce the rapid and complete transformation of the aniline into black. Recurring to Lightfoot's book of 1871, for it must not be forgotten that not only was Lightfoot the discoverer of aniline black, but up to his last illness worked at it unceasingly, and all that he wrote is important, we find the following passage, p. 34, "Whether the action from the copper is due to electrical action, catalysis, or actual change of its combination repeated over and over again, the fact is not to be disputed that the most infinitesimal quantity of the four metals—copper, iron, vanadium, uranium,—is sufficient in the chloride of aniline and chlorate of potash solutions to set up a state of things that will gradually produce the black. In the whole range of chemistry there is scarcely a parallel case of such marked results obtained from such infinitesimal quantities." This is written with reference to actual experimental results, but with regard to the use of infinitesimal quantities in practice, he further remarks, "it is

very different in the practice of the calico printer. Other elements there, as time, intensity and stability, require much larger quantities."

M. Guyard says that vanadium is one thousand times more powerful than copper in producing aniline black, and at a loss to compare its action with any known chemical phenomena, likens it to a spark which determines the combustion of the mass of aniline and chlorates. Our own experiments do not entirely confirm the statements of M. Guyard; in fluid solutions its action is certainly most astonishing, and incomparably more energetic than the same weight of copper, but upon cloth it certainly is not one thousand times more powerful, perhaps not ten times more powerful. M. Guyard's explanation of the action is that there is no metal which so easily changes its state of oxidation as vanadium does; under the slightest reducing action, vanadic acid passes into one of the lower oxides, and again, under the slightest oxidizing influences, becomes again vanadic acid. When vanadic acid is dissolved in hydrochloric acid, it is transformed into a vanadous chloride, and when the solution is evaporated in the air, it is partially changed into vanadic acid. If, on the other hand, vanadous chloride is brought into contact with a chlorate, chlorine is evolved, and vanadic acid produced, and reciprocally, if vanadic acid, or a vanadate, is introduced into solution of muriate of aniline, it is instantly reduced into vanadous chloride, and if chlorates be present with aniline, the reduction and oxidation continue until there is no trace of aniline left to be oxidized. We do not give the whole of M. Guyard's paper, which is in great part concerned with the theory of aniline black, and the consideration of which may be postponed. With regard to uranium, which was included in Mr. Pinkney's patent, our author says that at the maximum of oxidation it does not act, but at the minimum it gives fine blacks, and that its supposed power was actually due to vanadium which was contained in the pitchblende from which it was extracted.

It is too soon to say what practical results may be expected from the unique properties of vanadium; it has not yet been

sufficiently tried in aniline blacks to enable us to say whether it possesses any clear advantages over copper, but there can be no doubt that it will find some valuable technical applications, and will yield one more illustration of the benefits to be derived from investigations into the unknown.

2. *On the Dip-blue Styles of Calico Prints.**

BY MR. G. H. UNDERWOOD.

Blockers; Blue, Orange, and Yellow.—The dipping for this style as well as the subsequent treatments are the same as for the blue, orange, and white style as far as that style goes; the style now treated of is usually dyed a little darker than the low Greek style, and it differs from the orange style by having a portion of the orange converted into yellow by means of printing with block certain acid compositions which act upon the orange chromate of lead, and taking up some of the lead convert it into the yellow chromate, producing a double effect from a single original colour.

The following receipts shew the compositions found most suitable for producing the yellow.

Yellow Blocking Paste for Orange. No. 1.

28 lb. alum.
33 lb. nitrate of lead.
12 gallons water.

These are well dissolved, mixed, and stirred together; left for some hours to settle, and then the clear taken and mixed with—

13 gallons water.
100 lb. gum substitute.
1 gallon nitric acid.

This was found to be a good and cheap colour for the purpose; two others presenting some slight differences in

* Continued from page 80.

composition, and which have been successfully used are here given.

Yellow Blocking Paste. No. 2.

28 lb. alum.
33 lb. nitrate of lead.
18 gallons water; take the clear.
36 lb. patent gum substitute.
12 lb. new gum substitute.
6 lb. nitric acid.

Yellow Blocking Paste. No. 3.

13 lb. nitrate of lead.
12 gallons water.
15 lb. alum; thicken the clear with
50 lb. patent gum.
1 quart nitric acid.

After raising the orange in the chrome beck, great care must be taken that the lime be throughly washed out of the cloth, otherwise the blocking paste will not cut the orange regularly and great unevenness in the shades will result. After washing well and drying, the pieces are given over to the block printer; when printed they are fly-winced, dried, and made up for the market.

Blue, Orange, and Yellow.

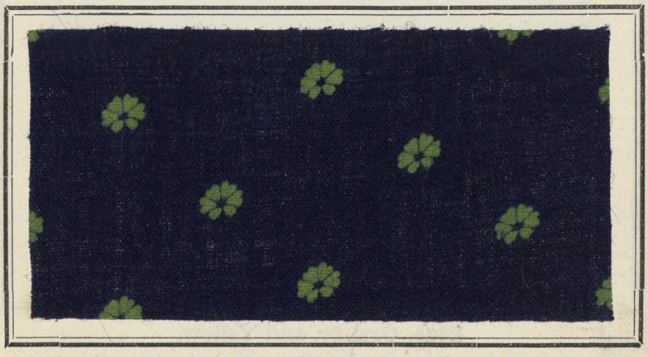
Two Blue and Green Style.—In this style the calico is first skied a light blue shade, then printed with the required design with the orange and white paste colours already given.

The pieces are limed, dipped up to the required shade, stripped from the frame, bowled, soured, washed, raised orange in the chrome beck, washed, banded, and left on a stillage.

Cutting the Orange for Green.—A stone cistern is set with about 150 gallons of water and made slightly acid with nitric acid, care must be taken that it is not too strongly acid, or the light blue will be destroyed by the liberated chromic acid; 2 or 3 pints of nitric acid should make the water sufficiently acid; three or four pieces of the cloth are now winced a few ends in the acidulated water and the green colour is gradually developed, when the pieces may be washed with the fly-wince, dried, and made up.

The orange paste is rather too strong for the production of a good bright green. I have got better results by using only half the quantity of sulphate of lead given in that receipt.

Blue and Green Style.—This style is obtained in exactly the same manner as the preceding, the only difference being that no white paste roller is employed to obtain the light blue, this style containing only a dark blue and green; the process of raising and cutting is similar to the preceding style. Sometimes an imitation of this style is made by first printing a white paste, dyeing to shade required, washing, drying, and printing a steam green by block to cover the white.



Blue and Green.

Blue, Green, and White Style.—This style can be obtained by two distinct processes: the first method is by printing an

orange paste mixed with Prussian blue before dyeing and raising in chrome. The second process is conducted as follows: the cloth is skied, then printed with the orange paste (p. 79), with only half the quantity of sulphate of lead, and the white is obtained by a discharge white resist paste, which will be found further on.

For the Prussian blue green style the cloth is printed with the white paste (p. 78) and the following orange-green paste.

Orange-Green Paste.

12 lb. sulphate of copper.
10 lb. nitrate of lead.
24 lb. sulphate of lead.
9 lb. flour substitute.
1½ lb. calcined farina.
2 gallons water.
1½ gallons Prussian blue standard.

This should measure 5½ gallons.

Prussian Blue Standard.

12 lb. red prussiate of potash.
4 gallons boiling water.
12 lb. green copperas.
4 gallons boiling water.

Dissolve the salts separately, mix, and stir well.

After printing, the pieces go through the usual course of dipping, washing, souring, &c., and then the green is developed by raising in the chrome beck; the white paste in this style preserves the cloth white as in the previous styles.

In the skied green and discharge white style the cloth is first skied, then printed with the orange paste and dyed up to the shade required, washed, raised in the chrome beck, washed, and then cut in weak nitric acid; but the white is obtained by means of a discharge-resist, which is a resist containing no lead salts, but bichromate of potash, into which at the time of printing, a portion of muriatic acid is well mixed, which, liberating the chromic acid, enables it to discharge the pale sky blue, leaving a perfect white. The following is a receipt for this so-called discharge-resist.

Discharge-Resist for Block on Sky Blue.

16 lb. pipeclay.
6 lb. sulphate of copper.
8 lb. acetate of copper.
1 lb. bichloride of mercury.
3 lb. East India gum.

Mix well together, and add, when cold, 7 lb. bichromate of potash in fine powder, and sufficient water to make the whole into about 5 gallons. Immediately before printing, add to each quart of this discharge-resist, 10 oz. nitrate of copper at 80° Tw., and 2 oz. muriatic acid; the muriatic may be omitted when the whites are large.

It is evident that this discharge-resist can only be printed by block, the presence of mercury salts and so great a quantity of pipeclay unfitting it for roller printing. The following modification gives a much cheaper colour, which may be advantageously worked in the machine.

Discharge-Resist. G. H. U.

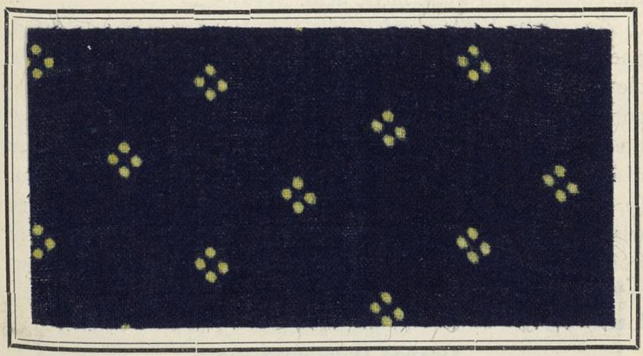
7 gallons water.
12 lb. sulphate of copper.
1¼ lb. acetate of lime.
3 lb. best flour.
1½ lb. dark British gum.
1 pint nitrate of copper.

When cool, add 3 lb. to 4 lb. chrome salts, and when required for use, to each gallon add ¾ to 1 quart muriatic acid at 20° Tw.

Blue, Green, and White.

The light blue is seen to be discharged as the cloth dries and the copper salts act as a resist in the subsequent dipping.

Blue and Yellow, and Blue, Yellow, and White Styles.—These styles are obtained by printing with the ordinary orange paste when yellow alone is required, but with both orange and white when yellow and white are required. The cloth is dyed after printing in the usual manner and with all the precautions given for dyeing the orange styles, raised in chrome, washed, and cut in very weak nitric acid. It may be again observed that if the acid be too strong the end aimed at will not be attained, for instead of converting the orange dichromate into the yellow chromate of lead the whole of the lead will be dissolved off the cloth and only a white pattern be left where there should be yellow, the length of time in which the acid acts is also to be attended to so as not to exceed the required effect.



Blue and Yellow.

Two Blue and Yellow.—This style is produced by first skying the pieces through the sky vat, washing, and drying; then printing the white and orange resist colour; the white preserves the light blue its original shade; the dipping is conducted as for blue, orange, and white, the orange is raised in the chrome beck and the pieces washed and dried and then passed full width through the cutting machine. The box of the cutting machine is kept regularly supplied with the cutting

liquor whilst the pieces are passing through. The cloth passes directly from the cutting liquor into a cistern or range of cisterns of cold water so divided that the pieces pass lastly through pure water. The cutting liquor for this style is made as follows:—

12 quarts sulphuric acid,
16 lb. oxalic acid,
and sufficient water to give a solution of 6° to 8° Tw.

The object of this cutting after previous raising is to decompose the chromate of lead liberating the chromic acid which reacts upon the sky blue and completely discharges it, leaving a clear white ground upon which the yellow is obtained by a second raising in the chrome beck and a cutting in weak nitric acid which fully develops the yellow.

Two Blues and Orange.—This style is obtained in precisely the same manner as the two blue and yellow style, omitting the cutting with weak nitric acid.

Two Blues, Yellow, and White.—A style but seldom worked, and believed to have been first produced by the writer. The cloth is first skied, washed, and dried, then printed in a three-colour pattern with (1) white resist paste to protect the sky blue, (2) the discharge white resist (p. 138) and (3) an orange discharge paste. The white resist paste is the ordinary colour (p. 78), but the discharge white resist contains chromates which act as dischargers, the discharge orange paste differs from the ordinary orange paste by containing discharging agents, and is used to obtain the yellow; it is made as follows:—

Orange Discharge Paste.

1 gallon water.
5 lb. sulphate of copper.
5 lb. nitrate of lead.
10 lb. sulphate of lead.
3½ lb. flour.

This paste is cooled, and when required for use 3 lb. chrome salts dissolved in boiling water are well mixed with it; immediately before printing add 1 quart muriatic acid at 20° Tw.

This paste should only be made in in the smallest quantity

required as it is soon spoiled for working; the cloth printed must be soft dried, to avoid destruction of the cloth from the corrosive action of the chromic and muriatic acids, the sky blue is seen to be discharged as the cloth becomes dry.

Immediately after printing, the cloth is hooked for dipping; if necessary it may be limed as for orange and white previous to going into the indigo vats, after dyeing it is washed, soured, and taken to the raising house and raised orange, washed, drained on a stillage, and then cut with weak nitric acid to give the yellow. If the orange is not reduced by nitric acid, the style would be two blues, orange, and white.

Two Blues, Green, Yellow, and White.—This style requires a four-colour machine to work, (1) white paste, (2) discharge white paste, (3) the discharge yellow, and (4) the mild orange paste to give the green. The treatment of the cloth is substantially the same as in the previous style.

Two Blues and White by Blocking.—This style, called French, is produced by first printing by machine a white resist paste, then dyeing a light blue, washing, souring, and drying, and then blocking on the following paste, which is printed over the whites and those parts of the light blue which are to be preserved.

Blocking Paste.

3 quarts water.
1 quart 4 lb. gum senegal water.
4 lb. sulphate of copper.
1 lb. brown sugar of lead.
1½ lb. sulphate of lead.
6 lb. pipeclay.

Two Blues and White by Discharge.—The cloth being skied a light blue, is printed with the ordinary white and orange resist paste and then dyed to the required shade, stripped, soured, raised in the chrome beck, passed open through the cutting machine with the same cutting liquor as used for two blues and yellow (p. 140). The cutting liquor, in acting upon the chromate of lead, liberates chromic acid, which, acting upon the light blue, oxidizes and destroys it, producing a white; the pieces are then well washed, dried and made up.

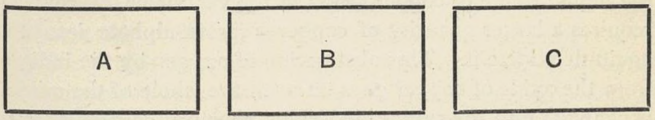
Two Blues and White.

Before proceeding to the other styles it is judged advisable to treat in detail of some of the processes which follow the dipping, and of which the names only have been mentioned.

The first process through which the pieces are put, after being stripped from the frame, is bowling. This is a very simple process of itself, but some care must be exercised in the bowling of "oranges" to prevent the "marking off." I may as well here state that all the navy and baft styles may lay any length of time after being stripped from the frames without receiving any injury to the quality of work, but "oranges" should be bowled as soon as possible, for when once soured they will not mark off, nor can injury arise to the quality of the work. The object of bowling is twofold, first to remove all the loose indigo from the surface of the cloth, and at the same time to remove the lime and oxide of iron which the cloth brings out of the vat, adhering to its surface, which economizes the sulphuric acid of the "sour kettles," by removing these neutralizing bodies previous to the entrance of the cloth into the sours.

Bowling by hand is generally worked in the following manner. There are two vats filled up with water to within 8 or 10 inches from the top, over each of which there is a

moveable wince, the greater part of the indigo is left behind in the first wince pit (at the bottom of each pit there should be a "flake," *i.e.* a false ribbed bottom), and the piece is then sent forward to the second wince pit which is filled with fresh water every morning, and after working the first day, it in its turn becomes the first wincing pit, and that which was the first wincing pit is allowed to settle until the following morning, and then drawn off and the indigo laded out into a store vat; if convenient it would be found advantageous to have three vats for this bowling process, and to be worked in the following order:—A is a bowling pit which has worked two days, doing about 40 frames each day (from 5 sets), and left to settle. B is a pit that is doing its second day's work, which on the morrow will be allowed to settle, and A will become the second wincing vat (the fresh one). C is the second wincing pit to-day, which on the morrow will become the first wincing pit, which in its turn will be left to settle, and become again the fresh or second wincing pit.



A Bowling pit settling after doing two days' work.
B Bowling pit doing its second day's work.
C Bowling pit doing its first day's work, having been set with fresh water the day it commences work.

The pieces after stripping from the frames are carried to the bowling vats, and if they be "oranges," they must be immediately immersed in the first bowling vat, the end being thrown upon the side of the vat—one end (two pieces) is thrown over the wince in about 3 or 4 bands, to this is given four ends and then knocked out, drained a short time on the dripper, and then winced in the bowling pit C in the same manner; then knocked out, drained on the dripper, and if an orange, taken and thrown into the souring pit immediately after draining a minute or two.

The bowlings, *i.e.*, the sediment of indigo paste, oxide of

iron, lime, &c., which have collected at the bottom of the bowling vat after two days' work, contain a large quantity of oxide of copper which has been removed from the cloth along with the paste; this oxide is very detrimental to the well-working of the vats in which it is used, causing them to work "thick," from the large quantity of feed that is necessary to spring the indigo. The reason of the bowlings requiring more "feed" to spring them than indigo, is owing to the following chemical phenomenon. As before stated the bowlings contain large quantities of oxide of copper brought off the cloth by the friction of the wince, this has the composition of the black oxide of copper. The lime and copperas employed deoxidizes the indigo, giving rise to white indigo (deoxidized blue indigo). This deoxidized indigo coming into contact with the oxide of copper contained in the bowlings, abstracts a portion of the oxygen of the oxide of copper, reducing it to the state of sub-oxide, and is re-converted into blue indigo. And this chemical change keeps going on so long as any of the higher oxide of copper exists in the vat, which, of course, requires a larger quantity of copperas (protosulphate iron) to again deoxidize it. This abstraction of oxygen by the indigo from the oxide of copper goes on until the whole of the oxide is changed into the sub-oxide. This chemical change is thus illustrated: *

$$2CuO + C_{16}H_5NO = Cu_2O + C_{16}H_5NO_2$$

This, as before stated, necessitates the employment of so large a quantity of copperas and lime, that before the vat is properly exhausted it becomes so thick that it is impossible to get good work owing to the cloth "grounding;" and more than this it is a great waste of indigo, for the amount of indigo in a bowling vat that has ceased to dye is very great in comparison to an ordinary indigo vat which has been well dipped out.

The disadvantages of a bowling vat, *i. e.*, a dye vat set with bowlings, are, that it requires more springing material, considerably more time and raking to bring it into a dyeing

* O = 8 C = 6

condition, it works much thicker, it does not work out so well, and it leaves a large quantity of indigo unextracted. All these disadvantages may be got over by a very easy and economical process. The supernatant liquor of the vat after settling is drawn off with a syphon made of copper or gutta percha. The two legs are joined together with india-rubber tubing, and a piece of glass pipe, equal in diameter to the bore of the syphon, is introduced, so that the workmen may see when the liquor is running perfectly clear and free from indigo; after the clear liquor is removed, the bowlings are carried away and put in large tubs, and there treated with weak sulphuric acid at 6° Tw., which dissolves the whole of the oxides of iron and copper; this solution is allowed to settle, the indigo is precipitated to the bottom of the tubs, and the clear liquor, containing the sulphates of iron and copper, is run off into other tubs below the level of the casks in which the bowlings are treated. These lower casks are filled with iron turnings, and communicate with each other, the bottom of the first to the top of the second, and so on through the whole of the series. At the last one runs out a perfectly neutral protosulphate of iron, free from the copper first dissolved out of the bowlings. The copper is precipitated by the iron contained in the casks, whilst the sulphate of peroxide of iron is reduced into protosulphate through the agency of the metallic iron. After a length of time the iron may be all dissolved by an excess of sulphuric acid, and the copper which has been precipitated can be collected. This process was patented by Mr. Leese, of Manchester.

The bowlings are drenched with water until traces of copper only are found in solution; the first washing is run through the lower casks, the subsequent ones being run away as too weak in copper to be worth extracting. The bowlings are taken away to the vats and these set. They work quite equal to indigo, require no more springing, work clear, and dye out gradually to the end. After being dipped out, no more indigo is found in them than in the spent indigo enterers.

The process of souring by hand is done in similar vats to the bowling process, near the bottom of the souring kettle

or vat there is a flake introduced, so that the heavy portions of lead and paste that are removed from the pattern on the cloth by the action of the wince may collect and settle there. The strength of the sours (weak sulphuric acid) is generally kept at 10° Tw. by the addition of brown sulphuric acid. The manner of freshening the sour vats is as follows:—In the morning, previous to commencing work, about 30 or 40 gallons are taken out of the sour kettle; this liquor is carried and put into the first cask of the series, where the acid combines with the iron and forms sulphate of protoxide of iron, and the copper is precipitated as described above, and 1 to 1½ bottles of brown vitriol added, and then the sours are well raked up so as to mix the whole, the sour kettle is then ready for work. Immediately after the pieces are bowled they are banded up and drained on the dripper for a minute or two, and then carried by the bowler into the sour kettle, in which they have four to six, or even eight ends, according to the style of patterns. The object of souring is twofold, first to transform the whole of the oxide of lead into sulphate of lead, so that the oranges can be raised by the double decomposition of the sulphate of lead and chromate of potash, and to clear the blue from the oxide of iron, &c., on the surface of the cloth, after the pieces are soured they remain on the dripper some time to drain, and are then carried off to the fly wince to be washed. The pieces do not run any risk from marking off after they are soured, however long they may lay together, but they run some risk if they are allowed to remain too long from becoming dry, when the action of the sulphuric acid becomes corrosive to the fibre and the pieces are rendered rotten. One sour vat ought to be sufficient for five sets of dippers doing 42 frames (a day and a half's work) per day each in every week or fortnight, according to the amount of pattern on the cloth during the time. The sediment from the bottom of the sour kettle (called technically sour grounds) is scoped up with a copper scope and put into tubs, and after settling therein the clear liquor is drawn off; the sediment is generally then set in a dipping vat for the sake of the indigo it contains, but it requires a very large amount of copperas

and lime to spring it well; these vats are called by the dippers "sour ground vats," and always work exceedingly thick, and work out (not absolutely, for the indigo appears to be buried by the amount of paste and springing material) very soon, the grounds containing a large amount of indigo, and require in some cases as many as twelve to fourteen boils by the boiling process to abstract the indigo therefrom. Hot souring is sometimes had recourse to for bafts of large patterns, so that the paste may be removed from the pattern in order to leave the cloth where the pattern is printed soft and supple; this should be done in a small square cistern lined with lead (about 5 lb. lead, the joints being made with the blow pipe) into which steam blows through a leaden pipe. The strength of sours employed should not be more than 6° Tw. when cold; three to four ends are sufficient for the goods, and they should be fly winced immediately after knocking out, and not be allowed to lay together, otherwise there is very great danger of the pieces rotting. The next process through which the pieces go after souring is washing preparatory to their being raised in the chrome beck, this is effected by the fly wince, a large quantity of water being necessary to well wash the pieces, and to insure the perfect removal of the sulphuric acid brought by the pieces from the sour kettles. The clear water runs into the wince pit at the end where the cloth comes out, so that the cloth in leaving the pit meets with a supply of fresh water.

[*To be continued.*]

3. *Kolb on Linen Bleaching.*

THE following is a condensed resumé of Dr. Kolb's papers in the Bulletin of the Industrial Society of Mulhouse, vol. xxxviii., p. 647-907. He considers that bleaching is very much in the same state that Berthollet left it, except for

improved mechanical appliances, and finds that all authorities since his time have adopted the hypothesis enunciated in the paper published in the *Annales de Chemie* for May, 1790, which runs as follows:—"Linen contains some colouring matters which can be directly removed by alkalies, but it contains others which require to be oxidized to become soluble, the latter by oxidation acquire precisely the same properties as the former, so that the action of chlorine upon these bodies is simply to change them into bodies soluble in alkalies."

The operations of bleaching resolve themselves into the use of three chemical agents.

1. A diluted alkali which removes from the fibre the yellow colouring soluble in ley.

2. Chlorine, by means of which the matter insoluble in alkali is oxidized and becomes soluble in alkali.

3. Diluted acids which remove from the fibre the alkaline and chlorine compounds with which it has been treated.

The remarks of the author refer chiefly to linen yarns, and are divided under three heads of action of alkalies, action of chlorine, and action of acids, antichlores, etc.

Action of Alkalies.—The microscope shews flax in its natural state to be a vasicular tube, articulated at intervals, partitioned, cylindrical, open at its extremities; these tubes are united by a gummy matter which it is the object of steeping or retting to dissolve. After steeping the gummy matter is gone, and there is seen a certain number of brilliant scales of a resinous appearance, unequally distributed over the fibres and in a manner attached to them by their rough surfaces. These scales are of a light amber colour, darkened by alkalies and completely soluble in them. They can be in great measure detached by mechanical operations. Berthollet was content to call this substance yellow colouring matter. Kirwan, in a paper read to the Royal Society of Dublin in 1793, deduced from his experiments that "the colouring matter extracted from linen yarn by alkalies was a particular kind of rosin, and which differed from other rosins by not being soluble in essential oils." Others have given it other names to suit their theories.

The author chose Russian linen yarn, which is very difficult to bleach, for the purpose of his experiments; an elementary analysis taught him nothing; alcohol and ether extracted 4·8 per cent. of a white fatty matter of the consistence of wax, and an odorous greenish substance to which the particular smell in linen bleaching is owing. The fatty matter is saponified by caustic alkalies and gives a solution which froths; carbonate of soda dissolves more of the greenish matter than of the fatty, and this explains why yarns treated with carbonate of soda are softer than those treated with caustic soda.

The yarn which had been treated with alcohol was next boiled in diluted caustic soda until it ceased to lose weight, it lost 22·1 per cent., and the alkali had acquired a tolerably dark brown colour, but did not froth and had no smell, owing to the previous treatment. Caustic potash and ammonia give the same results, and even carbonate of soda, though its action is somewhat slower.

When the alkaline liquor is neutralized by acid, there is a precipitation of yellowish brown floculent gelatinous matter. but the liquor remains coloured, containing matter not precipitated either by excess of acid, or by addition of lime or baryta. The unbleached yarn treated with cold water for a week lost only 0·6 per cent. in weight; boiled for twenty-four hours with water it lost 3·2 per cent; boiled with water for seven days, renewing the water twice a day, it lost 16·4 per cent.; and boiled in water for a week under a pressure of five atmospheres it lost 18·1 per cent. The liquors from these treatments have a feeble acid reaction, and are not precipitated by dilute acids or by baryta, but matters can be removed from solution by sub-acetate of lead. These characters of the solution shew the idea of a resinous saponification to be inadmissible.

Carbonate of soda is completely neutralized when boiled with an excess of linen yarn, and carbonic acid is liberated; sulphuret of sodium acts as effectually as caustic soda, removing 21·5 per cent. of the weight of yarn previously treated with alcohol, and after eight hours' boiling no sulphuretted hydrogen was to be found in the solution.

These experiments lead to the conclusion that the colouring matter acts as an acid, decomposing carbonates and sulphurets. Lime acts in the same manner as caustic soda, removing 21·2 per cent. of the weight of the yarn, and for every 100 parts of colouring matter dissolved, 48 parts of lime were found to have entered into solution; carbonate of lime in the shape of chalk has a similar but much slower action. The lime and chalk have an injurious action upon the fibre, especially if it is exposed to air while boiling with these substances.

The matter dissolved by alkalies proved upon examination to possess all the properties of the metapectic acid obtained by Frémy, by acting upon pectose or pectic acid. The question then arose whether the retted flax contained pectic acid ready formed; or whether the pectic acid was formed from pectose by the action of the alkalies. Experiment shewed plainly that fully-formed pectic acid exists; and the conclusions to be drawn are, that in the green flax, the so-called gummy matter cementing the fibres is nothing but pectose; that in the retting pectic fermentation takes place, transforming the pectose into pectine, which dissolves, and pectic acid, which is insoluble and remains mechanically attached to the fibres. In the retting there is formation of ammonia, and probably some metapectic of ammonia is formed which gives the peculiar colour to the flax.

Although as it has been shewn boiling water alone transforms the pectic acid into soluble metapectic acid, the action is too slow to be of technical application; the pectates formed by the action of cold alkalies are of a gummy consistence and form a coagulum round the fibre which stops further action, cold carbonate of soda acts but feebly upon the pectic acid, but at boiling temperature the acid is transformed into metapectic acid, which decomposes the carbonate so well that it is indifferent whether caustic or carbonated alkalies be employed.

The author gives a table of results from numerous experiments shewing the loss in weight of yarn and the strength of yarn after various treatments with solution of

carbonate of soda, caustic soda, and slacked lime. It is found (1) that the weakening of the yarn is not in proportion to the weight lost, (2) that the weakening is independent of the proportion of carbonate of soda employed even when the solution is very concentrated, (3) that caustic soda weakens the fibres more easily than carbonate of soda, (4) that lime, even in the cold, weakens the fibre very considerably, (5) that the greatest weakening of the fibre is by prolonged boiling, especially with caustic soda, (6) that eight hours' boiling does not seem to injure the strength of the fibre, (7) the loss of weight by boiling with alkalies varies according to the origin of the yarn, and may be from 15 up to 36 per cent.

After a number of succesive boilings with alkali the fibre remains of a constant weight, the brownish colour has disappeared, and the yarn has only a pale grey shade, which is believed to be due to the process of retting, as it varies with the different methods employed.

The author submitted this purified fibre to elementary analysis, and found that its composition was precisely the same as that of cellulose, either the grey colouring matter has a composition similar to cellulose, or it was too small in quantity to sensibly affect the results of the analysis. By dissolving the cellulose in the copper-ammoniacal liquor of Peligot, filtering through asbestos, and treating with acid, the cellulose is precipitated perfectly white, but if precipitated without filtration the cellulose carries down with it some floculent matters, and is coloured unevenly grey. The grey matter was isolated and presented the following characters, it is bleached but not dissolved by chlorine or hypochlorites, it is insoluble in acids and dilute alkalies, in alcohol, ether, &c. When this substance is decolourized by chlorine water it is insoluble in potash or soda, and is not coloured by these agents; it possesses none of the properties of pectic or metapectic acid.

Action of Chlorine.—If yarn be thoroughly purged of its pectic matters and steeped in exceedingly weak chlorine water, it will be bleached in twenty-four hours without losing in weight or suffering in strength; if a stronger chlorine water be taken, the bleaching will be more rapid and accompanied

by a loss of 8 per cent. in weight, and its tensile strength will be nearly destroyed. In the first case the colouring matter alone has been modified, in the second the cellulose has been actively attacked. Analysis shews that the loss of weight is due to cellulose oxidized and converted into carbonic acid. By experimenting separately upon the grey matter, the cellulose and the pectic substance with chlorine water of various strengths, it was found that in diluted chlorine water the grey matter alone was bleached; in a stronger solution the cellulose was acted upon, and it was not until a very strong solution was employed that the brown pectic matters were acted upon. From these experiments it is clear that chlorine can only be depended upon to bleach the grey matter, and that it cannot be counted upon to bleach the fawn colour, which is only acted upon after the cellulose is seriously injured.

When linen contains for example 25 per cent. of its weight of pectic matters, the first alkaline treatment it gets in practice is never sufficient to remove the whole of this quantity, scarcely 10 per cent. is removed. The succeeding chlorine treatment can only act upon the grey colouring matter, for if it is so weak as not to act upon the cellulose of the fibre, it can only have the most insignificant action upon the 15 per cent. of pectic matters remaining, which, by their ochery colour, mask the white of the fibre; it is only by successive alkaline treatments that the pectose is dissolved and the fibre whitened. The great excess of pectic matters prevent the chlorine attacking the whole of the grey matters at one operation, hence the necessity of alternating the alkaline treatments with more and more diluted chlorine treatments.

The author made experiments upon the action of dry chlorine upon dry linen exhausted by alkalies, no bleaching action was observed even when exposed to sunlight, the fibre was completely disintegrated, but seemed chemically unaltered. Dry hypochlorous acid bleached the same linen instantly and destroyed the fibre totally; when the hypochlorous gas was passed over the linen in a long tube dry

chlorine alone was delivered at the exit end, the gas was decomposed, the oxygen having been absorbed. Ozone liberated from a mixture of sulphuric acid and permanganate of potash bleaches the linen slowly, and slightly augments its weight; dry or moist oxygen has no bleaching action. While chlorine water rapidly injures the tensile strength of the fibre, it is remarkable that hypochlorous acid bleaches more quickly and is much less injurious, and only when in a concentrated state acts in a conspicuously hurtful manner. Concentrated peroxide of hydrogen bleaches the linen in about five hours, completely destroys the fibre, and shews a loss of 6 per cent. of weight; in more dilute solutions of the peroxide, the bleaching can be accomplished without perceptible injury of the fibre, and with but slight loss in weight.

From these experiments it appears that the bleaching is actually accomplished by the oxidation of the colouring matter, and that injury to the fibre is traceable to chlorine; and the author has shewn that solution of bleaching powder can directly yield oxygen without the intervention of an acid, and the hypochlorite of lime is changed into chloride of calcium, no free chlorine is produced, and the fibre only suffers such injury as can be attributed to active oxygen. Experiments are quoted in proof of this statement, and shew that linen is bleached by immersion in solution of bleaching powder without acid, and there is not much weakening of the fibre; this, of course, only refers to proper strengths of bleaching powder, very strong solutions reduce yarn to pulp in a short time. The hypochlorite of soda behaves in precisely the same manner as the hypochlorite of lime; in contact with linen yarn it is decomposed into common salt and active oxygen, but is somewhat more injurious to the strength of the fibre. The same action takes place if an excess of alkali or lime be present with the hypochlorites, the oxidation is effected with the same facility, but if instead of alkali, acid is added, the results are totally different; a current of carbonic acid sets hypochlorous acid free, this acts upon the yarn both by its oxygen and by its chlorine, and the bleaching is accompanied by destruction of the fibre; if, instead of carbonic

acid, a stronger acid, such as hydrochloric acid, be mixed with the hypochlorite, chlorine is liberated, and the maximum destructive action upon the fibre is obtained.

In practical bleaching the yarn is washed with boiling water after the alkali boil; this washing is very important if the goods have to remain a considerable time between the alkaline and chlorine treatments, for it is frequently found that yarn not well washed is injured in strength. This action of soda has been variously interpreted, but the real explanation of it is, that by exposure to air the soda becomes concentrated and carbonated, then crystallizes and tears the fibre; sulphate of soda has the same action in a stronger degree, the alkalinity counts for nothing in this phenomena. No harm is done by putting the linen still containing alkali direct into the bleaching powder solution; but attention is drawn to errors made in the strength of bleaching solution when reliance is placed upon the hydrometer, the employment of the solution one degree or more weaker or stronger than prescribed is a daily occurrence in bleachworks, and this divergence in the strength of weak solutions frequently makes the difference between a safe and a destructive bleaching action of the liquor; chemical means of testing should be employed, which are a hundred times more exact than the hydrometer.

The old method of treating linen with bleaching solution was to steep it in pits and leave it several hours, this gives unevenness in the bleaching, and was remedied by causing the goods to be moved, but as this could not be well done in the liquor itself the system of rollers was employed, which is still in use, this exposes the cloth to the action of the carbonic acid in the air, hypochlorous acid is formed, which has been shewn to be more destructive to the fibre than neutral or alkaline bleaching powder solution.

Action of Acids.—After the bleaching solution treatment the linen is passed into hydrochloric acid, this is necessary to remove lime, but if any considerable amount of undecomposed bleaching liquor is in the cloth there will be liberation of chlorine gas, which is very injurious to the strength of the

goods, the cloth or yarn ought to be washed between the bleaching liquor and acid treatments.

Acids should be used as weak and washed out as quickly as possible, for a prolonged contact, say for twenty-four hours, with hydrochloric acid of two degrees of the areometer (say 3 to 3½° Tw.) is proved to be injurious; it has been said that the presence of chlorate of lime in bleaching powder is particularly injurious, but this is not the case, at least experiments made with chlorate of lime and chloric acid do not support this view, no injury to strength was found.

In many bleach works what are called *antichlores* are employed to destroy the chlorine or hydrochloric acid which may not be completely removed from the linen; it is observed that chlorine adheres more tenaciously to linen fibre than hypochlorous acid.

The most usual antichlores are hyposulphite of soda, protochloride of tin, and arsenious acid. Fordos and Gelis have justly observed that if these substances destroy chlorine they have the disadvantage of forming acids which act injuriously upon the fibre, and which are retained in the cellulose by a peculiar sort of capillary affinity. The author proposes ammonia as the most suitable antichlore, it forms with chlorine and hyprochlorites, free nitrogen and hydrochlorate of ammonia, two substances perfectly innocuous, and the excess of ammonia at the same time completely neutralizes all traces of acid.

Ammonia is a good test as to the completeness and success of the bleaching; well bleached linen is not in the least coloured by it, linen which is white but not thoroughly freed from pectic matters becomes yellowish in weak ammonia; such linen will most probably become yellow if kept in store for some length of time.

4. Upon the Former and Present State of Engraving for Industrial Purposes in the neighbourhood of Rouen.

A REPORT of the present state of engraving for calico printing in the Rouen district seeming a subject of interest to the Committee of Industrial Art of the Industrial Society of Rouen, a commission was appointed from that body composed of MM. Bentz, Buquet, and Benderitter. They were requested to undertake the work, and the following is taken from the report made by M. J. Buquet.

As it is acknowledged that engraving for industrial purposes proceeded from artistic engraving, it was deemed indispensable to glance at the history of this art, the means employed, and the changes which it has undergone, in order to meet the demands made upon it; for at the present time, engraving in all its varied phases, from camoe-cutting and die-sinking for medals, down to the engraving of copper-plates and rollers for printing either on paper for fine art, or on textile fabrics or paper hangings, is an auxiliary to industry.

It is certain that engraving by incision upon a plain surface was known to the ancients; their monumental inscriptions were made by this process.

Engraving in relief is not less ancient; the cuniform impressions on the burned clay bricks of Nineveh indicate the use of punches, and ancient coins could not be executed without moulds and stamps.

It is apparent that the first practical use of engraving was for stamping, and it is necessary to come down to an epoch relatively modern to find it employed in printing; but it is as applied to printing that this art has expanded, and become the indispensable assistant of science, art, and industry.

In 1425 the Biblia Pauperum (the poor man's Bible) was produced in France with engravings and text, the whole was cut on wood, and the impressions obtained by rubbing. An

engraving of St. Christopher, of German origin, is dated 1423, and one of St. Bernard, engraved in France by B. Milnet, in 1425. These are the actual dates of the origin of engraving for printing in the West, for the earliest printed books of Germany and the Low Countries are dated 1445, and for Paris, 1470.

It is unnecessary to enumerate the admirable engravings of Albert Durer, or of Lucas of Leyden, and they are only mentioned to fix the commencement of the sixteenth century as the time when the art of wood engraving was at its best; it declined during the seventeenth century, and only renewed its position in the book trade and fine arts about the year 1832.

At the present time two totally distinct methods are employed for engraving blocks; the first is the ancient method in which the wood is cut so as to leave the design in relief; it demanded all the perseverance of the old masters to obtain an artistic result by this laborious method which is now exclusively devoted to manufacturing industry.

The cameo engraving which Huge de Carpi practised with success in 1500 ought not to be passed over, it was executed by means of three blocks; the first bore the outlines, the second the half-tints, and the third the strong shading. This process was employed under Louis XIII. for the manufacture of printed effects intended for tapestry; this method was in use until 1746, but the colours, which were either oil or water colours, being only superficially applied were wanting in durability. Goods of this style are to be found at Paris, Versailles, Marseilles, and Orange.

In 1736, Captain Beaulieu described the processes of printing which he had the opportunity of studying at Pondicherry. The experiments which he made in conjunction with the Academician Dufay were perfectly successful, but there is no record to shew that their results were followed by manufacture on a large scale. It is, however, certain that towards 1754 Cottin and Cabones were authorized to establish a works at the Arsenal in Paris.

In 1778, Abraham Fray, of Geneva, coming from Corbeil,

was the first to print with block in the valley of Bendeville, and he was followed by Abraham Pouchet, of Balbec. They held royal letters patent dated 1759.

Peter Roger founded a print works at Déville, and manufacturies rapidly increased. It was at this time that the block-cutters wishing to improve their productions, began to use copper in the construction of the block, shaped by hammering, filing, or drawing, so as to obtain finer outlines, not liable to become clogged with colour.

This kind of work required much ingenuity and skill on the part of the workman, and was justly considered as the most perfect method of obtaining impressions from blocks. Since then several processes have replaced this kind of work. These are (1) the polytype of 1835; (2) the stereotype method by means of plaster moulds, which commenced at Toisville in 1838 with the experiments of the brothers Seguin and M. Chiffray, who introduced the process in Rouen in 1840, and instructed M. Gerard, of Déville. Since this time the polytype method has prevailed, by help of what is known as the burning machine, in which a blade of platinum at a white heat burns the design into a block of lime-tree wood, from which casts in metal can be obtained as often as required.

Engraving in relief is now but little employed in calico printing; it is too slow when applied by hand and too coarse when worked in the perrotine, and is principally used for entering certain colours after machine printing.

Block printing by hand is however still carried on in Alsace for the production of high class and consequently high priced products, which cannot be produced equally perfect by any other process.

In 1808 the flat press printing machine was introduced into Rouen and employed to print small designs for black and white ground garments, and afterwards furnitures, in imitation of the production of Nantes, Jouy, and Munster. There were at this time a great number of plate engravers at Rouen, and when the roller printing machine began to be successfully employed some of these engravers took up roller engraving by means of the punching machine.

The flat plate could not compete for rapidity of printing with the roller, and the copper-plate engravers transferred their labours to roller engraving, but the flat plate was not wholly abandoned, for up to 1825 it was used for furnitures and foulards.

Since 1826 furniture styles have been entirely done by roller, and some of these were engraved after the acquatinta style in single colours, which had a durable success and is employed up to this date, and the present styles in three or four colours are really a continuation of it. At the present time large furniture patterns are always in part at least engraved by hand, but the number of hand engravers is very limited, owing to the vicissitudes which this branch of the trade has undergone.

In 1755 the process of printing by roller was invented by Bonvalet,* a woollen printer of Amiens. This method extended to all woven fabrics, was improved in a remarkable degree by Oberkampf-Nobson.

In 1772 Gingembre and Fiezenger made experiments at the Paris mint with a machine of their invention to engrave rollers by punches and the fly press. This process was introduced into Rouen in 1813 by Petit, Hugo, and Curé, engravers and machine makers. At this period small designs called mignonettes prevailed, to which designs for resists followed. At this time also the elder Carliez constructed an engraving machine for the firm of Girard. In 1822 Lefévre, a Parisian machine maker, having sold a punching machine for engraving rollers of a superior construction to any previously existing, undertook to instruct a certain number of pupils in the use of the machine.

Machine engraving became thus improved, and the demands of trade extending its employment, there was created a special class of engravers who have contributed by their discoveries to those improvements which makers have successively introduced into the system.

* This is quite a new name and a new date in the history of calico printing by roller, and being found in conjunction with Oberkampf, whose claims are given up elsewhere, seems to indicate an imperfect acquaintance with the literature of the subject.—*Ed.*

Although the application of mill engraving by punching in 1800, by Perkins, and the rose-engine or eccentric lathe engraving by graver, or by etching invented by White in 1810, were not adopted until later on in Rouen, they should be mentioned. The engraving machine for the circular mill, perfected in England in 1820, by Perkins and Fairman, and introduced in France by M. M. Hausmann, of Mulhouse, in 1825, was only tried in Rouen in 1829.

The mill engraving process which allows the execution of large designs is the principal process at present in use for roller engraving.

Towards 1854 the galvanoplastic process came into use, and Cripp's pentagraph, afterwards improved by Rigby and Shield.

Although the mechanical work of an engraver may seem to have no claim to be called artistic, it would be unjust to refuse to consider it as an art. The engraver's work generally commences with the graver or the tracer, and requires much taste and knowledge so to execute it as to give the proper effects in the printing machine.

Up to 1854 roller engraving was in a flourishing state, and there were numerous workshops. At the present moment there are only thirteen establishments in Normandy, including those on printworks, occupying altogether about 160 workmen; there are 38 mill engraving machines, 15 ruling machines, 2 pentagraphs, and 1 eccentric; three works employ steam power; this is scarcely the half of the single establishment of Lockett's, of Manchester. To this decadence must be added the total absence for fifteen years past of learners or apprentices. Each year shews a gap in the number of engravers. Is it possible to surmount this want by seeking capable men from abroad? That is not probable, since, in other countries, there is no superfluous number of engravers.

The absence of apprentices is owing to the necessity of giving up three or four years to learning, and is a sacrifice to which the modern manufacturing system has quite unaccustomed the working class.

No doubt improvements in processes, increased rapidity of

execution, and diminution of cost are important considerations for trade, but whither will these lead if a total neglect of art deprives industry of its help?

5. *Wool and Silk Dyeing at the Gobelins in 1847.*

[The following, which has an historical as well as some practical interest, is extracted from an article which appeared in the Art Journal, 1853, p. 127, and seemed worth recording in the Textile Colourist. Our practical readers will be able to fill up the hiatuses of weights and measures.]

THE following extracts from the note book of the writer of this article*—notes made during the time he received the special permission of Louis Philippe to attend daily at the dyehouse and inspect the operations in progress — may perhaps prove of some interest to many readers. To reproduce with correctness on tapestry any painting requires the employment of an immense number of shades of colour, the obtaining of which is entirely dependent on the practised eye and skilful manipulation of the dyer, who, in the preparation of ingredients employed in forming a bath for any particular colour, has recourse more frequently to the "rule of thumb" than to scales and weights. It is, therefore, impossible to give the pounds and ounces of dye-wares used in most cases, the relative proportions of these to one another differing according to their respective qualities and to the particular circumstances of the case. Both the silk and the wool dyed at the Gobelins are in skeins or hanks.

Light Flesh Colour to Dark Crimson on Wool.—Alum and tartar mordant. Bath of cochineal, to which is added decoction of logwood, sumach, weld, and sulphate of iron, in suitable proportions.

* The article is unsigned, and we have no clue to the writer's name.—*Ed.*

Marrone (Chestnut) and Savoyard to Black on Alumed Silk.—The bath is formed by boiling together for an hour or two weld, madder, and a little logwood and fustic; sulphate of iron is then added. To obtain darker shades a further addition of logwood is made, and the silk passed through a solution of sulphate of iron, and some of the bruniture (saddening) or dark mixture kept ready for use, the preparation of which will be given afterwards.

Pink on Alumed Silk.—Bath formed of solution of alum and cochineal. About 4 oz. of cochineal to 1 lb. of silk. About one-fourth of the copper is filled with water, and the cochineal being added, it is heated for an hour and a half. The decoction is now boiled for a few minutes, and the copper filled up with cold water, and but very little fire kept under. The silk is put in at the temperature of 120° F., and the heat gradually increased.

Light to Dark Yellow for Wool.—Make a bath of weld; for light colours boil the weld for ten or fifteen minutes only, but for dark colours boil the weld for two or three hours.

Chocolate on Wool.—Alum and tartar on mordant. A yellow body is first given to the wool by a dyebath of weld, for which purpose the weld should be boiled about twenty minutes. Then add a small quantity of madder, and pass the wool through the bath. Afterwards, gradually add some bruniture (saddening) and decoction of galls, also some pyrolignite of iron, and if not yellow enough add some strong decoction of weld; if too red, put through alum and tartar mordant again, and proceed as before with weld and bruniture, *q.s.* About 2 lb. of madder will suffice for 30 lb. of wool.

Black on Wool (1).—For 20 lb. of wool use 1 lb. of tartar and 3 lb. of sulphate of iron for mordant. Make a bath of logwood, and add 3 oz. of sulphate of copper; to give darker colour add some sumach. The addition of a little weld or fustic is also useful.

Black on Wool (2).—Pass the wool through the indigo vat, and afterwards through a bath of cochineal and sulphate of iron, or of logwood, galls, or sumach.

Deep Gold Brown on Wool.—Alum and tartar mordant. Make bath of weld by boiling for half an hour or more, and add gradually *q.s.* of madder. Use three successive baths of weld, four bundles for each 40 lb. of wool.

Mahogany Colour on Silk.—First give body with a solution of annatto according to tint required, then pass through two baths of weld, finishing with madder and bruniture.

Marrone on Wool.—Pass the wool through three baths of weld; in last bath put three or four pailsful of soot for each 40 lb. of wool. Boil one hour and skim; pass the wool through, next pass through bath of madder and bruniture, *q.s.*

Blue-Black on Wool.—Pass the wool through a solution composed of 1 lb. of tartar, 1 lb. of sulphate, or equivalent quantity of acetate of iron, and 5 or 6 oz. of verdigris; finish with a bath of logwood, sumach, and sulphate or acetate of iron.

Turkey Yellow on Wool.—A bath is formed by boiling four bundles of weld, weighing from 10 to 12 lb. each, in 150 gallons of water for about twenty minutes. Through this bath 42 lb. of wool, previously treated with alum and tartar mordant, are passed three times successively. Last time add about two hansdful of madder gradually. Then throw away two-thirds of the contents of the copper, fill up with cold water, add about 1 litre of bruniture, and pass the wool through again.

Lilac on Wool.—Treat with alum and tartar mordant for about half an hour, take out skeins for lighter shades first. Dissolve about 1 oz. of ammoniated cochineal in 3 pints of hot water in a tin vessel. In another tin vessel, capable of holding 4 or 5 gallons, put 2 gallons of water, and about 1 of tartar and alum mordant, with a small additional quantity of alum and tartar; boil till dissolved. If it should have a dark appearance, throw away one-third and fill up with cold water; add the ammoniated cochineal gradually, and pass all the skeins of wool through the bath all the while on the fire, and the temperature at first about 130° F. gradually increased. Add some more ammoniated cochineal to a fresh bath if necessary, and give also a bath of archil (very small

quantity). Then to a vessel of cold water put a bowlful of warm indigo vat liquor, and give the wool the desired shades by passing it through this blue solution. For dark lilac the wool may be put through the indigo vat. The wool should be wrung out, and dried quickly.

Rose Colour on Wool.—Treat 60 lb. of wool with alum and tartar mordant for two hours. Prepare a bath with about ½ lb. of cochineal, and three handsful of madder previously dissolved in water, add gradually. Expose the wool to the air, then empty the bath, and start a fresh one, add gradually more solution of cochineal and tartar to obtain the required shades. About 2 lb. of cochineal are sufficient for 60 lb. of wool. A small quantity of the tin solution may be added if requisite.

Green on Wool.—Place 20 lb. of wool in a vessel containing 100 gallons of water at 186° F., in which 4 lb. of soda crystals have previously been dissolved, and let remain therein for half an hour. Then wash the wool in water and expose to the air. Alum and tartar mordant. Put about three large handsful of bois jaune (fustic) in 2 or 3 gallons of water, boil, and keep hot for two hours. Put ½ lb. of carmine of indigo into a gallon of water. Mix the decoction of bois jaune with the indigo solution in the bath in proportions according to the shade of green required. If any of the skeins take the green colour unevenly, pass them through the soda-bath above mentioned, which will remove the blue; then mordant again with alum and tartar, and proceed as before. Add some alum to the bath before using it for green, and also occasionally in the course of the dyeing.

Dark Greens.—Use strong decoction of yellow wood, or preferably, the red fustic with solution of carmine of indigo, and a little indigo solution according to the tint required. Alum also may be added. For very dark greens, pass through the indigo vat.

Dutch Black on Silk.—Pass the silk through bath of galls and sumach, in the proportion of about ½ lb. of galls and 3 lb. of sumach to 1 lb. of silk; wash, then pass through bath of sulphate of iron, and afterwards solution of Prussian blue in

muriatic acid; then pass through fulling mill with fullers earth. Bag the silk.

Green-grey on Wool.—Pass the wool through a weak bath of weld and madder, to give various gradations of straw colour. Darkest shade first; others progressively put into the bath; than add more decoction of weld and madder as may be desired; finish with pyrolignite of iron.

Dead Green on Wool.—Bath of madder, weld, and bruniture, and for darkest shades of this and *vert-mort-jaune,* add soot *q.s.*

Lilac to Plum Colour on Wool.—Bath of cochineal, afterwards pass through archil in hot water; takes the indigo vat afterwards better than cochineal alone, and more evenly.

Reds and Marrone on Silk and Wool.—Use bath of red sandal wood with mordant of muriate of tin.

Purplish-blue.—Mordant of alum, and solution of tin. Afterwards bath of logwood or Brazil wood.

Brown.—Bath of pyrolignite of iron, Brazil wood, and galls.

Bordeaux Wine or Claret Colour on Wool.—Alum and tartar mordant and bath of cochineal, madder, and weld.

Fine Black for Silk.—Extract of chestnut with tartar and sulphate of iron.

Light Yellow on Wool.—Boil one bundle of weld to each 30 lbs. of wool for from ten to fifteen minutes.

Grey-Green.—Bath of madder and weld with some bruniture; finish with indigo vat.

Brown.—Decoction of walnut peel with madder, and pyrolignite of iron or bruniture.

Deep Yellow.—First give bath of weld, then madder, and finish with bruniture.

Gobelins Purple.—Bath of cochineal and indigo vat. Alum and tartar mordant.

Grey-Blue on Wool.—After treatment with soda, give indigo vat according to shade; wash. Give mordant of alum and tartar in hot water for a few minutes; then pass the wool through a bath of madder and weld, adding a small quantity of cochineal to the darkest shades.

Yellow on Silk.—First, solution of annatto, then alum mordant, and finish with bath of weld.

Green on Silk.—Mixture of solution of indigo and carmine of indigo with turmeric.

Light Paille.—Bath of weld, madder, and bruniture.

Olive (not solid).—Bath of logwood and sulphate of iron.

Olive (solid).—Pass through indigo vat, after which dip three times in bath of weld.

Marrone.—Give body of weld, then madder, pyrolignite of iron, and bruniture.

Golden-Yellow.—Bath of weld and madder, with the addition of a small quantity of annatto.

Flesh Colour.—Bath of cochineal, madder, and red fustic.

Yellow Olive (Vert d'osier Jaune).—Bath of weld and bruniture, with addittion of madder for deep shades.

Columbia Blue (Light Violet).—Bath of cochineal and indigo vat.

Blue.—Indigo vat only. Very dark blue, add pyrolignite of iron.

Green-Primrose (Vert gai Jaune).—Bath of weld and indigo vat for lighter colours; add pyrolignite of iron or bruniture for darker colours.

Green for Silk.—Bath of weld and indigo vat.

Dead Heavy Black for Silk.—Extract of chestnut solution, and afterwards indigo vat.

Dust-Grey (Gris de Perle).—Bath of cochineal, weld, and bruniture.

Gris de Lin.—Bath of cochineal and indigo vat.

Silver-Grey.—Bath of cochineal, madder, and bruniture.

Orange-Gold.—Bath of cochineal, madder, solution of tin, and fustic.

Aluming of Silk.—Put about 12 oz. of alum for each 4 lb. of silk, with sufficient quantity of water; after twenty-four hours add 4 oz. more. Let the whole remain together about forty hours at the temperature of the atmosphere, in a dark cellar.

Ammoniated Cochineal.—One pound of cochineal, 3 lbs. of liquor of ammonia; mix together to form a paste.

Dissolution of Indigo.—Dissolve indigo in concentrated sulphuric acid; pass some wool through it to remove the red or brown particles of indigo.

Alum and Tartar Mordant for Wool.—Six pounds of alum, 1½ to 2 lb. of tartar to 30 lb. of wool; remain one hour, one hour and a half, or two hours, according to tint required.

Bruniture.—One pail of sumach, six of logwood, and 1½ lb. of galls. Boil together in 30 parts of water for three hours. Slacken the fire, fill up with cold water, run off into store vessel, and when cold, add 12 lb. of sulphate of iron.

Carmine of Indigo.—One pound of indigo to 3½ lb. of sulphuric acid.

Tin Solution.—To 8 lb. of nitric acid, add 1 lb. of muriate of ammonia, and afterwards add gradually 1 lb. of pure tin in fine shavings, and 2 lb. of water.

Degummage or Scouring of Silk.—Boil 42 lb. of silk for one hour and a half with 11 lb. Marseilles soap, and afterwards boil again for an hour and a half with 6 lbs. of soap.

Degraissage or Scouring of Wool.—Soak the wool for forty-eight hours in a mixture of lime and water, using 4 lb. of lime for 20 lb. of wool. Wool to be dyed green must be scoured with soda, as mentioned above.

Mordants.—No alum and tartar mordant for blue. Tartar only for crimson. Alum the only mordant for silk.

The indigo vat (cuve d' Inde) used at the Gobelins is a deep copper vessel set in brickwork; its shape is conical, narrowing downwards, so that a space is left between its side and the brickwork which surrounds it, and on which it rests at the upper part. The lower part of the vat is about a foot and a half in the ground. To start the vat there is put into it some water, 2 lb. of *cendres gravelées*, a bowlful of bran, and a handful of madder; and a fire of wood being introduced through a door opening into the brickwork, the whole is boiled for about an hour. One lb. of powdered indigo is then added to a small portion of the above, and the mixture put into the vat, together with the requisite quantity of water to fill the vat. The vat is then shut up, a small fire is placed within the brickwork, so as to heat the sides of the vat, and a careful rousing of its contents is then given. The temperature of the vat should be kept at about 60° F. for a day or two, a rousing being given to it every twelve hours. At the

expiration of forty-eight hours, if well managed, the liquid in the vat will be of a fine green colour, and its surface will be covered with a blue scum, or *fleurée*, with coppery coloured flakes. Should the colour not be considered deep enough, what is termed a brevet is given to it. This is prepared by putting 1½ lb. of *cendres gravelées*, a small bowlful of bran, and a handful of madder in about 4 gallons of water, the madder being added when the water is on the point of boiling. After boiling two or three minutes, the whole is put into the vat, the temperature of which is about 150° F. The contents are then well stirred, and a moderate heat kept up. One, two, or more brevets are sometimes required, as the vat proves weak and the colour diminishes. When the liquid in the vat assumes a dark and thick appearance, a clearing must be given it, which is done as follows:—Fill a copper holding about 90 gallons with the liquor of the vat, leaving the sediment behind; add to the liquor 1 lb. of *cendres gravelées*, and two small bowlsful of bran; light a fire underneath, and when the liquor has got tolerably warm, skim off the bran, and add another two bowlsful. When the liquor boils, skim off the bran again, let boil for two or three minutes, and then add cold water, and put out the fire. Fill up with cold water, and after about half an hour put the contents into the vat, stir up well, put a moderate fire under, and cover up. When the indigo is found to be expended, a fresh addition of it with *cendres gravelées*, bran, and madder must be made.*

Weld or Madder Colours.—If not good or even, put into alum or tartar mordant and boil for two hours. Use for dark colours as chocolate, &c.

Weld.—Always boil it in hard water; the colour obtained is much clearer.

Dyebath.—Always give weak bath first; the colour takes

* *Cendres gravelées* are the product of the combustion of wine lees and vine branches, and are very rich in alkali, containing about 16 per cent. of potash. The alkali is used as a solvent of the indigo, and being more soluble than lime the dyebath thus obtained is much richer in colour. It is, of course, much more expensive than lime; but in an establishment like the Gobelins, the best method is desired. Wool dyed in the potash vat possesses considerably more softness than that dyed in the lime vat.

more uniformly. In light shades give bath as cool as possible; the colour will be more even.

Archil gives a degree of freshness and clearness to colours.

Decoction of Brazil wood improves by age, but

Decoction of Logwood deteriorates by being kept; it is best when made a day or two before use.

6. *Upon the Action of Acids in Dyeing with the Colouring Matters of Madder or its Artificial Substitutes.**

BY M. A. ROSENSTIEHL.

In a former communication I made known the result of my researches upon the part which the different colouring matters of madder took in dyeing. I only alluded to the subject which I propose to treat in this paper, that is the influence of acids in dyeing. In the previous paper I determined the proportions of carbonate of lime which gave the best results, and I shewed the necessity of employing this salt in the state of soluble bicarbonate. But this compound is so unstable, that when the temperature is raised the carbonic acid is displaced by the colouring matter, which then enters into combination with the lime, forming a purple precipitate which is no use in dyeing. The lime-lake of alizarine was shewn to be easily decomposed by carbonic acid, the purpurine lake only slowly decomposed, and the pseudo-purpurine lake hardly at all acted upon; but the presence of carbonic acid was shewn to retard the formation of these lakes. The conclusion follows that better dyeing would be obtained if carbonic acid was passed through the liquors while dyeing, and experiment on the smaller scale has confirmed this, and shewn a considerable difference between a sample dyed with and without the help of carbonic acid; the dyebath, instead of

* Bulletin de la Soc. Ch., xxv., p. 53.

being turbid and coloured at the end, was remarkably clear. My experiments on the small scale, made with all the care which these kind of experiments demand, indicated an economy of 20 per cent. of colouring matter.

The experiments were repeated upon a larger scale upon pieces 25 yards long, in a suitable dyeing vessel, so constructed that there was 1 to 1½ litres of water for each metre of cloth. The water was heated by a worm to avoid increasing its bulk; several kinds of water were tried, and the result was that no economy or advantage was derived from the use of carbonic acid, except in one case where the water contained a large quantity of carbonate of lime.

This negative or even contradictory result is explained by saying that when working upon a litre of water in the laboratory, the carbonic acid gas naturally in the water soon escapes and allows calcareous lakes to form; but it is not so in larger quantities of water where the gas, or a sufficient quantity of it, remains in the water until the dyeing is finished. This explains the fact known to practical men but not understood, why it is impossible to dye two lots of pieces in the same bath properly freshened up; the cause is that there has been so much carbonic acid lost that there is not enough for a fresh operation. It was found upon further trials that acetic acid would do instead of carbonic acid, and that under the usual conditions of dyeing mordanted cloth, alizarine can easily decompose acetate of lime, the acid is set at liberty, and either evaporates with the steam or accumulates in the liquor without injuring the results, while the lime fixes upon the cloth at the same time as the colouring matter.

The nitrate and chloride of calcium are also decomposed during dyeing, the liquor, which is neutral to begin with, becomes rapidly acid as the dyeing progresses, until a point is reached where the dyeing stops. Water containing chloride or nitrate of lime gives better results than distilled water in dyeing, so true is it that lime is indispensable for the madder class of colours. It may be concluded from the preceding facts that alizarine and its congeners act as strong acids when in presence of the oxides which serve as mordants; to support

this view the steam colours from alizarine and extract of madder are cited where the colouring matter is in presence of a mixture of acetates, sulphates, nitrates, and chlorides, which it must decompose in order to become fixed. In this case the decomposition is more complete than it can be in dyeing, because the displaced acids are to a certain extent carried away by the steam.

The acetate is the salt of lime most suitable for dyeing, and I have ascertained its action upon each of the colouring matters of madder, and upon artificial alizarine.

Alizarine, which does not saturate mordants in distilled water, dyes up perfectly well in presence of an equivalent of acetate of lime, better still with two equivalents, not well with three equivalents, and the dye is completely exhausted.

Pseudo-Purpurine, which does not dye at all in presence of carbonate of lime, fixes very well with acetate, an excess of which is not injurious. There is a partial change into purpurine during the dyeing.

Purpurine saturates mordants very well with addition of two equivalents of acetate of lime.

Extracts of Madder, and the red and purple *artificial alizarines* also dye with two equivalents of acetate of lime, the mordants are saturated, the liquor is spent and clearer than with carbonic acid.

It is concluded from these experiments that acetate of lime in proper proportions can be substituted for the carbonate, and it is suggested that in laboratory experiments, when testing the dyeing power of madder extracts or artificial substitutes, some acetate of lime should be added if distilled water is used; or if a calcareous water be employed, it should be corrected with acetic acid, and so much acetate of lime added as is required to complete the two equivalents. I employ normal solutions containing one-tenth of acetic acid, and of acetate of lime slightly acid; and experience shews that the best results are obtained if the dye liquor is acid from the commencement. By modifying in this manner the method of testing colouring matters, a much closer agreement will be found between the trials on the small scale, and the

results of practical working. The method adopted in some dyeworks of correcting an excessively calcareous water with acetic acid is perfectly rational, and should be extended; if a water contains sulphates, nitrates, and chlorides in hurtful quantity, it can be improved by addition of either acetate of lime or acetate of soda in proper quantity; an excess of acetate of soda must be carefully avoided, for it dissolves the colouring substances like an alkaline solution when warm, depositing them when cold. Such a mixture dyes very badly even in presence of lime salts, and seems to suggest that the acetate of soda is disassociated by heat, and that its base forms a real combination with the colouring matter.

In conclusion, I have shewn that by using acetate of lime in practical dyeing, many successive lots can be dyed in the same water by freshening up with acetate of lime and colouring matter. I have made eight successive dyes in this manner.

[In a note it is added that several years ago an English process of rapid dyeing was offered for sale at Mulhouse, in which acetate of lime was employed. M. Rosenstiehl was not aware of this at the time of composing this paper, and could find no account of it in the literature of the subject, but he is anxious to make the statement that the inventor may not be deprived of anything which he may claim.]

7. *Critical and Historical Notes concerning the Production of Adrianople or Turkey Red, and the Theory of this Colour.**

BY THEODORE CHATEAU,

Corresponding Member of the Industrial Societies of Mulhouse and Amiens, &c., &c.

IT seems proved that the red dye, variously called Adrianople, Turkey, Grecian, Levantine, and Indian red, originated in India, and was from there introduced into the Levant, whence,

* Abstracted and condensed from "Moniteur Scientifique," vi., (3,) p. 7.

after having undergone many modifications, it was imported into France by some Greeks towards the middle of the eighteenth century.

The Levantines held for a long period the secret of the process, and had a monopoly of the trade in red dyed cottons. When Felix visited Greece in the latter part of the eighteenth century, he found the principal Turkey red dyeworks in Thessaly, others were spread on the flanks of the mountains Ossa and Pelion. The waters of the vale of Tempe were very suitable for dyeing, and there existed numerous small works, the principal of which were those of Ambelakia. It was dyers from Smyrna, Salonica, and Adrianople who first worked the process in France, and up to the end of the last century they were at the head of the French dyeworks of the interior; but it was naturally difficult for a handful of foreigners to preserve their secrets for a length of time from the workmen employed, and in the course of ten years from their introduction their methods of working were copied and imitated so perfectly that we were no longer dependent upon them (Girardin). This is one version, but we have more precise and detailed accounts. It is generally allowed that it was in 1747 the Greek dyers were engaged by Fesquet, Gondard, and Haristoi, manufacturers at Darnetal and Aubenas. In 1748 Flachat, who had long resided in the Ottoman empire, collected some workmen, and with them commenced an establishment at Saint-Chamond, near Lyons; but the secret was soon out, and numerous imitators sprang up. At first yarns only were dyed, but in 1811 Koechlins and Weber commenced dyeing calico. Still another statement is that the Rouennais discovered themselves, and without foreign help, the method of Turkey red dyeing, and that Greeks from Smyrna only commenced in the midland provinces after the dyers of Rouen had achieved considerable success, and that the Levantines did nothing more than improve some of the processes, and that in a short time the Rouennais excelled the foreigners in this colour. About 1760 the Abbé Mazéas published some observations, which threw much light upon Turkey red dyeing. In 1765 the govern-

ment published all that could be learned about the process under the title: *Memoire concernant le procédé de la teinture du coton rouge incarnat d'Adrianople sur le coton filé.* Le Pileur d'Alpigny in 1776 and 1798, Schaeffer in 1803, Chaptal in 1807, and Vitalis in 1823, also published descriptions of the process. The brightening with tin solutions is said to be the discovery of Arvers and Saint-Evron, of Rouen, in 1785. It was Papillon, a Frenchman, who introduced the process into England, or rather into Scotland, in 1790, where he established a works. His process was communicated for a payment to the celebrated chemist, Dr. Black, to be kept secret for a number of years, and was afterwards published. The superiority of the Rouen colour was partly owing to the following circumstances: cotton, to be dyed Turkey red, has to be submitted to several preparatory treatments, between each of which it must be completely dried. In the centre and south of France this could be tolerably well accomplished in the open air or under sheds, but the climate in Rouen was frequently cold and moist, and from the beginning the dyers were compelled to use heated stoves, and it was found that the best temperature was from 143 to 151° F., which was, of course, much higher than that of the atmosphere. The other dyers in Provence adhered to natural drying up to 1808.

M. Chateau then gives at full length letters from the Catholic missionairies in India, describing, partly from accounts given to them, and partly from actual observation, the methods employed by the natives for dyeing the red colour. These letters are to be found in the collection of the celebrated "Lettres édifiantes et curieuses," 1743, and bear the date of 1742; they are of great interest, and were no doubt at that time of great importance, but they are very lengthy, and contain much which may be omitted. The following extracts will be found to contain all that is necessary to quote.

The letter of F. Cœur-Doux, of the 18th January, 1742, contains the following. "I have taken advantage of some leisure time to make myself acquainted with the manner in

which the Hindoos produce those beautiful cloths which form part of the commerce of the companies trading here; these cloths owe their price and value to their brilliancy,* and I may say to the fixedness and adherence of the colours with which they are dyed, which is such, that so far from losing their brightness when they are washed, they become even more beautiful. This, as far as I know, is what European industry has not yet accomplished . . . . What I have to say concerning these Indian prints *(peintures indiennes)* is what I have learned from some neophytes who are expert in this business. I have questioned them at different times and apart from one another, and it is their replies which I forward."

Before printing or pencilling *(peindre)*, the cloth has to receive some preparation; it is first half bleached, and then soaked in a decoction of myrobalans made in buffalo milk, rung out and dried in the sun, next washed and dried again. It is then subjected to a sort of beetling process by hand, the object of which is to render its surface more uniform and proper to be pencilled. The use of milk according to F. Cœur-Doux is to produce the same effect that gum, size, or other preparations have on paper making, that is, to prevent running or spreading of fluids applied to the surface. Buffalo milk is preferred to cow milk because it contains more fatty matter, and is more unctuous. The next process is to design flowers and other things upon the cloth, and then apply black and indigo blue in their proper places. For want of full details (the whole text of the letter not being given) there is some uncertainty of the nature of the colours, but next it is said, "the red is applied after the blue, but the wax which is upon the cloth must be first removed, and the cloth bleached and prepared to receive the colour." It is evident that this refers to a wax resist, and to blue dipping. The method of

* Here and elsewhere it is evident that the missionaries are speaking not alone of self-coloured reds, but of many coloured prints, and the processes are frequently confounded as will be seen; this is what might be expected from non-technical observers, however intelligent. But the first letter appears to refer exclusively to a system of printing or pencilling, and not at all to Turkey red.—*Ed.*

removing the wax is by putting the cloth into hot water which melts and liberates the wax. The bleaching is accomplished by washing and beating the cloth, and steeping it in sheeps' dung, washing, and exposing to sunshine for three days, occasionally degging with water to keep the cloth moist. The cloth is then washed again, and boiled in a sort of earth named ola, which appears to be a species of native alkali; it is again well washed, and steeped for a day and a night in water containing a small quantity of buffalo or cows' dung, washed again and exposed to the sun, washed again and dried.

To prepare this bleached cloth to receive the red, it is again steeped in decoction of a species of myrobalans, dried and steeped in buffalo milk, wrung out and dried ; then in those places which have to be preserved white a wax preparation is painted, and lastly, the red is applied by a pencil. The red is given as composed of 2 oz. of alum in 2 pints of water, and 4 oz. of sapan wood in powder, but more or less alum may be used according to the depth of colour required. The cloth is prepared for dyeing by washing in water and beating, great pains are taken to have it clean, and it is said to be beaten thirty times on the stone, the milk preparation causing it to resist the entrance of water. It is then dyed in a kind of madder called chaya or chaya-ver. No operation analagous to modern dunging or fixing is described, and it is difficult to believe that alum without some addition of acetates or alkali would yield alumina enough to the cloth to dye up a good red. After dyeing, the cloth is washed in a pond, well beaten, and bleached with sheeps' dung ; the third day it is soaped, beaten, and exposed to light in a humid state, and finally, washed in hot water.

This is in brief the substance of the letter of F. Cœur-Doux which goes into great detail upon some points.

The next letter, which has no date, but must be sometime before 1743, refers more precisely to red dyeing. The first process is to obtain the ashes of the plant *nayourivi*, a solution of the ashes is made and filtered and some sheeps' dung added ; then a small quantity of what is called yeast is mixed

with it; the yeast consists of ley of ashes mixed with serpents' dung and oil of sesame, which has been left to ferment 48 hours, and to the whole a quantity of oil of sesame, or, it would appear, other kind of oil or fat. When these drugs have been well mixed the oil will be rendered white and will not swim on the top, but if it is not so it is because the ashes have not been good and have been made from some other wood than the *nayourivi*. This mixture is worked into the cloth and left at the bottom of a vessel all night; in the morning some ley of ashes is added to make the whole thin enough, so that by kneading and working the cloth every part of it may be penetrated with the mixture, it is then left in the vessel until the next day when it is again well kneaded and worked, then wrung and exposed to the full heat of the sun until evening, when it is returned to the oily emulsion made sufficiently fluid by addition of ley of ashes. This process is continued for eight days and nights, after which it is washed in water containing some ashes to extract the excess of oil and afterwards in common water, using, by preference, hard water; it is then dried. The cloth is then steeped for a night in a decoction of the leaves of the *cacha* and dried, which gives it a yellowish colour; it is next steeped in a decoction of the bark or roots of the *nouna* and dried, this gives it a reddish colour. The real dyeing matter is the chayaver. The cloth appears to be immersed frequently in a mixture of this dye-stuff and water and dried, but eventually it undegoes a regular dyeing which is protracted to eighteen hours. It will be observed that there is no mention of alum or any mineral mordant in this proeess.

A second process of dyeing Turkey red is given, totally differing from the one just detailed; the bleached cloth is steeped in an astringent and dried in the shade, it acquires a yellow colour and is mordanted as follows:—a solution of alum is made in hot water and cooled by addition of cold water, the cloth to be treated is extended upon the grass and a clean linen rag is wetted with the alum solution and passed over the face side of the cloth so as to wet it, the cloth is turned and the other side treated in the same way and then

left to dry, afterwards washed in a pond to remove the excess of alum and equalize the mordanting. A second sponging over is given on the grass, but this time the cloth is not dried before treating, afterwards dried, well washed and dyed in chayaver for eight hours, left in the liquor all night, well washed and dried; no further operation, such as soaping, is described. Although there is no oiling described in this process, it is possible that the so-called bleaching may include the oil treatment.

[*To be continued.*]

8. PROCEEDINGS OF SOCIETIES.

Industrial Society of Mulhouse.—For several months past the Bulletin of this society has not contained any papers upon calico printing or subjects immediately connected with it; from the sittings of the society and its sections, as reported in the last number to hand, we have gleaned the following notes: Mr. Charles Strobel, chemist at Messrs. Henri Haeffly and Co., has observed that nitrous acid transforms alizarine red, obtained by either dyeing or steaming, into a good orange, which does not become red by a prolonged boiling in soap.

On the 28th October, 1875, M. Rosenstiehl requested that a sealed document which he had deposited on the 25th November, 1874, should be read. The president accordingly opened the paper, which treated of the influence of carbonic acid upon the colouring matters of madder during dyeing. This paper has been recently published in the Bulletin of the Chemical Society of Paris, and an abstract of it will be found in the present number of the Textile Colourist.

At the meeting of the 24th November, 1875, Mr. Goppelsroeder requested the president to open a sealed packet which

he had deposited with the society on the 30th of June preceding. Mr. Goppelsroeder announced that he had been engaged for six months upon the investigation of the action of a galvanic current upon organic bodies, and especially upon those of the aromatic series, hoping that electrolysis would be a means of obtaining colouring matters. He commenced with alizarine, thinking that he would get purpurine at the positive pole, but up to the present time without success ; he was not even able to transform purpurine into alizarine at the negative pole. From the benzol and napthaline series he had obtained all the colours of the spectrum, and he drew special attention to a purple and a black possessing metallic reflection. Mr. Goppelsroeder is continuing his researches, and would have still further delayed the publishing of them, if Mr. J. Coquillon had not made a communication upon the same subject on the 30th August last to the Academy of Sciences. Thanks were voted with applause to the reader, and his memoir referred to the chemical section.

At the same meeting, Mr. Brandt read reports upon two communications recently received from Mr. Wagner, one concerning the action of alkaline ferricyanide of potassium upon the different madder colours ; the other concerning the solution of damaged albumen by means of pepsine. These communications were ordered to be printed.

At a meeting of the chemical section, Mr. Eugene Dollfus reported upon a communication of Mr. Aly, referring to the albuminous fluid extracted from the intestines of animals. He found that it coagulated by heating, but it was so prone to enter into putrefaction in warm weather, that he proposed to defer his examination to a cooler season.

With reference to Mr. Strobel's communication, Mr. Rosenstiehl said he had repeated the experiment upon Meissonniers' extract of madder, Meister Lucius' alizarine, and also alizarine from Schaaf and Lauth, and reds obtained by steaming. He observed that purpurine did not answer well, but alizarine fixed on cloth furnished good results. In attempting to obtain the orange colour by acting upon a sulphuric acid solution of alizarine with nitrous vapours, there was complete destruction

of the colouring matter.* He, nevertheless, succeeded in isolating the orange colouring matter formed upon the cloth; it is in small quantity, but it is capable of dyeing with mordants.

At the meeting of the 10th November, 1875, M. Eugene Dollfus gave his report upon the proposed substitute for albumen, the gastric and intestinal mucous of animals suggested by Mr. Ernest Aly, of Blackwell Station, United States. The report was unfavourable, the feeble coagulation which takes place by heat is not a true albuminous coagulum, for it is easily soluble in ammonia or carbonate of soda; the coagulation only takes place when the mucous is acid. Altogether this substance resembles caseine or lactarine more than albumen, and it appears hopeless to expect that it can serve as an albumen substitute.

The society will celebrate its fiftieth anniversary in the coming month of May with considerable ceremony. There will be an exhibition of the manufactures of Alsace, including all the kinds of textiles produced in that district, an exhibition of selected machines, and an exhibition of paintings by Alsaltian artists. A general meeting on the 11th of May at two o'clock will precede the opening of the exhibition. The Horticultural Society of Mulhouse will also assist by organizing an exhibition of flowers and ornamental plants. On the evening of the 11th May, there will be a subscription banquet of the members of the Industrial Society; the Musical Society of the town will also aid by giving a special concert, including, it is hoped, some original composition by Alsatian musicians. Several manufacturing establishments have expressed their willingness to throw open their doors to the members of the society, and altogether there seems a cordial combination to produce a very agreeable and interesting meeting.

Society for the Promotion of Scientific Industry.—The chemical section met on the 11th February, 1876, Mr. W. C.

* Mr. Strobel's observation is not new, it may be found in the Editor's Chemistry of Calico Printing, 1860, p. 56, and in the Dictionary of Calico Printing, p. 161.

Wright in the chair. Mr. Charles Dreyfus, the president of the section, read a paper upon the manufacture of albumen from blood, and made estimates of the cost of plant and working. This paper will probably be printed in full. In the conversation which followed, a representative of Messrs. Smith and Forrest, blood albumen makers, gave some interesting practical details of the manufacture. The present price of an ox's blood was 9d., and the price of albumen to wholesale dealers was 1s. 6d. per lb., the utensils were much more costly than the author of the paper assumed. Sheep's blood did not give so good an albumen as ox's blood, it was weaker, and did not keep well, going opaque or mildewy; it was believed that horse's blood gave the best albumen of all. Pig's blood gave a very inferior albumen; although the serum was quite clear, the albumen was always of a bad colour. Albumen was much improved in colour by exposure to the sunlight; no chemicals could bleach it. Albumen was injured easily, and it was not evident why; a cask of albumen could not cross the equator and back without being completely spoiled for printers' purposes; it was not wise to keep albumen more than a year or so, for even well stored it was injured before two years old. The serum could not be cleared from red globules by any sort of filtration or precipitation; if it would not clear itself by deposition, it could not be cleared. It was best on drying the serum to submit it at once to a temperature of 100° F. to check any tendency to decomposition, and finish the drying at a lower temperature. A member drew attention to the fact that the clot left after the serum had drained off contained 70 or 80 per cent. of liquid; the real improvement to be aimed at was to utilize this mass of albumen which was lost, for it was shewn that the dark coloured albumen obtained by pressing the serum out of the clot was worth so little, that it did not repay the expense of extraction; it was better to use the clot up for manure. It was incidentally mentioned, that however much albumen, or anything else was removed from the blood, the Turkey red dyers found it quite as good for their requirements as in its original condition, a statement which did not surprise one or two practical chemists.

The paper was referred to the chairman to report upon; the report will be awaited for with some interest, as it is known the reporter can communicate interesting particulars upon some little known properties of albumen.

The section passed a resolution recommending the Council of the Society to publish a list of prize questions for essays. If the Council should approve of this step, we shall be glad to give publicity to the particulars.

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9. British and Foreign Patents, from the Commissioners of Patents Journal, January 21st to February 18th, 1876, inclusive.

Bleaching.

2918. ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, for an invention of "An improvement in bleaching vegetable fibrous substances."—A communication to him from abroad by Charles Louis Joseph Coinsin-Bordat, of Paris, France.—Dated 18th August, 1875.—This patent has passed the Great Seal.

3669. THOMAS JAMES SMITH, of the firm of Robertson, Brooman, and Company, of 166, Fleet Street, in the city of London, Patent Agents, has given notice to proceed in respect of the invention of "Improvements in bleaching wool and silk."—A communication to him from abroad by Cyprien Marie Tessie du Motay, of 23, Boulevard de Strasbourg, Paris, France, Chemist.

38569. L. CORYN, of Ghent, for "A new mode of applying steam-bleaching."—Dated 4th January, 1876.—Belgian patent.

38640. C. L. J. COINSIN-BORDAT, a patent of improvement for "Bleaching vegetable textile substances by a decolouring paste."—Dated 13th January, 1876. — (Original patent, 18th August, 1875).—Belgian patent.

Steaming and Ageing.

2943. EDWARD JAMES JONES, of the firm of James Black and Company, Calico Printers, of Dalmonach Works, in the county of Dumbarton, North Britain, for an invention of "Improvements

in apparatus for ageing or steaming woven or other web fabrics or yarns."—Dated 21st August, 1875.—This patent has passed the Great Seal.

3328. SAMUEL KNOWLES, of Tottington, near Bury, in the county of Lancaster, Calico Printer, and JAMES KAY, of Bury aforesaid, Engineer, have given notice to proceed in respect of the invention of "Improvements in apparatus for drying, stretching, steaming, and ageing woven fabrics, and for drying fibrous materials and other substances."

3517. WILLIAM HOLT, of Halifax, in the county of York, Dyer and Finisher, has given notice to proceed in respect of the invention of "Improvemets in apparatus for steaming textile fabrics and yarns or warps."

250. WILLIAM MATHER, of the firm of Messieurs Mather and Platt, of Salford, in the county of Lancaster, Engineer, for an invention of "Improvements in apparatus for steaming printed fabrics."—Dated 21st January, 1876.

269. OATES INGHAM, of the firm of Oates, Ingham, and Sons, of Bradford, in the county of York, Dyers and Finishers, and CHARLES HERBERT HOLT, of Huddersfield, in the same county, Engineer, for an invention of "A new or improved method of and apparatus for steaming or 'blowing' woven fabrics in the process of dyeing and finishing."—Dated 24th January, 1876.—Provisional protection has been granted to this patent.

56. K. THIERRY-MIEG, of Paris, for "An improved apparatus for fixing colours on fabrics by steam and hot air."—3 years.—Dated 23rd May, 1875.—Grand Duchy of Baden.

Apparatus and Processes for Dyeing and Printing.

2845. RICHARD MARSDEN, JOHN DAY MARSDEN, and HENRY MARSDEN, of Dewsbury, in the county of York, for an invention of "Improvements in machinery or apparatus for dyeing, washing, and scouring fabrics."—Dated 12th Auuust, 1875.—This patent has passed the Great Seal.

3483. JOHN HENRY JOHNSON, of 47, Lincoln's Inn Fields, in the county of Middlesex, Gentleman, has given notice to proceed in respect of the invention of "Improvements in machinery or apparatus for printing textile fabrics and other fabrics or articles, and in means employed in connection therewith."—A communication to him from abroad by Albert Aune François

Le Tellier, and Louis Désiré Verstraet, of Paris, in the republic of France.

4134. To JAMES HUMMERSTON, of Leeds, in the county of York, for the invention of "A new or improved machine for printing on paper, floor-cloths, and woollen or other woven or felted fabrics."—Provisional protection has been granted to this patent.

229. GEORGE RYDILL, of Grove House, Dewsbury, in the county of York, for an invention of "Improvements in machinery and apparatus for dyeing, staining, and drying animal and vegetable substances, and for bleaching purposes."—Dated 20th January, 1873.—This patent has become void.

171,728. HARRIS HOWARD, of Cincinnati, Ohio, assignor of one-half of his right to F. R. Thompson, of the same place, for "Padding Fabrics."—Application filed 11th November, 1875.—American patent.

Claim.—"As a new article of manufacture, the padding material composed of alternate layers of glycerined paper and cotton or other batting or wadding, substantially as set forth."

32. A. CHIFFRAY, of Maromme, for "Improvements in his process for printing colours on both sides of fabrics, and for obtaining ribs thereon, as patented on the 17th December, 1872."—3 years.—Dated 6th April, 1873.—Grand Duchy of Baden.

38,636. G. CLEIS & Co., for an imported invention of "A direct process of painting stuffs or tissues."—Dated 13th January, 1876.—(French patent, 6th July, 1875).—Belgian patent.

Copper Rollers and Engraving.

4515. HENRY WILDE, of Manchester, in the county of Lancaster, Engineer, has given notice to proceed in respect of the invention of "Improvements in the manufacture of metal rollers for printing calico and other textile fabrics, part of which is applicable to the refining of copper."

4524. WILLIAM ROBERT LAKE, of the firm of Haseltine, Lake, and Co., Patent Agents, Southampton Buildings, London, for an invention of "Improvements in pantograph engraving machines."—A communication to him from abroad by John Hope, of Providence, Rhode Island, United States of America.—Dated 29th December, 1875.—This patent has passed the Great Seal.

364. THOMAS NIXON, Pentagraph Engraver to Messrs. John Orr Ewing & Co., of Alexandria, in the county of Dumbarton,

North Britain, for an invention of "Improvements in pentagraph engraving machines."—Dated 29th January, 1876.

Preparation and Treatment of Colouring Matters.

420. JOSEPH CLAYTON, of Radcliffe, in the county of Lancaster, for an invention of "An improved paste for fixing and brightening aniline and pigment colours in printing on cotton, woollen, silk, or mixed fabrics."—Dated 10th February, 1869.—The stamp duty of £100 has been paid on this patent.

2713. JOHN AUCHINVOLE, of Glasgow, in the county of Lanark, North Britain, Merchant, for an invention of "Improvements in recovering surplus indigo from textile materials or fabrics."—A communication to him from abroad by Camile Bouhon, residing at Ensival, in Belgium.—Dated 31st July, 1875.—This patent has passed the Great Seal.

3320. ALFRED WEIGEL, of 21, Mark Lane, in the city of London, has given notice to proceed in respect of the invention of "Improvements in the production of certain colouring matters."

4208. GEORGE HILL UNDERWOOD, of Manchester, in the county of Lancaster, has given notice to proceed in respect of the invention of "Improvements in the treatment of indigo for dyeing and printing.

4484. HORACE MOUNTFORD WILKINSON, of 2, Place des Barricades, in the city of Brussels, in the kingdom of Belgium, at present residing at 5, Charlotte Street, Portland Place, in the county of Middlesex, for the invention of "The manufacture of a new ink, applicable also for dyeing, colouring, and other purposes."—A communication to him from abroad by Camile Joly, of Rue d'Anderlecht, No. 3, Brussels.—Provisional protection has been granted to this patent.

44. JUSTUS WOLFF, of Wyke, near Bradford, Consulting and Engineering Chemist, and RALPH BETLEY, of Wigan, Analytical and Consulting Chemist, have given notice to proceed in respect of the invention of "Improvements in the production of colouring matters capable of being employed for the purpose of dyeing and printing."

238. IVAN LEVINSTEIN, of Manchester, in the county of Lancaster, Colour and Chemical Manufacturer, for an invention of "Improvements in the application and treatment of residues arising from the manufacture of magenta."—Dated 20th January, 1876.

313. JUSTUS WOLFF, of Wyke, near Bradford, Consulting and Engineering Chemist, and RALPH BETLEY, of Wigan, Analytical and Consulting Chemist, for an invention of "Improvements in the production of aniline dyes."—Dated 26th January, 1876.—Notice to proceed has been given.

670. JOSEPH FIRTH, of Leeds, in the county of York, for an invention of "Improved apparatus for use in dyeing fabrics indigo blue."—Dated 17th February, 1876.

31. Dr. MITSCHERLICH, of Sinsleben, for "A process of extracting tannine by means of sulphurous acid."—3 years.—Dated 6th April, 1875.—Grand Duchy of Baden.

171,787. OTTO FIORILLO, of Baltimore, Md., for "Processes of manufacturing aniline bronzes."—Application filed 8th Dec., 1875.—American patent.

Brief.—"The process of manufacturing various aniline bronzes, especially golden bronze, by dissolving aniline-red and aniline-purple in alcohol, and adding benzoic acid, then boiling and adding gum-benzoin until the colour changes from green to golden bronze."

Claim.—"1, the process of manufacturing bronze paint or colour of various shades by mixing benzoic acid with aniline colours, substantially as and for the purpose hereinbefore set forth. 2, the process of manufacturing aniline bronze herein described, consisting in, first, dissolving aniline-red and aniline-purple in alcohol; secondly, adding benzoic acid; thirdly, boiling the mixture; fourthly, adding gum-benzoin; and, fifthly, boiling this mixture until the colour changes from green to a golden bronze."

Wool Treatments.

4088. EDWIN POWLEY ALEXANDER, of 14, Southampton Buildings, in the county of Middlesex, Consulting Engineer and Patent Agent, for an invention of "A new or improved mode or method of and apparatus for effecting the carbonization of vegetable materials contained in wool, woollen rags, or other animal substances."—A communication to him from abroad by Daniel Michel, of Paris, in the republic of France, Woollen Waste Manufacturer.—Dated 25th November, 1875.—This patent has passed the Great Seal.

4168. ALFRED FORD, of 19, Blandford Square, in the county of Middlesex, Gentleman, for an invention of "Improvements in the method of cleansing wool, and of recovering the products." Dated 2nd December, 1875.—This patent has passed the Great Seal.

242. GEORGE HENRY NUSSEY and WILLIAM BRADSHAW LEACH-

MAN, both of Leeds, in the county of York, for an invention of "Improvements in machinery or apparatus for pressing woollen and other woven or felted fabrics."—Dated 21st January, 1876.

Yarns, Hanks, Cops.

3319. WILLIAM REID, Manager to Messrs. Donald Matheson and Co., of Govan Croft Dye Works, in the county of Lanark, North Britain, has given notice to proceed in respect of the invention of "Improvements in apparatus to be used in connection with the various processes of treating yarns with liquids."

166. SIDNEY EMSLEY, Agent, of Bradford, and SAMUEL SMITH, Machine Maker, of Low Bridge Works, Keighley, both in the county of York, for an invention of "Improvements in winding and gassing yarns, and in apparatus connected therewith."—Dated 15th January, 1876.

468. CHARLES TOUSSAINT, one of the firm of Toussaint, Levy, and Co., of Saint Dié, in the department of the Vosges, France, Manufacturer, for an invention of "Improvements in bleaching cotton on shuttle cops, bobbins, or in hanks."—Dated 5th February, 1876.

46. K. GÖHRUNG, of Stuttgart, for "An apparatus for washing, bleaching, and dyeing yarn in cops."—3 years.—Dated 8th May, 1875.—Grand Duchy of Baden.

38. C. HAUSER and SON, of Vienna, for "Dyeing raw cotton and spinning threads of mixed colours."—1 year.—(Public).—Dated 4th August, 1875.—Austrain patent.

Finishing Processes.

226. ROBERT GILLES LOWNDES, of the firm of James Young and Sons, Bleachers and Finishers, of Auldhousefield and Crofthead, both in the county of Renfrew, North Britain, and MALCOLM M. CALLUM, of Barrhead, also in the county of Renfrew, Machinist, for an invention of "Improvements in machinery or apparatus to be employed for finishing textile or other fabrics."—Dated 25th January, 1869.—This patent has become void.

134. FREDERICK JOHN TRIPPE, of Southampton, in the county of Southampton, Woollen Draper, for an invention of "An improved machine for cutting textile fabrics into small portions for patterns, samples, and other purposes."—Dated 13th January, 1873.—This patent has become void.

3425. SAMUEL BRENTNALL, of Manchester, Merchant, and JOHN SMITH RAWORTH, of Manchester, Engineer, have given notice to proceed in respect of the invention of "Improvements in machines for beetling and finishing textile fabrics."

3512. ROBERT BURLISON, Mechanic, and JAMES WHITAKER, Commission Agent, both of Bradford, in the county of York, have given notice to proceed in respect of the invention of "Improvements in tentering and drying machines."

3571. JOHN WALSH, of Halifax, in the county of York, Presser, and CHARLES WILLIAM STEAD, of the same place, Machine Maker, have given notice to proceed in respect of the invention of "Improvements in machinery or apparatus for 'papering' piece goods or woven fabrics for pressing and taking the papers out after pressing."

4454. WILLIAM KEMPE and ARTHUR KEMPE, both of Holbeck Mills, Leeds, in the county of York, have given notice to proceed in respect of the invention of "Improvements in raising the nap upon cloths and fabrics, and in apparatus employed therein."

215. TO MAXIMILIAN ZINGLER, of 19, Buckland Crescent, Belsize Park, in the county of Middlesex, for the invention of "Improvements in the manufacture of varnish, applicable also to sizing and waterproofings for textile fabrics."

5365. THE ROSAMOND WOOLLEN COMPANY (assignee of C. E. Scrimgeour), of Almonte, Ont., for "A process and apparatus for finishing cloth." (Procédé et appareil pour parachever le drap.)—5 years.—Dated 11th November, 1875.—Canadian patent.

Claim.—"1st, subjecting the cloth in the process of finishing to the action of vapour generated from water in a close vessel by the injection of steam under pressure. 2nd, the combination of a perforated vapour distributing cylinder D, with its box E, or other device for vapourizing the cloth, and a close water tank A. for generating vapour connected thereto by a pipe C, and having a steam inlet pipe B, for connection with a boiler."

6829. S. C. TALCOTT, of Ashtabula, Ohio, for "Measuring packaged fabrics."—Patent No. 165,131, dated 29th June, 1875.—Application filed 30th September, 1875.—American patent.

Claim.—"1st, the preparation of fabrics for sale and inventory by measuring, graduation, notation, and packaging, substantially as described. 2, in combination with the graduation and notation, transverse guide-lines, to facilitate the folding or severance of the fabric without bias, substantially as described.

THE TEXTILE COLOURIST.

No. 4.—APRIL, 1876.

1. *Notes on the Composition and Testing of Tin Red Liquors.**

BY MR. J. W. JONES.

THE object of the writer in drawing attention to the composition of tin red liquors is to suggest the probable cause of those irregularities in dyed reds containing quantities of tin crystals, varying from 3 to 4 oz. up to 1 lb. per gallon, which must at one time or another have occupied the attention of almost every person connected with the management of a printworks; and to suggest at the same time a method by which these irregularities may be avoided.

The first point to be noted is, that the capability of any red liquor to "stand" tin crystals is in the inverse ratio of the amount of sulphuric acid present in such red liquor, or to explain more clearly, to a red liquor consisting of acetate of alumina alone, tin crystals up to 1 lb. or even 1½ lb. per gallon can be added and the red will still be full and bright, while on the contrary, to a red liquor containing above a certain percentage of sulphuric acid, present in the case of mordants made with common alum as a double sulphate of alumina and potash, or more commonly, double sulphate of alumina and ammonia, according to the kind of alum employed, and in case of mordants made with cake alum as sulphate of alumina, a very moderate quantity of tin crystals not exceeding 2 or 3 oz. per gallon cannot be added without the red immediately

* Communicated by the author.

losing body and becoming sensibly poorer in shade. It does not make the slightest difference how the acetate of alumina is produced, whether by dissolving alumina hydrate in acetic acid or by double decomposition, the reds with tin crystals will always be good, it being only requisite in the latter case that the sulphates be perfectly decomposed.

The following shews the composition of, and percentage of sulphuric acid in, six mordants all carefully made and estimated several times to ensure correctness, accompanied by observations on the reds they yielded when printed with 1 lb. tin crystals per gallon, and will serve to demonstrate this assertion more clearly:—

Mordant No. 1.

1 gallon pyrolignite of lime, 20° Tw.
2½ lb. alum.

Percentage of sulphuric acid, ·670.

This mordant gave a very full, bright red, scarcely so bright, however, as that furnished by No. 2.

Mordant No. 2.

1 gallon pyrolignite of lime, 15° Tw.
2½ lb. alum.

Percentage of sulphuric acid, 2·521.

This mordant gave an excellent red, full and bright.

Mordant No. 3.

1 gallon pyrolignite of lime, 11° Tw.
2½ lb. alum.

Percentage of sulphuric acid, 6·512.

This mordant gave an exceedingly poor, uneven red.

Mordant No. 4.

1 gallon water.
2½ lb. cake alum.
2½ lb. acetate of lead.
¼ lb. soda ash.

Percentage of sulphuric acid, 4·17.

Gave a red similar to that of mordant 3.

Mordant No. 5.

1 gallon water.
3¾ lb. cake alum.
3¾ lb. acetate of lead.
8½ oz. soda ash.
4¼ oz. rock salt.

Percentage of sulphuric acid, 3·925.
Gave a red similar to that of mordant 3.

Mordant No. 6.

1 gallon water.
3 lb. alum.
2¼ lb. acetate of lead.

Percentage of sulphuric acid, 8·12.
Gave the worst red of all.

All of these mordants when printed without tin crystals gave good reds, No. 4 being the brightest.

To test this point still more thoroughly, two variations of mordant No. 4 were made by giving in the one case 3¾ lb., and in the other 4½ lb., instead of 2½ lb. acetate of lead present. In the case of the mordant to which 4½ lb. was given, there was an excess of acetate of lead; both gave full good reds when printed with 1 lb. tin crystals per gallon, while mordant No. 4, printed at the same time, was very inferior.

The estimation of Hervey's tin red liquor gave 2·911 per cent., and that of Turnbull's red liquor, in use chiefly in Scotland, gave 2·68 per cent. of sulphuric acid. (For these two estimations I am indebted to a friend).

Accepting as true, then, that the presence of too great a proportion of sulphuric acid in tin red liquids is prejudicial, we naturally demand (1) is there an advantage in having any sulphuric acid present, and (2) if so, up to what percentage can it be admitted without the mordant losing its power of standing tin crystals, (3) what is the probable action of the sulphates?

In answer to the first question it must be observed that the reds made from mordants containing a small percentage of sulphuric acid are always rather brighter than those made

from perfectly decomposed mordants, see observations on mordant No. 1. The result of various trials has led the writer to believe that with mordants containing more than from 3 to 3·25 per cent., there is a great danger of the reds coming up poor and uneven, especially if containing more than 4 oz. of tin crystals per gallon, and the best of all is one containing, like mordant No. 2, about 2·5 per cent. only of sulphuric acid; but in considering the action of the sulphates, we shall have occasion to speak further upon this question.

We come now to consider the part played by the sulphates, and it may be remarked that it is impossible to speak on this question with any great degree of certainty, the exact composition of a common red liquor even not being as yet known with certainty, but from experiments I have made, it is certain that the proportion of sulphuric acid existing as sulphate of ammonia in any mordant, in the making of which common alum has been employed, has no injurious action in the case of reds containing tin crystals.

According to Schützenberger, a mordant made from cake alum and acetate of lead contains a trace of sulphate of lead; basic sulphate of alumina in a variable quantity, accordingly as more or less of the cake alum is decomposed (which basic sulphate we know from a direct experiment of Mons. D. Koechlin is an excellent mordant); also basic acetate of alumina and free acetic acid; and it appears at least probable that the cause of mordants containing above a certain percentage of sulphate of alumina giving bad reds when printed with tin crystals, is that although when printed without tin crystals, the excess of cake alum is formed into basic sulphate of alumina, on the contrary, when tin crystals are added, the free hydrochloric acid which is developed by their decomposition prevents, by itself combining with a portion of the alumina, this formation of the basic sulphate, and as the neutral sulphate, which in that case remains unchanged, cannot act as a mordant, there must necessarily be a weakening of such red liquor, the greater the more sulphate of alumina it contains. This explanation seems the most probable, but it is only a question of theoretical interest.

The importance of having a well-made mordant for reds containing tin crystals is great, not only because it gives a brighter and fuller red, but because with such a mordant, the reds can be worked comparatively weak and still give better shades, and require less dyestuff than much stronger reds made from mordants of inferior composition. If the mordants are made from cake alum, much greater care is required in employing them, as it is well known that cake alum is very irregular in its composition, sometimes being much more acid than at other times, for this reason the red liquors made from it should be very carefully tested before being used.

The red liquors can, of course, be tested by printing a colour made from them, and containing, say 1 lb. tin crystals per gallon, and dyeing it along with a type red liquor; but in works where there is a chemist it is much more expeditious, and quite as certain to have a careful estimation of the amount of sulphuric acid made, and to use for reds containing tin crystals only such red liquors as contain less than 3 per cent. if made from common alum, and a proportionably smaller percentage if made from sulphate of alumina or cake alum as it is generally called. The writer knows of one printworks where, since the introduction of this method of testing the red liquors some two or three years ago, there has not been a single case of reds containing tin crystals coming up poor and under dyed.

2. *On the Recovery of Indigo from Spent Vats.*

BY MR. G. H. UNDERWOOD.*

AFTER the lime and copperas vat used in dyeing calico has been as far exhausted as is practicable, there still remains a quantity of indigo, both in solution and with the insoluble

* Communicated by the Author.

residue, at the bottom of the vat which well repays the cost of recovering it. With regard to that which remains in solution, the usual custom is to allow the vat to settle well, and pump the clear liquor into an adjoining empty vat, and employ it in setting a new vat, instead of the same quantity of water. The insoluble matter at the bottom may be treated by three different methods.

(1.) It was proposed to treat the whole residue with an excess of muriatic acid, which would dissolve the lime, iron, and copper, and leave the indigo insoluble. This simple process does not, however, succeed in practice, a large quantity of acid is required to neutralize the lime, and it does not dissolve the sulphate of lime, sand, organic matters, lint, or fibre, which form a considerable portion of the bottoms, so that a small quantity of indigo is left diffused through a mass of foreign matters, in which it is so buried and hidden as to be nearly valueless.

(2.) The cold water process is worked by having a number of pits or receptacles of large size at a lower level than the dyeing vats, and in communication with them. The vat bottoms are mixed with water, and well agitated. When the insoluble matters have subsided, the clear supernatant fluid is run into a large pit; the bottoms are again raked up with clear water, left to settle, and the clear run into the pit, and this treatment repeated as long as any indigo is dissolved from the bottoms. The weak indigo solution is soon oxidized in the pits and precipitates; by having a series of pits at different levels, and connected with one another, the last pit can be kept running off water free from indigo. The pits are drawn off at certain intervals, and the indigo collected. This process requires but little attention, and costs nothing in materials, but it will be shewn that it is not successful in extracting the whole of the indigo from the residues.

(3.) The hot process consists in heating the vat bottoms with caustic soda and orpiment, and is the best process where there is not room or convenience for the construction of settling pits, and may perhaps be the best under any circumstances. The bottoms are placed in iron boiling vats, which

are of such a size that one boiling vat is sufficiently large for the treatment of one dye vat, and there may be as many as necessary. The boiling vats are provided with plug holes at various distances from the bottom. A stock reducing liquor is made by taking in the proportion of 1 lb. orpiment, 1 gallon of strong caustic soda, and ½ a gallon of water; the orpiment is finely ground, and the whole boiled by steam in an iron vessel until solution is effected; it is usual to prepare about 30 gallons of the reducing liquor at one operation. From 3 to 4 quarts of this reducing liquor are added to the contents of the boiling vat, which are well raked up, and thoroughly boiled. The steam being turned off, the contents are allowed to settle, and drawn off by the plug holes into a cistern, and thence pumped up into spouts leading into receivers placed 10 or 12 ft. above the dyehouse level. The spouts are purposely made broad and shallow, so as to cause the liquid to come as much as possible into contact with the air; the indigo in solution is speedily oxidized, becomes insoluble, and settles to the bottom of the receivers. The clear and hot liquor from which the indigo has been deposited, is used instead of water in the boiling up of a fresh lot of bottoms, or re-boiling a lot already treated. If the indigo vats have been well set, and well dipped out, it will be found that from five to seven times boiling with the orpiment liquor will be required to remove all the indigo from the bottoms, but there may be cases which demand twelve or fourteen successive boilings.

If the cold water process is the cheapest in materials, it may be said in favour of the hot process that it is more rapid in action, and extracts more indigo from the bottoms. As to which of the two processes is really preferable on the score of economy, it can only be said that much depends upon circumstances of position, of quality of water, of methods of working, value of indigo, and space available. Experiments made under favourable conditions have shewn that vat bottoms washed fourteen times with water and raked up in an exceptionably perfect manner at every washing ceased to yield indigo to water, white cloth not being in the least coloured by prolonged immersion in the liquid. These vat bottoms, which

were exhausted as far as cold water could exhaust them, were transferred to the boiling vats and made up to 800 gallons with water and reducing liquor. When boiled in the usual way the first treatment shewed that there was a sufficient amount of indigo dissolved to make it profitable to extract, and even up to the third boiling indigo was extracted in relatively large amounts from what would be considered in the old process an exhausted and valueless material. To ascertain quickly whether a given specimen of vat bottoms contains much or little indigo, the best process is to have the vat and bottoms vigorously raked up and a sample, say one quart, withdrawn; this is mixed with 250 grains of orpiment and a couple of ounces of caustic soda, and boiled in an iron pan, the liquid cooled, and then tested by immersing bits of white calico in the clear part. The depth of shade which is dyed in a given time will indicate sufficiently well to the experienced eye what is the probable amount of indigo present.

3. VANADIUM.

To the Editor of the Textile Colourist.

Sir,—Having read your article on this most curious and interesting metal in the March number of the "Textile Colourist" with much interest, and in view of the most important part which it is destined to play, not only in medicines and photography, but eminently in the art of dyeing and printing silk, woollen, and cotton fabrics, a few words in reference to its recent discovery in greater abundance, and its application to calico printing, may not be without interest to your subscribers, at the same time that it records historically the progress hitherto attained.

We are indebted to Professor Roscoe for the discovery of vanadium in the residues left after the extraction of cobalt by the acid process as lately conducted at the works, Mottram St. Andrew's, Cheshire.

Availing himself of the use of our furnaces and utensils which were larger than the apparatus, &c., then at his command in the old Owens College, Quay Street, Manchester, a quantity of these residues were worked up early in the year 1867, and sufficient vanadic acid was

made to enable him to conduct his exhaustive researches, and to determine once and for all the atomic weight, and the true constituents of the various compounds of vanadium.

All the vanadic acid made having been used up by Dr. Roscoe in these original investigations early in the spring of the year 1870, a larger batch of the residues was put into work, and about 100 oz. of vanadic acid was produced, the largest amount of vanadic acid there had been in the world up to that date. From this store of 100 oz., Professor Roscoe very liberally placed at our disposal about 30 oz., the rest being required for his further experiments. In December of the same year it was sent up to London, to the eminent metallurgical firm of Johnson, Matthey, & Co., for sale, and it may be regarded as an evidence of the earnestness of purpose with which the late Mr. John Lightfoot, of Accrington, conducted his experiments, and watched the advent of any substance calculated to advance his discovery of the best method of working aniline black, for there is little doubt that almost immediately afterwards, he must have procured some vanadium oxide from this stock, for whilst in his original specification for printing and dyeing fabrics and yarns, and which is dated October 12th, 1870, vanadium is not mentioned, yet in the completed specification of his patent, dated April 12th, 1871, only a little over three months after the first lot of vanadium oxide was offered for sale, he states the fact that other metals and their compounds than copper, can be used to form aniline black, and amongst the rest he enumerates the oxide of vanadium, and in a small work by him on aniline black, published May 1st, 1871, he records some interesting experiments made with various metals, and in it he states that the *best black* is obtained by the use of vanadium.

It was without doubt because of Mr. John Lightfoot's ignorance of the marvellous power possessed by the various salts of vanadium when brought into contact with a mixture of aniline hydrochlorate, and the chlorates of sodium and potassium to form aniline black, that he did not introduce it into the original specification of his patent, but between the dates, October 12th, 1870, and April 12th, 1871, he acquired this information when acting under the advice of his patent agent, who would inform him that the completed specification of his patent could only be an amplification of his original specification, but that no new matter could legally be introduced into it. Although he mentions that vanadium could be used, he does not claim its use in his patent.

The high price of vanadium oxide, then 60s. per oz., and its exceeding rarity, were reasons why he would decline to apply specially for a patent for its use in the formation of aniline black; indeed it is on record that about this time he said that by far the best and most powerful agent to use in order to produce aniline black was vanadium, but that there was not sufficient vanadium in the world to supply the wants of one firm of calico printers, much less the requirements of the whole trade.

It was about this date that Mr. Robert Pinkney, of the firm of Blackwood & Co., London, requiring a substitute for copper for their marking ink,—independent of and absolutely in ignorance that the late Mr. John Lightfoot was at the same moment engaged experimenting on the same substance for the same purpose—made some original investigations upon the use of the salts of vanadium in the formation of a permanent black. He found that only a few grains of the chloride of vanadium, say from 7 to 12 grains for 1 gallon of liquid, consisting of hydrochlorate of aniline, and chlorate of soda, were sufficient for the formation of aniline black; and acting upon the belief, that if vanadium was required, it would be forthcoming, he applied for a patent for the use of the salts of vanadium in the formation of aniline black, October 16th, 1871, and since then, hundreds of thousands of bottles of marking ink, called "Jetoline," have been sold by this firm, in all of which vanadium has been used.

At the time of the removal of the Owens College from its old premises, Quay Street, to its present palatial buildings, Dr. Roscoe very generously gave me all his stock of residues from the Mottram Mine, amounting to about one ton, and at the same time earnestly suggested that every effort should be made to obtain supplies from some other source, for, he argued, there was the requisite furnaces, utensils, and knowledge required to prepare the salts of vanadium, and if once a quantity of this substance, with its wonderful and quite unique properties, existed with reasonable probability of further supplies, many uses for it must sooner or later be developed.

This advice has been adopted, and in course of time control over the only known deposit of vanadium in the world has been obtained.

The results have abundantly vindicated the soundness of Dr. Roscoe's advice, and the number of applications opening out for this most marvellous substance has demonstrated the immense value of original researches, even upon substances which may seem to be amongst the rarest in nature.

Unfortunately the amount of vanadium found in the ore obtained from the deposit named is only a few ounces per ton, but as the properties possessed by the compounds of this metal are of the most extraordinary and valuable character, and as the smallest quantity of it performs a great amount of work, it may possibly suffice for present wants until other and richer deposits are found. Meanwhile, the many and important uses opening out for the salts of this metal in science, manufacture, and arts, marks another step onward in that ultimate victory of man over nature, which it is his privilege and birthright to assume.

Thanks to chemistry for having enabled us to score this additional victory.

Magnesium Works, Patricroft. S. M.

4. The Manuscripts of Jehan le Begue.

IN the Supplement to the preceding number of the Textile Colourist, reference was made to the above manuscript or manuscripts as proving that a species of calico printing, or rather pencilling or staining was practised in London so long ago as 1410 or earlier, and as we have never seen any notice of these MSS. in the literarure of dyeing and printing, we believe that the following notes and extracts will be novel and interesting to the more liberal minds connected with these manufactures. Our knowledge of these MSS. is due to Mrs. Merrifield, and it is from her works upon the Arts of Painting that we draw the following particulars.

The original manuscript is in the Bibliothèque Royale of Paris, it is written on paper and numbered 6741. Its existence was known to Lessing, who mentions it in 1774, but he quoted only the title, and it does not appear that he read or examined the work. Parts of the MSS. appear to have been known to other writers upon the history of painting, but the greater portion, and all that is interesting to the dyer and calico printer, seems to have been unknown until about 1842 or 1843. Mrs. Merrifield procured a copy in 1844, and the whole work was for the first time published by her in the original, with a translation of the greater part of it. Some parts are so technical in their language that the attempt to translate them has not been made.

It is known of Jehan le Begue that in the year 1431 he composed, or rather compiled, this manuscript, he was at that time 63 years of age, and by profession a licentiate of the law. The sources of his work were a collection of treatises on painting written by Jehan Alcherius or Alcerius. The compiler says he was not accustomed to such writing, and is said to have made numerous mistakes throughout the manuscript.

Of Jehan Alcherius or Alcerius (written also Archerius) some particulars are known from his own writings; he left

Milan for Paris in 1382, taking with him a receipt for making writing ink, apparently at that time new, made from gall-nuts, gum arabic and Roman vitriol (sulphate of iron); in 1398 he was at Paris; in 1409 he was back at Milan, where he copied some receipts from books lent him by the Servite Fathers; in 1410 he was at Bologna, and there became acquainted with one Theodore, a native of Flanders and an embroiderer, who gave him the receipts for staining or pencilling on linen cloth which have been alluded to, as well as the manner in which they were applied. Mrs. Merrifield is mistaken in her remarks as well as in her translation of receipt No. 92, which she considers to be a mordant, but, as will be seen, it is actually a discharge for certain colours. We think there can be no doubt of the application of these colours as being quite different to painting properly so called; they were evidently intended to sink into and penetrate the cloth instead of resting on the surface, and stress is laid upon the fact that they do not thicken the cloth as oil paints do. Whether such stained and figured cloths were used as garments is not so easy to decide, Mrs. Merrifield thinks they certainly were, and quotes Mr. Planché, in his History of British Costume, where a chronicler of the fourteenth century says: "All that time the Englishmen were clothed all in coates and hoodes peynted with letters and flowers." An epigram which was affixed to the church door of St. Peter, Stangate, seems to confirm this:—

"Long beirds hertiles,
Peynted hoods witless,
Gay cotes graceless,
Maketh Englonde thriftless."

It is, however, hard to imagine that coats or hoods painted with such colours as would be produced by the receipts which follow, were ever an article of fashionable wear; the most probable presumption is that the fabrics produced were cheap imitations of tapestry, and this receives support from a passage in Canon Rock's introduction to his Catalogue of Textile Fabrics at South Kensington (p. cxiv).

"Imitated tapestry—if paintings on canvas may be so called—existed here hundreds of years ago, under the name of 'stayned

cloth,' and the workers of it were embodied into a London civic guild. Of this 'stayned cloth' we have lately found hangings upon the walls of a dining-room in one mansion; in another ornamenting, with great effect, the top of a stair-case.

At the beginning of the sixteenth century, Exeter Cathedral had several pieces of old painted or 'stayned cloth:' 1 pannus veteratus depictus cum ymaginibus Sancte Andree in medio et Petri et Pauli ex lateribus; 1 front stayned cum crucifixo, Mariæ et Johanne, Petro et Paulo; viij parvi panni linei stayned," etc.

The very great use at that time of such articles in household furniture may be witnessed in the will, A.D. 1503, of Katharine Lady Hastings, who bequeaths, besides several other such pieces "an old hangin of counterfeit arres of Knollys, which now hangeth in the hall, and all such hangyngs of old bawdekyn, or lynen paynted as now hang in the chappell."

Although Canon Rock uses the words "paintings on canvass," which suggests oil paintings, it is evident that such productions would be very poor imitations of tapestry; and the words "stayned cloth," so frequently used, seems to imply the use of water colours.

To return to Jehan Alcherius. He is found in Paris, in 1410, and in 1411 is occupied in correcting his manuscripts. From this time nothing more is known of him; and twenty years afterwards his manuscripts are in the hands of Jehan le Begue, who copied them with his own hand into one volume. There seems to be no doubt concerning the genuineness and date of this manuscript.

After a vocabulary of Latin synonymes, which occupies twenty-eight pages of print, and which does not admit of easy translation, there come one hundred and eighteen receipts, called Experiments upon Colours, for the most part referring to painting, but we pass on to the 88th receipt, after which is written in Latin:—

After the preceding, it was written in the MS.: "All the things contained in this unbound book, namely, from number 47 unto this page, I wrote 'in Janua,' in the year 1409, in the month of June, extracting them from a book lent to me by brother Diony-

sius de (sic) of the order of the Servants of Mary, which order in Milan, is called Del Sacho: and from that same book I copied also many experiments for making colours for illuminating books, which experiments I wrote in another quire which precedes this."

These are the experiments Nos. 1 to 47 inclusive.

Also in the same MS., in another unbound book attached to the preceding, it was thus written: "On Tuesday, the 11th day of February, 1410, I caused the following to be copied in Bologna, from recipes lent to me at that place, by Theodore (sic) of Flanders, an embroiderer, accustomed to work at Pavia, during the life of the late renowned Duke of Milan: which recipes the said Theodore said he had procured in London, in England, from the persons who work with the waters hereinafter mentioned."

The following recipes were brought from England.

The receipts themselves are written in old French, and the notes upon them in Latin. We give Mrs. Merrifield's translation, which, except in one or two cases, has been made with great care and accuracy.

89. *To make Black Water.*—Take a pint of water from under the grindstone on which knives are ground, and place it over the fire, and throw into it a glass of vinegar and 2 oz. of galls; then take ½ an oz. of alum, and an oz. of copperas, and boil it until it is reduced by one-third, and then let it stand for a day.

90. *To make Green Water.*—Take an oz. of verdigris, ½ an oz. of alum, a little saffron, and a little parsley; grind the whole well together, and distemper it with one glass of vinegar; then strain it through a cloth into a saucer, and let it rest for a day.

91. *To make Red Water.*—Take an oz. of rags or clippings of scarlet [cloth], and soak them in a jar in a pint of strong ley; then put the jar over the fire, and throw into it a little alum and gum arabic, and make it boil until it is reduced one-half, and let it rest for a day.

92. *To make the Water for Staining Cloth of all Colours, and to make it quite White.*—Take a pint of strong ley, and put it over

the fire, and throw into it an ounce of alum, and an ounce of saltpetre, and when it is melted, take it off the fire and use it.

Note.—It seems also possible to draw with the said water, on coloured woollen cloths, any letters and other drawings, the parts within the outlines of which only, where the water has touched, will be bleached, and thus there will be white letters and figures; the ground, where it has not been touched by the water, still retaining its own colour.

93. *To make the Red Water.*—Take an ounce of Brazil in powder, and a 6th part of alum de glace, and make it boil well in a vessel of clear water, until it is reduced to one-half, and then use it.

94. *To make the Green Water.*—Take an ounce of water of the leaves of the black nightshade, and ½ an ounce of alum, and the worth of a blanc of saffron, and ij. oz. of verdigris; grind all together as well as you can, and distemper with a chopine of strong vinegar, and then use it.

95. *To make the Violet Water.*—Take an ounce of turnsole, and soak it in a chopine of strong and tepid ley, and then use it.

What is here called turnsole, is to be understood "Bresil."

96. *To make the Blue Water.*—Take an ounce of indigo of Bandas, that is to say, Baguedel, and reduce it to powder, and then distemper it with ½ a "lot" of strong lessive fondisse, and put it on the fire, and just before it boils, throw into it a 6th part of quicklime and the same quantity of "meltrac" (?), and then take it off the fire and stir it well, and when it is tepid, use it.

Also in the said MS., over a recipe immediately following, was written, "At the beginning of this are wanting several words, which had been cut off, as appeared when I caused this to be copied from the MS., but I think it is for making the water of an azure colour, or a blue or indigo water."

97. Take the worth of a blanc of quicklime, and the same quantity of calcined lees of wine, and of calx of tin, and some "creeres" of indigo, and boil all together in two lots of clear water for an instant, and stir it well, and then take it off the fire, and throw into it a glass of cold water, and when it is settled you can use it.

Also in the same MS., over the two paragraphs following, it was thus written, "I think that the following recipes are for making two

green waters, as I collect from the contents, and the names and things which are mentioned in them."

One oz. of tartar of white wine, 1 oz. of salg-em, 1 oz. of alum de glace, ½ an oz. of saltpetre, ½ an oz. of rhubarb; take a chopine of water, and put it into a new earthen jar, and when you see that the water begins to boil, put in your powder, and take it off the fire, and stir it with a skewer, and let it cool.

Then follows the description of the method of applying these colours or coloured waters, which although given at full length in English and Latin, pp. 81-82 of the Supplement to this Journal, is repeated here for facility of reference.

"The true method of working in England with (coloured) waters. The aforesaid Theodore, from whom I had the above written recipes for the aforesaid waters, told me that in England the painters work with these waters upon closely woven cloths wetted with gum water made with gum arabic, and then dried and afterwards stretched out on the floor of the soler upon thick woollen and frieze cloths; and painters walking with their clean feet over the said cloths, work and paint upon them figures, stories, and other things. And because these cloths lie stretched out on a flat surface, the coloured waters do not flow or spread in painting upon them, but remain where they are placed, and the watery moisture sinks into the woollen cloth, which absorbs it; and even the touches of the paint-brush made with these waters do not spread, because the gum with which, as already mentioned, the cloth is wetted, prevents their spreading. And when the cloths are thus painted, their texture is not thickened or darkened any more than if they had not been painted, because the aforesaid watery colours have not sufficient body to thicken the cloth."

It will be observed in No. 89 that the grindstone dust or mud would contain iron and oxide of iron in a fine state of division, which with the vinegar would form acetate of iron, which with the addition of galls, alum, and copperas, and the concentration of the liquor prescribed, would yield a tolerably dense black, similar to the "chemical black" in use a few years ago.

The green from No. 90 is partly mineral and partly vegetable, and might withstand a slight washing.

The red No. 91 has for basis lac dye, or kermes, with which scarlet cloth was at that time dyed; the alum and the alkali would give it some degree of fastness. The presence of gum

arabic is to be noted in this receipt, elsewhere no thickening materials are prescribed.

The title of the receipt No. 92 is wrongly translated, the French runs: "*Pour faire l'eaue a destaindre drap de toutes couleurs et faire devenir tout blanc*," and should read in English: "*To make a water for bleaching (or discharging) cloth of all colours, and to make it quite white.* It would be a strongly alkaline fluid and, though certainly not capable of completely bleaching the colours given, it would have a decolorising influence sufficient to produce a marked effect. The note is correctly translated from the Latin, and itself shows clearly what the composition was meant for.

In No. 93 we have a rude Brazil wood red, this wood having been long known as a red dyestuff; the green from No. 94 would be principally due to the copper salt, we do not know what influence the vegetable ingredients would have upon it.

In receipt No. 95 the transcriber has made a note that "tornesel" means Brazil or Brasil; perhaps it does not, and the note most probably was made in ignorance, for we have yet in French "tournesol" for a preparation of lichens analogous to archil which would give a fugitive violet colour.

In a note to No. 96, Mrs. Merrifield states that Baguedel was real indigo, but what "meltrac" is we do not know, it is not found in the table of synonymes, and we are left in doubt as to whether a true solution of indigo was effected by reduction, or whether only a suspension of the colouring matter was aimed at. The next receipt is also unsatisfactory; we have a strongly alkaline solution and a metal well known to have energetic reducing powers upon indigo, but if by a "calx of tin" we must understand the oxide left upon burning, that is the stannic oxide, we know it has no reducing powers, but if it was imperfectly oxidised and contained metallic tin in fine division, a true solution and reduction of indigo would take place and a fast colour produced.

In other parts of these manuscripts we have mixtures clearly indicated capable of reducing and dissolving indigo, and at present we are inclined to believe that in the colours Nos. 96 and 97 fast blues were produced.

Not only the manuscripts of Jehan le Begue, but the other manuscripts translated in Mrs. Merrifield's work, contain many receipts and accounts of colouring matters and dyeing which have great interest of an historical nature, and at another time we purpose giving an account of those portions which throw some light upon the early use of dyestuffs and chemicals.

5. *On the Dip-blue Styles of Calico Prints.**

BY MR. G. H. UNDERWOOD.

Chroming or Orange Raising.—After the orange pieces are well washed by the fly wince, they are removed to the fancy dyehouse to be raised orange. The oranges are raised in small becks, with small winces fixed across them heated by steam blowing into the liquor, which is kept at a continual boil. Four pieces or two lumps are generally raised at once, and they receive from four to eight ends according to the area of the pattern on the cloth. If the wince is broad three lumps may be raised at once.

The mode of fixing the bath is as follows: the standard chrome is first made.

Standard Chrome Liquor.

90 lb. chrome salt.
30 lb. caustic lime, or
60 lb. dry slacked lime.
50 gallons of water.

The chrome salts are perfectly dissolved in the water and the lime is added afterwards, this is well raked up for a short time, and the raising beck is made to stand 2° Tw. in the cold by adding so much of the standard as is necessary to raise the water of the beck up that strength. The beck is then raised to the boil, and two or three lumps of cloth are

* Continued from page 147.

immersed therein, and receive the necessary number of ends to ensure their perfect raising.

After raising, the pieces are wound round the wince, which is the means of extracting a large quantity of the chrome liquor from the pieces, they are then knocked out upon the dripper of the beck, where they drain until the whole of the pieces are knocked out of the beck, these pieces are then banded up and thrown into water to prevent "lime streaks." Lime streaks are occasioned by particles of the lime used in the raising liquor adhering to the cloth, leaving white specks and sometimes streaks on the surface of the cloth of some length, this is prevented by immediately throwing the raised cloth into water, which prevents the drying of the lime on the cloth. When these streaks occur they cannot be removed without a very severe washing, which is detrimental to both the orange and the blue and is very seldom resorted to, it being less loss to pass the pieces with the lime streaks than to remove them. Whilst in the pit or box of water the pieces are unbanded by a boy and the ends tied together, they are then run through a peculiar washing machine, where the cloth meets with a clean current of water; very little pressure is exerted on the cloth whilst passing through this washing machine, because of the liability of orange patterns to mark off under pressure; after passing through this machine they are put in the hydro-extractor, then dried and stiffened if required. For a fresh set of 6 pieces the raising beck is freshened up with 1 quart of the standard chrome liquor for each piece. At the conclusion of the day's work the chrome beck is allowed to settle, the clear liquor is drawn out and put into the tub in which the standard chrome liquor is prepared, and employed instead of water for the following setting. The grounds left at the bottom of the raising beck consisting of lime, sulphate of lead, &c., are drawn off by a tap at the bottom and the beck cleaned out for a fresh day's work.

It was formerly considered necessary to have the liquor in the raising beck at a strength of not less than 7° or 9° Tw., but it has been found that such a strength is not required, for the heaviest oranges can be fully raised at 2° Tw., and with a

much less cost for waste arising from the liquor carried away by the pieces and lost. Another advantage of using the weaker liquor is that the operatives employed in the raising and subsequent washing suffer much less from the injurious action of the chromate upon the skin. When the liquor was used at from 7° to 9° Tw. cases of ulcerated hands were quite usual among the workmen, but are very much less frequent when employing the weaker liquor.

If the orange colour is irregular, or wanting in depth, and the whites not good, the faults may be traced to the original liming or dyeing of the pieces, and it is proper to treat of the causes at this point. When the oranges have been hard limed, or over limed, they come up bare, and dull, and shew very little through on the back of the piece; the outlines, or contours, are pale, indicating that the lead has been removed. The lead basis of the orange is present in the original colour in the state of sulphate; this is acted upon by the lime, which decomposes it, forming sulphate of lime and oxide of lead, which latter forms a soluble compound with lime if the latter be present in excess; and there is believed to be another action of an excess of lime, and that is to precipitate the oxide of lead upon the cloth in a hard, coarse state of aggregation, which does not take so good a shade in the chroming. Prolonged dipping in weak vats, or what is called back-dipping, acts injuriously upon the orange, either by dissolving the lead, or causing it to set hard: that is, to assume a molecular condition, unfavourable for raising.

Bad whites are traceable to the same cause of over liming; for though the oxide of copper is not known to be soluble in lime water, the action of an excess of lime upon it for a length of time causes it to set hard, that is, instead of existing upon the cloth in a hydrated, gelatinous state, it becomes dry and contracted; it is then pervious to the vat liquor, which discolours, to a greater or less extent, the fibre underneath. It was found by experiment that to produce this effect on the copper resist required a really strong lime vat; and that even a very prolonged immersion in a weak vat had no injurious action upon the state of the copper oxide; the resist might

be dipped a hundred successive times in a properly set lime vat and still act perfectly; but if dipped but a short time in a strong vat it was injured.

The effects of soft liming, or under liming, are not less evident and injurious than those of over liming, whether upon the orange or the white. Underliming of oranges results in a bare colour, with unevenness from spots or flecks, accompanied in bad cases by light or white streaks starting from the edge of the pattern and at right angles with the length of the piece; these defects are most conspicuous in patterns containing much colour, and particularly in heavy stripes. The reason is evident: if there is not sufficient lime in suspension to decompose the sulphate of copper and fix it upon the spot it begins to dissolve, and the solution soon acquiring a density greater than that of the lime water sinks down in streams on the surface of the cloth until it is arrested by the alkalinity of the vat, and being thus fixed prevents the entrance of the indigo, at the same time the dense lead compounds in the colour not being fixed on the cloth communicate a tendency to the colour to fall or slip from its place, thus lead is lost, inferior and irregular oranges result, and white or light blue stains disfigure the cloth. A piece which is defective from under liming may have the orange in some parts quite good, both back and front, and it is remarkable that what is called the flecking of the colour is not generally perceived whilst draining from the lime vat, and is frequently not seen until the cloth has gone through three or four vats, when large specks of colour may be observed to start from the surface of the pattern, leaving a perfectly white spot beneath, or the colour may be seen to slip down from its place on the cloth on to the portion which should be free from it.

Two-blues and White Crossover.—This style requires twice printing and twice dipping. The pieces are first printed in white paste, then dipped to the required shade of light blue, washed off, and dried up. Then printed again with the white paste, which is preferred because of the ease with which it can

be removed from the cloth, and containing no lead it leaves the blue free from white specks. It is then dipped a second time, the light blue which has not been printed upon receives the indigo, forming a dark shade, which with the white and light blue can give rise to an endless variety of checked patterns.

Blue and Red Crossovers.—The red being from madder or garancine, this style requires much care to get good work, especially in the whites; if the cloth is not well bleached to commence with and the resist paste not thoroughly removed after the blue dyeing, bad whites are sure to result. Where the white is not very large it is better to print with the white resist paste, on account of its containing no lead and the facility with which all traces of it can be removed from the cloth by washing and souring; but if the white be of a massive character the ordinary navy paste (p. 75) must be used, because in large patterns it is less liable to "slip" or "fleck" than the white paste.

If the pieces have been printed with the white paste (p. 78) the ordinary process of bowling, souring, and washing is sufficient to clear the cloth previous to printing with the aluminous mordant. But should it have been deemed necessary to employ navy paste, the following process of removing the lead is advisable to adopt. After bowling and washing, give the pieces a few ends in weak, warm caustic soda, wash and give a few ends through weak muriatic acid, and wash well in the fly wince; by this treatment the lead will be entirely removed from the cloth.

In the blue dipping it is necessary to have a somewhat higher shade than the pattern, because of the punishment the blue receives in the after dyeing process. The cloth being cleared from the resist is dried and printed with the red mordant, aged one night, and dunged and dyed either in madder, or garancine, or alizarine, and brightened and cleared in the well-known manner.

Two-blues, Green, and Yellow by Twice Printing.—The cloth is first printed with a white paste in narrow stripes, which may run the length of the piece, be crossovers, or diagonals. It is

then dipped light blue; attention must be paid to the depth of shade, for if dyed too dark the resulting effect on the finished goods will be that of two blues, and not green and blue, unless the ground be afterwards dipped very dark, which for economical reasons is to be avoided. The goods are now printed with white and orange paste. The white paste preserves the printed portions white or light blue, the orange paste produces two colours on the finished cloth, a yellow colour where it falls upon the white stripe, and a green where it falls upon the light blue stripe. After printing, the cloth is limed in a soft lime vat and dipped to the required shade, washed, soured, raised in the chrome beck to orange, and then cut down by giving the pieces a few ends in very weak nitric acid, washed, and dried.

Green and Yellow with Berries.—Printed with navy paste, and dyed same as navy blue, washed, bowled, &c., and dried up. Padded in stannate of soda at 10° or 14° Tw., and then passed through sours at about 4° Tw., and well washed. The cloth thus uniformly mordanted both in the reserved and blue parts with oxide of tin (peroxide or stannic oxide) is then dyed in decoction of Persian berries, the whites become bright yellow, and the blue ground is converted into a dull, heavy green.

Other yellow dyes may be used instead of Persian berries, the cloth may be padded in lead salt, the lead fixed and dyed yellow with chrome and brightened with nitric acid.

Blue, Orange, Yellow, and White.—This style is identical with the blue, orange, and white style, as far as it goes. The yellow is produced by blocking parts of the orange with the yellow blocking paste (p. 135) which is essentially a nitrate of alumina, sufficiently acid to convert the orange into yellow. If the patterns are so large as to require separate liming before dipping, care must be taken that the liming is not too hard; and the block printing must be carefully done to produce a good effect.

The blue furniture style does not call for detailed notice; it has for basis, blue, orange, and white, and other colours are filled in by blocking.

Manganese Two Blue and White.—This style, which is more curious than practical, is obtained as follows. Commercial muriate of manganese or bronze liquor at 25° Tw., is thickened with gum, and printed on cloth, say in a stripe pattern. The printing requires much care, and the thickening and engraving so regulated that the colour is only upon the surface of the cloth, not penetrating to the back. The next step is to fix the oxide of manganese upon the cloth, which is done by passing through an alkaline fixing beck; the cloth is left wet some hours, washed, and dried. The part to be kept white is printed with the azure paste, the cloth run through the sky vat, allowed to oxidize, and then bowled and soured in sours containing sulphate of iron to facilitate the removal of the manganese. It will be found that those portions printed with manganese have dyed up a shade of blue three or four times as intense as the unprinted portions, producing a double effect. This is attributed to the oxidizing power of the manganese oxide, causing a greater precipitation of indigo upon those portions printed with it, than can take place upon the white parts.

The foregoing account of the indigo dip-blue styles has no pretension to be considered exhaustive, for it does not include several styles long known and extensively worked. The writer has treated of the styles with which a long and attentive practice has made him familiar, and he has not gone beyond them, nor sought to pass outside the bounds of his personal knowledge.

6. *Note upon a Method of Preventing the Action of Iron upon Alizarine and Madder Extract Colours.**

BY M. J. WAGNER.

SINCE the time when extracts of madder and artificial alizarine came into use for the direct production of reds and pinks in calico printing, iron under all its forms has been an implacable enemy to the colourist. It is especially the steel doctors which are injurious, being acted upon by the mixture of colouring matters, salts of alumina, and acetic acid which constitute the colour; a portion of iron is dissolved which tarnishes the colour. The action is not observed at the commencement of working, and the first pieces printed are always better than those which follow. Generally the evil is mitigated by taking care to change the colour, or employing but small quantities at a time, or furnishing from the box-doctor. The doctors are also covered with a varnish, either shellac dissolved in alcohol, a mixture of wax and suet, or suet alone, leaving the metal bare only at the edge. These contrivances answer fairly well for designs taking a great deal of colour, but when only a small quantity of colour passes on to the printed piece in comparison with what is used in furnishing, the proportion of dissolved iron augments very rapidly, and the colour must be changed or put on one side either to be treated by the process of M. Carlos Koechlin, or to serve for making puce or chocolate colours by addition of acetate of chromium.

There is another method of meeting the difficulty, and that is to use the so-called composition doctors, alloys of copper, tin, zinc, nickel and others; but up to the present time these doctors, though elastic, have not the temper of steel doctors, and it is especially for designs requiring but little colour that highly tempered doctors are required.

I have long sought for a remedy for this defect, and I believe I have solved the problem. Considering the well known

*Bull. de la Sec. Ind. de Rouen, No. iv., 1876.

reaction of sulphocyanide of potassium upon the salts or iron,* I introduced 10 to 20 grammes of it per litre of colour, and caused cloth to be printed with the colours in comparison with normal colour. After the printing, the colours were put into pots in contact with pieces of steel doctor about four inches long and left twenty-four hours, and then cloth again printed with them. The colour which had no sulphocyanide was very purplish, the others were fine reds perhaps a little darker than the original colour. The pieces of doctor which were in the colours with sulphocyanide were not acted upon, while that on the primitive colour was attacked.

I had the opportunity of trying this plan on the large scale, upon 50 pieces of the same pattern, made with a red to which 20 grammes of sulphocyanide per litre had been added (1 to 50). I could not see any difference between the colour on the first piece and the last piece printed with this colour.

Although the price of the sulphocyanide is rather high, it can no doubt be produced at a lower price if, as I hope, a more extended trial by others confirms my results and causes it to enter into use in calico printing.

M. J. Depierre was requested to report upon the note of M. Wagner, and we extract the following interesting particulars from the report made. It appears that since M. Wagner had sent his note, he had drawn attention to the fact that the sulphocyanide was of no use in colours made entirely with acetates. M. Depierre, therefore, confines his experiments to colours made with nitrates, and containing an excess of acetic acid, such as are in general use.

The results of his experiments confirmed in every detail the statements of M. J. Wagner ; and some additional ones were made of considerable interest, and are here noted.

Sulphocyanide of ammonium does not act so well as the potassium salt.

To ascertain whether the sulphocyanide acted as a whole

*Neither the ferrocyanide nor the ferricyanides can be used, for the iron, which is one of their component parts, combines with the alizarine during steaming and gives a violet colour as M. Horace Koechlin first pointed out.

or was decomposed, M. Depierre added sulphocyanide to alizarine violet, made in three ways,—with neutral ferrous acetate, neutral ferric acetate, and an acid mixture of both acetates; in one case sufficient sulphocyanide was added to convert all the iron into sulphocyanide, and in another ten times that quantity was added. The influence of the sulphocyanide was very small; all gave violet colours, but little different from the normal colour, the ferric acetate shewing the greatest difference. It is concluded from the experiments that the sulphocyanide of potassium has always a weak action, that it acts most energetically in fresh colours, being itself decomposed by time, and that its action is not in proportion to its quantity.

M. Depierre extended his experiments to ascertain the influence of arsenite of alumina upon alizarine reds and pinks, the object being to ascertain whether ferrous arsenite would be formed with iron present, and whether the alizarine lakes were more or less stable than the arsenite of iron which might be formed. The arsenite of alumina was prepared by precipitating acetate of alumina with arsenite of soda, and was used in the gelatinous state, containing 50 per cent. of water.

(1.) It is known that in printing alizarine pink with a steel doctor, that if the machine be stopped for a minute or two, and started again, the pink has a purplish colour at the point where the cloth stopped, and is tarnished for some distance. If the experiment be made with a colour containing 1 per cent. of arsenite of alumina, there is a violet hue across the piece at the point of stoppage, but there is no appreciable tarnishing of the parts following. This experiment indicates that the small proportion of arsenite present in the colour is not able to precipitate and render inert all the iron dissolved at the point of contact, but that it is sufficient to prevent its spreading.

(2.) The addition of arsenite of alumina to a very light alizarine lilac renders it still lighter, and when sufficient arsenite is added to precipitate the whole of the iron, no lilac is produced, but a pink instead. This shews that the iron has become inactive, and the alumina taken its place.

(3.) Three colours for pink were printed, the first very acid, but with no addition; the second containing .5 per cent. of ferric arsenite, there being sufficient iron in that quantity to give a medium purple; the third with the addition of the same quantity of iron in the state of ferric acetate. The third colour alone was much injured; the second, containing ferric arsenite scarcely distinguishable from a pure pink.

(4.) If longitudinal stripes be printed with a mixture of alizarine pink and purple, and then printed with a crossover, with a pink containing 2 per cent. of arsenite of alumina, the points of intersection come out red, while the longitudinal stripes are of a light chocolate. On the other hand, if a purple containing a sufficient quantity of arsenite of alumina be crossed over with a pink, the intersections give a red, and the intermediate parts are pink.

The arsenite of alumina is much cheaper than the sulphocyanide of potassium, it is easily prepared, and has been in actual use for some years.

Concerning the use of arsenic in calico printing, notice may be drawn to the proceedings of the Central Hygienic Council of Mulhouse, in which it is declared, after numerous experiments made upon textiles prepared with certain proportions of arsenite of alumina, that there is no danger in using these textiles. The text of the report (*Seance*, du 27 Mai, 1875) is as follows:—"In certain cases it is necessary to employ an arsenical mordant to fix colours, for which no substitute has yet been discovered. . . . But the amount of arsenical mordant remaining on the stuffs after repeated washings is very small; moreover, the arsenic is not fixed upon the fabric in the free state, but as a salt of alumina, which greatly diminishes its solubility.

"From numerous experiments made upon cloths with water, saliva, diluted acetic acid, and boiling solution of soap, it is found that the arsenic is nearly insoluble, and the wearing of these goods cannot give rise to poisoning in the ordinary conditions of life."

7. *Critical and Historical Notes concerning the Production of Adrianople or Turkey Red, and the Theory of this Colour.**

BY THEODORE CHATEAU.

Corresponding Member of the Industrial Societies of Mulhouse and Amiens, etc. etc.

THE processes already described required a period of three months for their completion,—of their origin, and whether imported from the farther East we have no accounts which can be relied upon. We only know that the methods of dyeing spread slowly westward into the Levant, probably through northern India, Persia, and Arabia. Note should be taken of the ancient knowledge of madder; the Greeks and Romans were acquainted with it; it was cultivated in central Gaul at the time of Strabo; in the seventh century it was sold at the fairs of St. Denis, near Paris, where existed a numerous body of wool dyers; in the middle ages it was cultivated in the province of Basse-Normandy, especially in the neighbourhood of Caen, the scarlet cloths of this place and Ypres, wool dyed with madder, had a great reputation which extended even to Italy where the goods were in demand; in 1671-72, Colbert drew up a set of instructions for the French dyers upon the culture and use of madder, with the view of becoming independent of the Dutch supply; in 1750, the government gave special privileges to the cultivators of madder, and later on caused madder seeds to be imported from Smyrna, and induced persons familiar with its culture to settle in Avignon.

We shall proceed now to consider the processes of dyeing used by various Eastern people as communicated by travellers who had seen them in the native dyeworks.

Greek or Levantine Process.—The Russian professor, Pallas, while at Astrakan on his travels, took the opportunity of obtaining information upon the methods of dyeing. One of his

* Abstracted and condensed from "Moniteur Scientifique, vi., (3), p. 301.

Continued from p. 178, Textile Colourist.

friends who was interested in a dyeworks, communicated to him the exact methods in use, and a description of which appeared in the *Journal de Pétersbourg* for the year 1776, being the first published account of what had up to that time been held as a secret.

The yarn is saturated with a mixture of fish oil made emulsive by means of solution of soda, it is left in the mixture from Saturday until Monday, it heats somewhat during this time, it is then washed, dried, and again steeped in the oily emulsion and hung in the open air unless rain prevents. On the Tuesday it is for a third time steeped in the emulsion, on the four following days it is steeped four times in a plain soda solution.

It then receives the first dye of an olive-green shade from fustic leaves, which are of an astringent nature, and mixed with one-tenth of the weight of the cotton of alum; the cotton, alum, and decoction of fustic leaves are boiled together, then hung up to dry, washed, and redried. The cotton is now sufficiently prepared for the red dyeing.

The madder dyeing vessel is prepared by taking a weight of madder said to be somewhat less than that of the cotton to be dyed, it is steeped and mixed with blood and boiled with it, the cotton is then entered into the dye bath, which is kept at a boiling heat.

When the cotton is well penetrated with the colouring matter it is taken out and dried, then placed in pots which are filled with a weak alkaline liquor, under which it is submerged, and the liquor raised to the boiling point, and the vessels kept filled up with fresh solution.

The cotton is washed from this liquor and dried; it is seen to be perfectly dyed; the operations take about twenty-one days. It was said that the Turks gave a more brilliant hue to the yarn and increased its weight at the same time by saturating again with an oily emulsion and leaving it to dry under a press, in this case they employ an olive oil and not fish oil. In general it is found that all fluid, fatty bodies which give a perfect emulsion with soda are suitable for this kind of dyeing.

The price of the raw materials for dyeing vary according to circumstances, freight, &c., but the establishment and carrying on of such a works requires a large capital. The madder is brought from Persia or the neighbourhood of Terek, the smaller roots of which are preferred, when ground it costs from tenpence to one shilling per lb.; 1 lb. of madder is reckoned sufficient for 1 lb. of cotton yarn. The fustic leaves come from Kislar, they are coarsely ground, small branches and all, and cost about one penny per lb. Cotton dyes only a loose pale red in the madder bath if it be not previously boiled with fustic leaves, or with gall-nuts, which were formerly employed. It requires about 1 lb. of fustic leaves to 2 lb. of cotton. Good soda is also obtained from Kislar at a low price. For one pood of cotton (36 lb. English), there is used 4 lb. of alum, 15 lb. fustic, 58 lb. fish oil, 36 lb. soda, and the same weight of madder.

Armenian Method.—Pallas gives briefly the following account of the method followed by the Armenians in dyeing Turkey red, it is from the *Journal de Pétersbourg* of the year 1776. The Armenians dye Turkey red by using the oil from certain fish; they look upon that species of oil which becomes perfectly milky when mixed with solution of soda as preferable to any other. After several immersions in the oil bath and repeated dryings of the oiled cotton, it is passed into an astringent bath containing a little alum; it is then dyed in madder mixed with calves' blood; lastly it is digested for twenty-four hours in a solution of soda.

Turkish Process.—Van Straalen gives the following translation from the Turkish regarding the details of the Oriental process of dyeing.

(1.) To dye 35 okes of cotton yarn (about 112 lbs.), there is taken 20 okes of ashes, and 8 okes of quicklime; the two latter substances are put into a large cauldron with soft water and boiled together until thoroughly mixed; the cotton is put in layers into small glazed jars and covered with cloth; the solution of ashes is then poured on the cotton, which is left to steep in it for three or four hours.

(2.) The cotton thus saturated with alkaline liquor is taken

out without wringing and thrown into a boiler with water; it is there boiled five or six hours, washed in the river, and dried in the sun.

(3.) The cotton being dry, a mixture is made of 4 okes of sheep's dung, and 4 okes of olive oil; they are well pounded together with the necessary quantity of water, and the cotton well steeped and saturated with the mixture; then the excess wrung out, and the cotton dried in the sun. The liquor wrung out of the cotton is preserved.

(4.) The cotton being again dry is put through the same operation as the last one, and again a third time, and if necessary, still again, or until the whole of the oily mixture has been taken up and dried upon the cotton. After each operation the cotton is exposed to the sun.

(5.) The next operation is to take 5 okes of a species of soda called in Turkish, *caja-tachi*, which is placed in a glazed earthenware jar half buried in the ground, three other jars being similarly placed; 5 okes of olive oil are added, and the requisite quantity of water, and the whole mixed up with a wooden stirrer. The cotton being in the other jars is then saturated with this emulsion and treated as described in sections 3 and 4, that is, steeped, wrung, and dried in the sun, then washed in the river and again dried in the sun.

(6.) When the alkali *caja-tachi* is mixed with the oil, the water should become white, which is an indication of a perfect mixture. The cotton from the last operation being dry, is treated with 4 okes of gall-nuts, which are powdered, and placed in a boiler with a sufficient quantity of water, and boiled for four or five hours; the cotton is laid out in the earthenware jars,* and the boiling gall liquor poured upon it; it is left a day, then washed in the river and dried in the sun.

(7.) A sufficient quantity of water is put into a boiler, and 4 okes of rock alum added; the whole is boiled for five hours, and the hot liquid poured upon the cotton contained as before in the earthenware jars, and is allowed to remain in the alum

* *Demi-jarres*, probably this is for the so-called demi-johns, very large earthenware vessels, originally made in Damaghan, in Khorassan, a province of Persia. *Ed.*

water all night; in the morning it is washed in water and dried, then 40 okes of madder roots, ground Lizaris, are mixed with 15 okes of sheep's blood, and the necessary quantity of water, and the quantity divided between two boilers, each containing 17½ okes of the cotton yarn; the boilers are covered with wooden lids, and kept at a boiling heat for five hours; they are not uncovered during the process of boiling, except for taking out small samples of the cotton from time to time to observe the process of the dyeing, which is apparently tested by mastication with saliva. If the dyeing is not perfect, the boiling is continued, care being taken that there is sufficient water in the boilers.

(8.) The dyeing being accomplished, the fire is drawn from under the boilers, and the cotton is left in until the whole is cold; it is then carried to the river and thoroughly washed. Afterwards, and without wringing or drying, it is thrown into a boiler filled with water made alkaline with the *caja-tachi*, and boiled for seven or eight hours, after which, it is washed and dried for the last time. The colour obtained by this process is not injured by touching with lemon juice or any other acid.

Grecian processes according to Felix.—Chaptal and others made a report upon the works of the traveller Felix, which appeared in the *Annales de Chemie*, (1) xxxii., pp. 195-214 (1798). The following is a full account of his memoir.

The cotton is first bleached by means of three leys—one of soda, the second of ashes, and the third of lime. The cotton is thrown into a copper and watered with each of the three leys in equal proportions, it is then boiled in pure water and washed in the river.

The second treatment is with a mixture of sheep dung, soda, and water; the sheep dung and soda being pounded together in a mortar, the proportions used being 1 measure of sheep dung, 6 of soda, and 40 of water. The mixture being made is passed through a sieve, and apparently only the clear or finer portion taken, which is placed in a copper, and 6 measures of olive oil added, and the whole stirred up until it

has become white like milk. The cotton is then watered with the mixture, and when it has been well imbibed it is wrung, pressed, and dried. This operation is repeated three or four times in the same liquor, because it is this treatment which gives evenness to the dyeing ; the time of leaving the cotton in the emulsion in each operation is five or six hours. It should be noted that the cotton is always dried out of this bath without rinsing or washing, which must only be done at the termination of the treatment. The cotton is then as white as if it had been grass-bleached.

The use of sheep dung is not practised in our dyehouses (in France), it is peculiar to the Levant. It may be thought that this excrement contributes nothing to the fastness of the colour, but it is known that it contains a large quantity of fully developed volatile alkali, which has the proverty of giving a pink hue to the red ; and it is probably owing to the use of this ingredient that the Levant reds owe their brightness and clearness. It is known that the Levant maroquin is prepared with dogs' dung, which increases the colour of the lake.

The sheep dung process is followed by the galling, which operation is performed by plunging the cotton in a warm solution, made by boiling 5 okes of powdered gall-nuts in water. This operation fits the cotton for absorbing the colours, and gives more body and fastness to them.

After the galling follows the aluming, which is twice repeated at an interval of two days, and consists in steeping the cotton in water, containing in solution 5 okes of alum and 5 okes of water, made alkaline by soda-ley. The aluming should be conducted with care, because it is this operation which chiefly causes the combination between the cotton and the colouring matters, and which enables the dye to sustain the destructive action of the air. After the second aluming the cotton is wrung, pressed, and being placed in a sack of open texture, is washed in running water. The next operation is the dyeing. In a boiler is placed 100 okes of water, 55 okes of lizaris (madder) in powder, and 1 oke of ox or or sheep's blood. The blood strengthens the colour, and the proportion of it is increased according to the shade desired.

A moderate fire is kept up under the boiler, and when the liquor commences to ferment and heat, the cotton is added in small portions at a time; the hanks are connected together by cords, and suspended on sticks which rest on the sides of the boiler; when the liquid boils well and regularly, the sticks are drawn out which held the hanks in a perpendicular position, and the hanks are let fall into the liquid, and remain there until two-thirds of the water has boiled away. When only one-third of the liquid remains, the cotton is taken out and washed in clear water.

The colour is perfected by treatment with water made alkaline by soda. This process, which gives the hue to the colour, is the most delicate and difficult of all. The cotton is boiled in this alkaline water with a constant heat until it has acquired the desired shade. All the art consists in seizing the right point, and the careful workman, therefore, watches the process with the most scrupulous attention for the moment when the cotton must be taken off the fire, and would rather burn his hand than be a moment late. When the colour is too pale the Levantines know how to darken it by increasing the quantity of the materials, and when they wish to make it brighter or more beautiful they employ various native roots, and amongst others one called *sassari.*

Early French Methods.—The description which follows of the first method of Turkey red dyeing followed in France was communicated to Flachat by some one who had seen the process worked in Turkey, it was practically carried out in 1748, at Saint Chamond, near Lyons.

Supposing that 100 lb. of cotton have to be dyed, 150 lb. of alicant soda are taken and placed in a sack of thin cloth and put into a boiler. The boiler is provided with a plug hole at the bottom so that the liquor from it may be run into another boiler set at a lower level. Solution of the ashes being effected it would appear that the alkali is caustified with 75 lb. of lime, and the clear liquor used to water the cotton. The cotton containing the alkaline liquid is then, without pressing out the liquor, transferred to a boiler, filled with water, and boiled for three hours, washed, and dried in the air.

A quantity of the alkaline ley equal to 400 pints is then well mixed up with 25 lb. of sheep's dung and the intestinal liquor (gall) of sheep, and the whole sieved through a hair sieve. When the mixture is complete 12½ lb. of good olive oil are stirred in, which immediately forms a soapy fluid. The cotton is then placed lump by lump in this liquid and left twelve hours, after which it is lightly wrung and dried. This operation is repeated three times. The liquor pressed out of the cotton is preserved, it is called *sickiou*, and is afterwards employed in brightening.

When the cotton has undergone three treatments in the first soapy liquid, and when it is perfectly dry, it receives three similar treatments in a composition like the first one, made with 400 pints of alkali and 12½ lb. of oil, but in this liquid there is no sheep's dung, and the excess of fluid expressed from the cotton is likewise preserved for after use. Finally the cotton is well washed in the river to remove oil, which would prevent the proper taking of the galls by the cotton. The cotton after this washing should be as white as if it had been grassed or crofted.

When dried, the cotton is subjected to the process of galling and then to two successive alumings. The gall-nuts in powder are employed in the proportion of one *quarteron* for each pound of cotton; 6 oz. of alum per pound are used in the first aluming and 4 oz. for the second; and lastly in the aluming there is added a quantity of alkaline solution employed equal to the weight of alum. Some days after the second aluming the dyeing is proceeded with; 2 lb. of lizaris (madder) are employed for each pound of cotton, and before commencing to dye about 20 lb. of sheep's blood are added to the dye bath; the cotton is well beaten in the dye from which the scum is also carefully removed.

Papillon's Process.

Step 1,—or Cleansing Operation.—For 100 lb. of cotton take 100 lb. of Alicante barilla, 20 lb. of pearl-ash, 100 lb. of quicklime. Mix the barilla with soft water in a deep tub, having a small hole near its bottom, which is to be

stopped at first with a peg, but covered within by a cloth, supported by two bricks, in order that the ashes may be hindered from either running through the hole or choking it, while the ley filters through it. Under this tub another is to be placed to receive the ley, and pure water is to be repeatedly passed through the first tub to form leys of different strength, which are to be kept separate until their strength has been examined. The strongest required for use must swim or float an egg, and is called the ley of six degrees of the French hydrometer, or "pese-liqueur." The weaker are afterwards brought to this strength by passing them through fresh barilla ; but a certain quantity of the weak, which is to make two degrees of the above hydrometer, must be reserved for dissolving the oil, the gum, and the salt, which are used in subsequent parts of the process. The ley of two degrees is called the weak barilla liquor, the other is called the strong. Dissolve the pearl-ash in ten pails (containing 4 gallons each) of soft water, and the lime in fourteen pails. Let all the liquors stand until they become quite clear, and then mix ten pails of each. Boil the cotton in the mixture five hours, then wash it in running water and dry it.

Step 2.—Bain-bis, or Grey Steep.—Take a sufficient quantity (ten pails) of the strong barilla water in a tub, and dissolve or dilute it in two pailsful of sheep's dung ; then pour into it 2 quart bottles of oil of vitriol, 1 lb. of gum arabic, and 1 lb. of salammoniac, both previously dissolved in a sufficient quantity of weak barilla water. The materials of this steep being mixed, tramp or tread down the cotton therein until it is well soaked ; let it steep twenty-four hours, then wring it hard and dry it. Steep it a third time twenty-four hours, after which, wring and dry it; and lastly, wash it well and dry it.

Step 3.—The White Steep.—This part of the process is precisely the same with the last in every particular, except that the sheep's dung is omitted in the composition of the steep.

Step 4.—Gall Steep.—Boil 25 lb. of galls, bruised, in ten pails of river water, until four or five are boiled away ; strain the liquor into a tub, and pour cold water on the galls in the

strainer to wash out of them all their tincture. As soon as the liquor is become milk-warm, dip the cotton into it hank by hank, handling it carefully all the time, and let it steep twenty-four hours ; then wring it carefully and equally, and dry it well without washing.

Step 5.—First Alum Steep.—Dissolve 25 lb. of Roman alum in fourteen pails of warm water without making it boil ; skim the liquor well, and add two pails of strong barilla water, and then let it cool until it be lukewarm. Dip your cotton, and handle it hank by hank and let it steep twenty-four hours ; wring it equally, and dry it well without washing.

Step. 6.—Second Alum Steep.—Is performed in every particular like the last; but when the cotton is dry, steep it six hours in the river, and then wash and dry it again.

Step 7.—Dyeing Steep.—The cotton is dyed in parcels of about 10 lb. at once ; for which take about 2½ gallons of ox blood, and mix it in the copper with twenty-eight pails of milk-warm water, which are to be well stirred, then add 25 lb. of madder, and stir the whole well together; then having beforehand put the 10 lb. of cotton on sticks, dip it into the liquor, and move and turn it constantly one hour, during which gradually increase the heat, so that the liquor may begin to boil at the end of the hour. Then sink the cotton and boil it gently one hour longer, and, lastly, wash and dry it. Take out so much of the boiling liquor as will leave the remainder only milk-warm when mixed with as much fresh water as may be required to fill the copper again, and then proceed to make up a dyeing liquor, as before, for the next 10 lb. of cotton ; and so proceed in succession with the whole.

Step 8.—The Fixing Steep.—Mix equal parts of the grey steep liquor and the white steep liquor, taking five or six pails of each. Tread down the cotton into this mixture, and let it steep six hours, then wring it moderately and equally, and dry it without washing.

Step 9.—Brightening Steep.—Ten pounds of white soap must be dissolved carefully and completely in sixteen or eighteen pails of warm water; because, if any little bits of the soap remain undissolved, they will make spots in the cotton.

Add to this four pails of strong barilla water and stir it well. Sink the cotton in this liquor, keeping it down with cross sticks, and cover it up ; boil it gently two hours, when, being washed and dried, it will be finished.*

Hausmann's Process, 1792.—This process was described by the inventor in a memoir addressed by him to Chaptal, then Minister of the Interior, entitled "*Observations upon madder, followed by a simple and regular process for obtaining the colour called Levant or Adrianople red of the greatest degree of beauty and fastness*" (vol. viii. of O'Reilly's Annals).

This process consists in dissolving alumina in caustic potash. For this purpose 1 pint of alum is dissolved in two pints of hot water, and while the solution is boiling sufficient caustic potash is added to precipitate and redissolve the alumina. Upon cooling and standing, the greater portion of the sulphate of potash is deposited, the clear is decanted, and to 33 parts of it 1 part of linseed oil is added, by which means an emulsion is obtained with which the cloth to be dyed is impregnated.

The cotton thus prepared is dried in a covered shed in summer, and a warm room in winter; after twenty-four hours ageing it is washed and dried, then again steeped in the alkaline emulsion, then immediately dried and the processes repeated until the cloth has received the necessary amount of emulsion. Two treatments are sufficient to yield a fine red, but by giving three or four in the same way very brilliant colours may be obtained.

The cotton is thus, at one operation, oiled and mordanted, and may be immediately dyed, which, in Hausmann's works, was done with addition of chalk amounting to one-sixth of the weight of madder employed, and thirty or forty times the weight of water.

The dyeing was carried on in a manner different from that usually followed. The madder bath was gradually heated in the course of one hour to a hand heat (not hot enough to scald the hand), then the cotton was put in and left for two

* Papillon's process is not translated from M. Chateau, but taken direct from the account in Bancroft's "Permanent Colours."—ii. p. 249.

hours, the operation lasting three hours. After dyeing, the material was perfectly washed and branned; soap and carbonate of potash were added to the bran when it was wished to have a crimson shade. M. Hausmann says, that by this process he obtained reds which excelled in beauty and brightness those of the Levant, and compared favourably with the best productions of France and Lausanne. Mr. B. Hausmann (the son) communicated to Persoz a confirmation of his father's statements, but at the same time acknowledged that the process had never been used on the large scale, not giving satisfactory results when tried.

Processes Proposed by Vogler.—We will not follow M. Chateau by giving a detailed account of Vogler's attempts to modify the Turkey red process (Annales de Chemie, 1796 (1), vol. iv.); they were unsuccessful, made almost at random, have no practical and scarely any scientific interest. It is sufficient to say that he tried animal gelatine as a basis, and also vegetable gelatinous substances, even gum and starch in mixture with alum, and thought they increased the beauty of the colour. He tried also addition of white arsenic to Hausmann's alkaline mordant, and corrosive sublimate in mixture with alum.

Gmelin's Process, 1803.—This description appears to be nothing more than a condensed account of some of the processes given above, but, as it is brief, and combines some features of different methods, we give it in full. Three solutions are prepared : the first with soda strong enough to mix at once with olive oil, the second of potash, and the third of lime. Equal quantities of each solution are thrown upon the cotton, and when it is well impregnated, it is boiled three hours in pure water, washed, and dried, Then 25 lb. of sheep's dung are mixed with 500 lb. of the soda solution and passed through a hair sieve ; 12½ lb. of olive oil are mixed with the sieved liquor, and the cotton impregnated with the emulsion, wrung out, and this operation repeated three times (drying between the steepings is not mentioned.—*Ed*). A decoction of 25 lb. gall-nuts is prepared in hot water, and when it has cooled the cotton is steeped in it for twenty-four hours, it is

then wrung out and, when dried, put into a solution of 25 lb. of alum and as much of the soda solution. The same process is repeated two or three days afterwards, and the cotton placed in a bag and left all night in a running stream. It is then sufficiently prepared for dyeing in madder. For 25 lb. of cotton, 20 lb. of still fluid ox blood, and 55 lb. of good ground madder are mixed with the requisite quantity of water (12 to 1,400 lb.), and the cotton well boiled in it. The cotton is washed and dried, and the colour brightened by passing it through a potash solution and then lightly boiling it for five or six hours in a well covered boiler.

Chaptal's Process, 1807.—This description is taken from a work by Chaptal, published in Paris, upon "The art of dyeing cotton red." The cotton was first submitted to a cleansing operation by boiling for half an hour with an alkaline solution at 2°, washing, and drying. The first preparation for 100 lb. of cotton consisted in taking 150 lb. of a clear solution of soda, marking from 1° to 2° Beaumé, and well mixing with it 10 lb. of oil; afterwards, about 12½ lb. of the fluid taken from the first stomach of ruminant animals was mixed with the oil and soda and well stirred up to secure a perfect mixture. The cotton was passed in this liquid and strongly pressed in every direction for three or four times, afterwards well wrung to free it from excess of the liquor and left until the following day. Then dried and passed into a soda solution marking 1½° to 2° or more. Dried and again passed into a solution at 2°; the strength of the solution being gradually increased at each passage.

The second preparation is to pass the cotton into a second oily bath which contains none of the gastric liquor employed in the first one. The second bath is composed of the remains of the first, to which is added 150 lb. of soda at 1°, and 8 lb. of oil. The processes of the first preparation are repeated and, lastly, the cotton is well washed in still water, wrung out, and dried. The cotton thus washed and dried is ready for mordanting. The mordants are alum and gall-nuts, without which the cotton does not take a full or fast colour. The galls are applied first: for 100 lb. of cotton, 10 lb. of broken

galls are boiled with 100 lb. of an infusion of 15 lb. of sumac; after boiling half an hour 50 lb. of cold water is added. The galling is done very hot, the cotton is well worked in it and then carefully wrung out; it is dried in the day time in calm weather; in foggy or rainy weather the cotton is blackened.

The aluming is effected in a bath of 150 lb. of warm water containing 12½ lb. to 15 lb. of Roman alum. The dull yellow colour acquired by the cotton in the galls turns to grey in the alum. The alumed cotton is dried and afterwards well washed to separate that portion of the preparation, and especially of the mordant which has not combined with, or does not adhere intimately to, the cotton.

The cotton is now submitted to a third oil treatment prepared with 7½ lb. of oil and soda solution at 1°; it is then passed through three successive leys, the first marking 2°, the second 3°, and the third 4° Beaumé; the cotton is dried each time and washed to deprive it of excess of oil. It is then galled with 7½ lb. of galls, without sumac, and alumed with 10 lb. of alum, washed as before, dried, and is then ready for dyeing.

The third oil treatment could be given immediately after the washing from the second oil, and the second galling and aluming with washings dispensed with.

For dyeing, 2 to 2½ lb. of good madder are required for each lb. of cotton; it is mixed with blood in the proportion of ½ a lb. for each lb. of cotton; the mixture is made by hand, and forms a paste, which is then transferred to the water in the madder copper; heat is applied, and as soon as the water is warm the cotton is entered and moved about during an hour without raising the heat to the boil; the cotton is put in a net and left in the bath, where the boiling is kept up for an hour. Upon coming out of the dye the cotton is well and completely washed in abundance of water.

The colour is brightened in a close boiler. In the first boil a soda ley at 2° is taken, and 10 lb. of white soap dissolved in it; the cotton is boiled for eight or twelve hours, according to the strength of the ley and the depth of shade of the dye. When by examination of a portion of the cotton it is found

sufficiently boiled, cold water is added to the boiler, the cotton withdrawn, washed, and dried. The second boiling is done with water made slightly alkaline with soda, and containing 12½ lb. of soap; the duration of the boiling is from four to six hours.

The final brightening is done by making a solution of tin as follows:—30 grammes salammoniac to 1 lb. of nitric acid, at 32° Beaumé; add tin in rods at the rate of 1 oz. to each pound of acid, or until the solution becomes opalescent. Seven and a half pounds of this tin solution are added to 100 lb. of warm water, in which is dissolved 3 lb. of alum. The mixture becomes white, and the dried cotton is plunged into it. The solution may be made stronger or weaker according to the depth of colour on the cotton. After remaining a sufficient length of time the cotton is washed in running water and the dyeing operations completed.

Chaptal gives another process for dyeing Indian red or "rouge brulé," which is a dull, heavy colour without brilliancy, but is sought after on account of its agreeing well with all other colours, and being similar to the red cotton handkerchiefs imported from India.

The cotton is treated with alkali as in the bright red, and then boiled for half an hour with lime water. After this operation it receives a strong oiling and three successive alkaline treatments, and washed; the mordanting is done in a warm solution of 12½ lb. alum, 4 lb. acetate of lead, ½ lb. of carbonate of soda, and a small quantity of salammoniac. The dyeing is done with 1½ lb. of madder for 1 lb. of cotton, and the brightening with soda and soap; if the colour is not full enough it is oiled a second time, and the mordanting and dyeing repeated.

[*To be continued.*]

LIST OF ENGLISH CALICO PRINTERS.

1st March, 1840.

NAME OF FIRM.	NAME OF WORKS.	Machines.	Tables.
Thomas Hoyle and Sons ..	Mayfield	9	186
Leese, Kershaw, and Co...	Ardwick Bridge ...	8	63
John Gallemore	Ancoats Bridge.....	4	...
Coates, Heald, Wilson, and Co.....	Strangeways	12	153
Ditto	Levenshulme.....	5	...
John Barge	Broughton Bridge...	3	40
Gisborne, Wilson, and Wilson.....	Adelphi	10	72
Bayley and Keeling.....	London Place	4	140
Coston and Lycett	Agecroft Bridge ...	3	45
Wood and Wright	Bank Bridge	11	105
Ainsworth, Sykes, and Ainsworth.....	Broughton Grove ...	5	17
Fielding and Rowbottom...	Bowker Bank	4	57
Wilson and Crighton	Blakeley.....	3	60
Coates and Heald	Seedley	4	61
Charles Neville.....	Harpurhey.....	3	42
Burford and Kay	Trub Smithy.....	2	58
S. Schwabe and Co.....	Middleton	7	120
Burgess and Townsend ...	Stansfield Hall	5	96
William Benecke and Co..	Bellfield Hall	4	66
James Hudson and Co. ...	Gale	5	82
John Scholes	Junction.....	...	...
Margerisons and Glover ...	Burnley	6	123
Cooke and Unsworth	Love Clough	3	86
John Brooks	Sunny Side	12	180
John and James Dugdale...	Lower House	7	140

NAME OF FIRM.	NAME OF WORKS.	Machines.	Tables.
Sheriff, Foster, Gillett, and Hindle	Sabden	9	190
James Thompson, Brother, and Sons	Primrose	7	284
Ainsworth, Sykes, and Co.	Barrow	3	35
Fort and Co.	Oakenshaw	7	206
Hargreaves, Dugdale, and Co.	Broad Oak	12	320
James Grimshaw	Plantation Mills	4	80
Robert Peel and Co.	Church Bank	5	132
Frederick Steiner	Church Bank	2	36
Simpson, Rostron, and Co.	Foxhill Bank	13	189
Reddish, Bickham, and Co.	Brookside	4	114
John Wardley and Co.	Spring Vale	2	20
Robert Turner and Co.	Mill Hill	9	184
John Wright and W. Aylmer	Brinscall	4	120
Potter and Ross	Darwen	4	75
Hamer, Clough, Smith, and Holgate	Irwell Springs	1	40
Smith and Lockett	Rockliffe Vale	2	46
Richard Holden	Denham Spings	1	40
Sandiford, Moon, and Layton	Kemp Mill	2	29
R. and M. Smith	Baxendale	6	172
Samuel and George Potter	Birkacre	3	75
Charles Swainson and Son	Bannister Hall	2	53
Thomas Bentley	Eccleston	1	30
Richard Cobden and Brothers	Cross Hall	5	182
George Kendrick Gill	Low Mill	2	36
William Yates	Waterhouses	1	32
Higgin, Darbyshire, and Chippendale	Horwich Vale	7	151
Callender, Bickham, & Co.	Bradshaw Hall	7	192

NAME OF FIRM.	NAMES OF WORKS.	Machines.	Tables.
John Anderton.....	Tootal Bridge	2	50
Hardman and Price.....	Bury Ground.....	7	176
Nelson, Knowles, and Co...	Tottington Mill.....	5	95
Hall and Gorton	Kirkless Mill.....	5	60
William Sudren	Bolholt	4	60
Jackson, Watson, and Greig	Rose Bank.....	4	29
Brown and Powell	Stubbins	3	84
William Grant & Brothers.	Ramsbottom	6	107
Doody and Price	Cobhouse Nab	5	28
Swanick and Johnson	Hollins Vale	4	96
Nuttall, Giles, & Watchurst	Hampson Mill	8	111
William Cowsill	Blackford Bridge ...	5	100
Alfred Thomas and Co. ...	Spring Water	2	129
Hutchinson and Sons	Radcliffe Shop	6	103
Horrocks, Goodlad, and Worthington.....	Mount Zion	6	170
West and Winder	Belmont.....	3	70
John Roberts and Co.	Prestolee	2	32
Henry Crompton.....	Tootal Vale	...	18
Roxburgh, Ashworth, & Co.	Know Mill.....	3	40
George and John Billington	Quarlton Vale	4	71
James Greaves	Turton Mill	2	80
James Andrew	Dainwater	4	116
George Andrew and Sons..	Compstall Bridge ...	2	37
Richard Matley	Hodge Mill	6	221
Thomas and John Dalton..	Hollingworth Mill ...	5	30
Edmund Potter	Dinting Vale.....	4	117
J. Bennett, executor to Thos. Oldham	Garrison.....	4	103
Edward Lucas	Wood Print Works.	2	48
Ingham and Yates	London Place	3	34
Loyd, Buchan, and Welsh.	Furness	3	93
Charles Robinson.....	Strines Hall	6	143
Lawrence Short	Wood End.....	2	34
John and Charles Yates ...	Rock Mill	2	16

NAME OF FIRM.	NAMES OF WORKS.	Machines.	Tables.
(Late) Brown and Powell...	Spring Vale	4	40
Charles Palfreyman.....	Wild Boar Clough...	...	...
John Marsland & Brothers	Marsland	10	146
Becker, Brothers, and Co...	Reddish Mills	4	118
Syddall and Addison	Chadkirk	3	9
Downes and Furnough ...	Cheadle Vale.....	3	39
John Lowe and Co.....	Shepley Hall.....	4	79
John and Robert Ashton...	Hyde	5	16
William Shepherd and Co.	Carbrook	2	...
Thomas Duckworth.....	Cheadle Grove	2	22
Otho Hulme and Sons.....	Medlock Vale	5	72
Ninety-three Firms.	Total	435	8324

LIST OF SCOTCH CALICO PRINTERS,

1st MARCH, 1840.

NAME OF FIRM.	NAME OF WORKS.	Machines.	Presses.	Tables.
Hector Sandiman ...	Tulloch	1	3	104
A. J. Duncan and Co.	Ruthven.....	3	6	124
James Stewart	Linlithgow.....	...	...	60
Thomas Shiels & Co.	Herbertshire	2	2	98
J. G. Adam	Denovan	1	...	210
D. and H. Ingles.....	Kincaid	...	4	130
George Mc. Farlane and Co.....	Lilieburn	1	2	59
R. Daglish, Falconer, and Co.....	Lennox Mill	7	2	210
Boyd, Mc. Nab, & Co.	Bellfield	1	1	44

NAME OF FIRM.	NAME OF WORKS.	Machines.	Presses.	Tables.
John Black and Co...	Milngavie	3	4	130
John Campbell	Burnbrae	...	...	16
Sharp and Buchanan	Strathblane	1	1	60
Mc. Donald and Mc. Kay	Cochney.....	...	6	...
Daniel Gilchrist and Co.	Dalsholm	1	2	89
Reid and Whiteman	Maryhill.....	3	8	95
John Mc. Gregor and Co.	Crossburn	...	...	30
Patrick Mitchell	Milton	3	4	128
William Stirling and Sons.....	Cordale, Leven	2	3	140
Ditto ditto	Dalquharn, Leven...	...	14	...
Arthur and Co.	Millburn, Leven ...	...	...	52
Ditto	Dillichip, Leven ...	...	6	60
Walter Neil and Co.	Kirkland Field, Leven	...	...	60
Gilbert Lang	Bonhill, Leven	1	2	60
Guthrie, Kinlock, &Co	Dalmonach, Leven..	6	5	170
Ditto ditto.	Ferry Field, Leven..	3	...	104
John Todd and Co...	Leven Field, Leven.	1	13	99
John Stewart and Co.	Leven Bank, Leven.	...	...	60
John Orr Ewing and Co.....	Alexandria, Leven...	1	5	84
Muir, Brown and Co.	Rose-street, Glasgow	...	17	21
Ditto ditto	Anderston	2	1	118
Sharp and Thomson	Meadowside	...	2	54
Skinner and Rough	Kelvinhaugh	1	9	70
William Smith & Co.	Clydebank.....	...	...	57
J. and R. Shaw	Thornfield, Glasgow	2	3	44
Henry Monteith and Co.....	Barrow Field.....	1	18	140
John Bartholomew and Co.....	Dalmarnock	4	8	62

NAME OF FIRM.	NAME OF WORKS.	Machines.	Presses.	Tables.
John Barr	Rutherglen	...	...	52
Mc. Queen and Mc. Auley	Shawfield Bank.....	1	2	42
Thomas Kennedy and Co.....	Little Govan	...	...	35
Gow, Primrose, & Co.	Little Govan	2	11	32
James Pender & Co.	Milend	...	...	22
Andrew Aitken	Camlachie	...	...	16
Charles Todd and Higginbotham ...	Springfield.....	5	11	100
Monteith, Walker, and Co.....	Parkholm	3	12	82
James Wardrop	Netherlee	...	...	32
Richard Mitchell ...	Busby.....	1	1	85
J. & W. Crum & Co.	Thornliebank	2	1	106
Scott and Hall	Wellmeadow	...	1	56
Lancaster and Clark	Croft Head	3	6	108
George Aitchison ...	Springbank	...	...	45
James Hendrie & Co.	South Arthurlie ...	3	1	80
Glen, Mc. Indoe, & Co.	Gateside, Neilston...	...	...	46
Hardie, Williamson, and Stark	Springfield.....	...	...	72
John Mathieson & Co.	Old Fernese	1	5	67
John Hamilton & Co.	New Ferneze.....	...	...	94
John Stenhouse & Co.	Crossmill	...	2	36
Francis Smith & Co.	Barrhead	...	...	12
Charles Todd and Higginbotham....	Darnley	1	...	56
Walter Buchanan and Co.	Blackley Mill.....	...	...	54
Harrow, Wilson, and Co.	Collinslea	...	...	70
Blair and Peacock ...	Linside, Paisley.....	1	...	33
Wm. Galloway Co....	Old Kirk Lane, Paisley	...	...	36

NAME OF FIRM.	NAME OF WORKS.	Machines.	Presses.	Tables.
Baird and Wallace...	Brick Kilns	...	...	32
John Mc. Gregor and Co.	Patrick Bank.....	1	...	40
W. and H. M. Frame	Kilbarchan	...	2	32
Anderson, Mc. Gregor and Co.	Townhead, Kilmarnock	...	...	61
Bickett and Young...	King-street, Kilmarnock	...	...	16
Thomas Neil	Glenfield, Kilmarnock	...	...	92
Young, Glassford, and Co.	Eastfield, Kilmarnock	...	...	79
Robert Templeton ...	Burnbank, Kilmarnock	...	...	24
William Geddes	Newton, Kilmarnock	...	...	40
William Hall and Co.	Greenholm, Kilmarnock	...	...	60
Dick and Kerr	Waterside, Kilmarnock	...	...	5
Peter Brown	Waterside, Kilmarnock	...	...	5
Seventy Firms	Total.....	75	206	4997

LIST OF IRISH CALICO PRINTERS,

24th FEBRUARY, 1839.

NAME OF FIRM.	NAME OF WORKS.	Total Cylinders.	Surface Machines.	Tables.
J. and J. Duffy & Co.	Ballsbridge	5	4	120
William Henry	Island Bridge	4	0	120
Waldron, Dodd, Cartin, and Co	Rathgar	4	1	68
Three Firms	Total.....	13	5	308

These lists are taken from a printed sheet which has no name attached to it. It is believed that it was compiled under the direction of the late Mr. Alfred Binyon, of Mayfield, and Mr. Thompson of Clitheroe, but we have no positive evidence upon the point.

In the original there are separate columns for 7/8 machines and others, including surface machines. In the Scotch list the flat presses and discharging presses are separately enumerated. Only one English and one Irish firm had presses.—*Ed.*

8. *Abridgments of Complete Specifications of Patents Recently Published.*

A.D. 1875, May, 18.—No. 1833.

POLLOCK, WILLIAM MATHER. "Improvements in Machinery for Stentering or Finishing Woven Fabrics." This invention relates "to machinery for imparting what is sometimes "termed the elastic finish to a woven fabric, by means "of stentering apparatus, arranged to give opposite longi- "tudinal reciprocations to the selvedges of the fabric, whilst it

"is being dried in a starched or dressed condition." The apparatus is shown in two drawings and cannot be described without them. The claims are (1) "The connection of the "cross lever, of elastic finish stentering machinery, to a con- "tinuously vibrating slotted lever by a rod which can be shifted to or from the centre of such slotted lever." (2) "The "actuating of vibrating punkahs, connected with stentering or "finishing machinery, by means of a continuously vibrating "slotted lever and rod which can be shifted to or from the "centre of such slotted lever."

A.D. 1875, May 29.—No. 1974.

SCHROEDER, HENRY *(Provisional Protection only).* "Improvements in Dyeing Woven Fabrics." The woven fabrics referred to are such as are known "as 'Meltons,' 'Devons,' or 'Pilots,' either unions or woollens." The invention consists in "dispensing entirely with the use of dyewoods." "Simply passing the fabric through a solution of aniline dye," or else in dyeing a foundation with "vegetable dye," and then finishing in aniline dye "and an amount of depth and brilliancy imparted to the original colour."

A.D. 1875, June 2.—No. 2033.

STEAD, HORATIO, and APPLEYARD, BENNET. "Improvements in Machinery and Apparatus for Steaming Woven Fabrics." This invention is not connected with calico printing; the apparatus employed consists of a suitable framework, upon which two perforated cylinders are mounted "and the piece "or fabric to be steamed is wound upon one of the cylinders "and steam forced through the perforations thereof; the fabric "is then unwound from the first cylinder and wound upon the "second, those portions of the fabric which were furthest from "the first cylinder being nearest to the second, so that all "portions of the fabric are equally steamed."

A.D. 1875, June 9.—No. 2117.

MARSDEN, RICHARD, and others *(Provisional Protection only).* "Improvements in Machinery or Apparatus for Dyeing Fabrics." This invention is for keeping the piece or fabric

open, to ensure regularity and evenness of colour, by "having "a scray, lattice sheet, or partition, placed inside the cistern, "under which the fabric passes. This lattice sheet is moveable "and can be raised out of the cistern, wound upon a winch, "and taken away when desired."

A.D. 1875, June 28.—No. 2343.

MACDONALD, STEVENSON WILLIAM. "Improvements in Preparing, and Apparatus for Drawing Off Water for Condensing Engines, for Feeding Steam-boilers, and for Scouring, Bleaching, and Dyeing." "The water for generating steam, "and for other purposes, being collected in an iron or other "cistern, tank, or lodge, is, with the aid of heat, which passes "from the boiler to the chimney, allowed sufficient time to "settle." "The same effects will be produced by injecting "the exhaust high-pressure steam into the water, or into "pipes passing through the water, or the water may be "allowed sufficient time to clarify by subsidation. If the "water contains mineral solutions or free acids, carbonate of "soda, or potash, or chloride of lime, or other equivalent "agents may be added to neutralise these injurious matters." When the water has clarified itself it is drawn off by "a flood-"pipe which is not allowed to dip so low as to catch the "sludge at the bottom of the cistern, tank, or lodge, neither "can it rise sufficiently high to draw off the injurious scum "which floats or swims on the surface when foul water is "heated." There are two claims, one for "purifying or pre-"paring water by heat or precipitation," and the other for an apparatus "for drawing water out of cisterns, tanks, or lodges, "within certain limits, as shewn and as described."

A.D. 1875, June 30.—No. 2371.

HAAS, HERMANN SAMSON. *(Provisional Protection only).* "Improvements in Cleansing and Bleaching Jute, Hemp, Flax and Cotton." "The jute in any state (raw yarn or in the "piece) is placed in solution composed of 100 parts of water, "and 8 parts of silicate of soda at a temperature of from 190 "to 212 degrees Fahrenheit. In this solution the jute is

"allowed to remain, say from eighteen to twenty minutes or "more, according to the strength and quality of the material. "The jute is then washed, first with hot water and afterwards "with fresh cold water, in order to free it from the colouring "matter and the silicate of soda." The subsequent processes of bleaching are the same as those in ordinary use.

A.D. 1875, July 5.—No. 2421.

WOLFF, JUSTUS, and BETLEY, RALPH. "Improvements in the Production of Aniline Dyes." This invention is for treating a mixture of aniline and nitro-benzol with suitable metallic salts, if the two materials are pure, soluble dyes are obtained capable of yielding blue colours, if toluidine be present in the aniline, or nitro-toluol in the nitro-benzol, dyes yielding various hues of black are obtained. The process is given as follows: "First, we mix about three parts by weight of aniline, with "about two parts by weight of protochloride of tin in crystals, "or the same amount of salt in solution in water, and then "add about one part by weight of nitro-benzol to the mixture; "we then allow it to remain until the primary reaction is "effected, and we then heat the mixture to about from 200° "to about 220° Celsius, until a sample drawn out and dropped "into boiling water communicates to the boiling water a "brownish yellow coloration." The colouring matter is extracted from the melt by water. The novelty claimed "is "the production of a dye or series of dyes from aniline or "from toluidine, or from mixtures of the same, and either "with or without the employment of xylidine, together with "nitro-benzol or nitro-toluol or mixtures of the same in con- "junction with metallic salts."

A.D. 1875, July 5.—No. 2422.

WOLFF, JUSTUS, and BYROM, WILLIAM ASCROFT. "Improvements in obtaining Aniline, and in the employment of the same or of compounds thereof." This invention is for the recovery of aniline from certain wash waters or waste waters by means of sulphate of copper which precipitates the aniline, and from which precipitate it can be obtained by distillation

with caustic soda, or the precipitate may "be used directly for "printing aniline colours such as black and gray, grayish blue, "etc., by mixing it with the corresponding quantity of hydro-"chloric acid, and of chlorate of potash, together with boiled "starch or with other thickening materials."

A.D. 1875, July 7.—No. 2448.

WOLFF, JUSTUS, and BETLEY, RALPH. "Improvements in the production of Dyes from Naphthaline and its derivatives." The invention claimed in this patent is "the produc-"tion of dyes from naphthaline, and also from the derivatives "therefrom, in which one atom of the hydrogen contained "therein is substituted by one molecule of benzol or its "derivatives," "by firstly submitting the same to an oxidising "process, and after separating the products of oxidation, sub-"mitting such products to a second oxidising process, and finally to the action of an alkali." The practical process is described as follows:—"We take one equivalent of naphthaline "mixed with one equivalent of dichlor benzol and two equiva-"lents of zinc powder, and heat this mixture in strong closed "vessels at a temperature of about 220° Celsius for about "twelve hours. The mass thus obtained we treat with about "three times its weight of acetic acid (glacial acetic acid being "preferred) in order to dissolve it, and add whilst warm, and "with slight and cautious agitation, and in small quantities at "a time chromic acid until no further reaction takes place; "then we add to this mixture about three to four times its "weight of cold water, the mass is then filtered off and the "residuum on the filter well washed, dried, and dissolved in "about three or four times its weight of fuming sulphuric acid "at a heat of from 220° to about 230° Celsius until it is ascer-"tained by a drawn sample that it completely dissolves in "water. The resulting substance we heat with water, neutralize "with quick lime, boil it, filter if necessary, evaporate and "treat the evaporated solution with caustic soda (in solution) "equal to about three times the weight of the substance which "has been dissolved in sulphuric acid for about four or six "hours at 170° to 200° Celsius, until it is ascertained by a

"sample treated with excess of acid that the mass does not "show any increase of precipitate created by the acid; then "we dissolve the resulting mass in water, neutralize it with "hydrochloric acid, filter, and wash; the material so obtained "is ready for dyeing and printing purposes." Another method is given with some variations.

A.D. 1875, July 9.—No. 2480.

HUGHES, EDWARD THOMAS. *(A Communication from Victor Weiss, of Langensalz, Prussia).* "Improvements in machinery or apparatus for washing and scouring wool." This relates to machinery or apparatus for washing wool by means of rollers, such rollers being arranged so as to allow of the washing liquor and soap waste being deposited at the bottom of 'the wash trough,' whereby the deposited waste liquor is allowed to settle, and the dirt will not be stirred up. The wool which is to be scoured or washed is conducted by a creeper or travelling apron to and between the scouring cylinders, and is delivered after passing through the machine on to another creeper, from which it passes to another wash trough, and so until it has been sufficiently treated. The claim is for improvements in machinery. There is a sheet of drawings.

A.D. 1875, July 13.—No. 2521.

WOLLASTON, CHARLES JAMES. "Improvements in the purification and decolorization of dye-waters." etc. The invention consists in the use of the "coke, carbon, or char obtained from the substance called Blackstone or Kimmeridge shale in the process of its destructive distillation in the manufacture of illuminating gas." "This coke carbon, or char, I "have discovered has an extraordinary power in absorbing "impurities, and in the removal of colouring matters, and after "filtration these noxious waters will be found to have become "practically pure, so that they may be discharged into any run-"ning stream without nuisance or injurious consequences of any "kind." The filters for refuse dye waters are constructed as follows:—"For the filtration of 300 to 350 gallons of refuse "dye per hour, a surface of about 36 superficial feet I find to

"be fully sufficient; and I make my filtering apparatus for "such a quantity by constructing a sunk tank 6 ft. by 6 ft., "by 6 ft. deep; this tank I place very slightly inclined from "the front to the back in order to allow of the escape of air "by suitable escape pipes which are provided. At the bottom "of this tank I provide perforated tiles, such as are used in "malt kiln floors, and upon those tiles I place a layer of "carbon about 3 inches in thickness, broken and sifted "through a sieve of three to the inch, carefully pressing the "carbon slightly in order to obtain a uniform bed of filtering "material. I then proceed to add a second thickness of the "carbon, sifted to a finer grain by a sieve about four or five to "the inch. I build up the filter bed with layers of this de-"scription, and of still finer carbon, each of 3 in. or 4 in. "thick, until I have a total depth of about 3 ft. of carbon; "a top layer of 1 in. or 2 in. I place of coarser material, "leaving nearly 3 ft. of depth for the refuse dye water." The claim is for the application of the carbonaceous matter obtained from Blackstone or Kimmeridge shale.

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9. British and Foreign Patents, from the Commissioners of Patents Journal, February 22nd to March 17th, 1876, inclusive.

Engraving, Rollers, and Printing.

3005. WILLIAM FOTHERGIL BATHO, of the city of Westminster, Engineer, and JOHN TREADWAY HANSON, of "Thames Chambers," Adelphi, in the county of Middlesex, Architect, for an invention of "Improved apparatus for printing and stamping wall papers or other substances for decorative purposes.—Dated 26th August, 1875.—This patent has passed the great seal.

3064. CHARLES HENRY SIEBER, of Fluntern, in the republic of Switzerland, Chemist, for an invention of "Certain improvements in printing and dyeing."—Partly a communication to him from abroad by Louis Gonin, of Deville les Rouen, near Rouen, France, Chemist, and partly his own invention.—Dated 1st September, 1875.—This patent has passed the great seal.

3483. JOHN HENRY JOHNSON, of 47, Lincoln's Inn Fields, in the

county of Middlesex, Gentleman, for an invention of "Improvements in machinery or apparatus for printing textile fabrics and other fabrics or articles, and in means employed in connection therewith."—A communication to him from abroad by Albert Aune François Le Tellier and Louis Désiré Verstraet, of Paris, in the republic of France.—Dated 7th October, 1875.—This patent has passed the great seal.

364. THOMAS NIXON, Pentagraph Engraver to Messrs. John Orr Ewing and Company, of Alexandria, in the county of Dumbarton, North Britain, for the invention of "Improvements in pentagraph engraving machines."—Provisional protection has been granted to this patent.

717. JAMES CHADWICK, of the Spring Brook Print Works, Chadderton, in the county of Lancaster, for an invention of "Improvements in dyeing and printing textile fabrics."—A communication to him from abroad by James Harley, of Lowell, Massachusetts, United States of America.—Dated 21st February, 1876.—Provisional protection has been granted to this patent.

1036. LÉON GODEFROY, Son, of the firm of Vve. L. Godefroy and Son, of Puteaux, near Paris, Printer, for an invention of "An improved process of printing or ornamenting woollen or other similar textile fabrics."—Dated 10th March, 1876.

662. THOMAS FORSTER, of Streatham, and RICHARD TAYLOR, of Warwick Street, Kennington, both in the county of Surrey, for an invention of "Improvements in the manufacture of printing rollers."—Dated 4th March, 1869.—This patent has become void

No. 172,340. JOSEPH PERKINS, of San Francisco, Cal., for "Color-printing blocks."—Application filed 23rd July, 1875.

Brief.—"Colour-block perforated with converging tubes through which different-coloured inks are forced to the printing face by pneumatic pressure." American patent.

Bleaching, Steaming, Drying, etc.

3228. SAMUEL KNOWLES, of Tottington, near Bury, in the county of Lancaster, Calico Printer, and JAMES KAY, of Bury aforesaid, Engineer, for an invention of "Improvements in apparatus for drying, stretching, steaming, and ageing woven fabrics, and for drying fibrous materials and other substances."—Dated 23rd September, 1875.—This patent has passed the great seal.

250. WILLIAM MATHER, of the firm of Messieurs Mather and Platt, of Salford, in the county of Lancaster, Engineer, has given notice

to proceed in respect of the invention of "Improvements in apparatus for steaming printed fabrics."

275. ANTHONY GAPPER SOUTHBY, of 3 New Inn, Strand, in the county of Middlesex, Civil Engineer, for the invention of "Improvements in the mode of and apparatus for recovering the alkali, from waste leys used in boiling vegetable fibres, and in utilizing the products obtained thereby."—Provisional protection has been granted to this patent.

565. JOSEPH DE KINDER and FRANCIS CUYLITS LA-TOUR, both of Antwerp, Belgium, Merchants, for the invention of "Improvements relating to the steeping or retting of flax, hemp, and other textile materials, the separation of their fibres, and the bleaching, calendering, and otherwise treating the same and the fabrics made thereof."—Provisional protection has been granted to this patent.

690. JAMES HORROCKS, of Eccles, in the county of Lancaster, for an invention of "Improvements in the boiling, scouring, or cleansing of textile fabrics and materials, and in apparatus therefor."—Dated 24th February, 1873.—The stamp duty of £50 has been paid upon this patent.

878. WILLIAM MATHER, of the firm of Messieurs Mather and Platt, of the Salford Iron Works, Manchester, in the county of Lancaster, Engineer, for an invention of "Improvements in the construction of steam drying cylinders."—This patent has become void.—Dated 11th March, 1873.

Preparation and Treatment of Colouring Matters.

3320. ALFRED WEIGEL, of 21, Mark Lane, in the city of London, for an invention of "Improvements in the production of certain colouring matters."—Dated 23rd September, 1873.—This patent has passed the great seal.

4138. ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, has given notice to proceed in respect of the invention of "Improved processes for the manufacture of artificial purpurine and other coloring matters, together with the application of such products."—A communication to him from abroad by William Jules Samuel Grawitz, of Paris, France.

4208. GEORGE HILL UNDERWOOD, of Manchester, in the county of Lancaster, for an invention of "Improvements in the treatment

of indigo for dyeing and printing."—Dated 6th December, 1875.—This patent has passed the great seal.

238. IVAN LEVINSTEIN, of Manchester, in the county of Lancaster, Colour and Chemical Manufacturer, for the invention of "Improvements in the application and treatment of residues arising from the manufacture of magenta."—Provisional protection has been granted to this patent.

670. JOSEPH FIRTH, of Leeds, in the county of York, for the invention of "Improved apparatus for use in dyeing fabrics indigo blue."—Provisional protection has been granted to this patent.

744. GEORGE BETZOLD, of Belfast, in the county of Antrim, in Ireland, Linen Merchant, for an invention of "Improvements in the preparation of colours for printing, dyeing, or staining, being a means of securing or increasing fastness in colours."—A communication to him from abroad by Johann Rossenbaum, of Magdeburgh, in the empire of Germany, Chemist.—Dated 23rd February, 1876.—Provisional protection has been granted to this patent.

1068. HENRY EDWARD NEWTON, of the Office for Patents, 66, Chancery lane, in the county of Middlesex, Civil Engineer, for an invention of "Improvements in the preparation of colours or pigments which by vitrification are rendered permanent."—A communication to him from abroad by Robert Jean Philippe Van der Haeghen Limelette, of Brussels, in the kingdom of Belgium.—Dated 11th March, 1876.

641. FREDERICK ALBERT GATTY, of Accrington, in the county of Lancaster, Manufacturing Chemist, for an invention of "A certain process or processes for obtaining the coloring matter of madder and another useful product."—Dated 3rd March, 1869. This patent has become void.

766. EDWARD HUNT, Professional Chemist, of Worsley Street, Salford, in the county of Lancashire, for an invention of "An improvement in dyeing and fixing of what are known as aniline colors."—Dated 3rd March, 1873.—This patent has become void.

783. EDWARD HUNT, Professional Chemist, and GEORGE MANLEY HOPWOOD, both of Worsley Street, Salford, in the county of Lancashire, for an invention of "Improvements in treating catechus, cutch, or gambier, to obtain products therefrom suitable for use in tanning, dyeing, and printing."—Dated 4th March, 1873.—This patent has become void.

Yarns, Hanks, Cops, etc.

3319. WILLIAM REID, Manager to Messrs. Donald Matheson and Company, of Govan Croft Dye Works, in the county of Lanark, North Britain, for an invention of "Improvements in apparatus to be used in connection with various processes of treating yarns with liquids."—Dated 23rd September, 1873.—This patent has passed the great seal.

468. CHARLES TOUSSAINT, one of the firm of Toussaint, Levy, and Co., of Saint Dié, in the department of the Vosges, France, Manufacturer, for the invention of "Improvements in bleaching cotton on shuttle cops, bobbins, or in hanks."—Provisional protection has been granted to this patent.

913. MAXIMILIAN BAERLEIN, of Manchester, in the county of Lancaster, for an invention of "Improvements in apparatus for drying yarn to be used in connection with sizing and other machines."—Dated 13th March, 1873.—The stamp duty of £50 has been paid upon this patent.

38,791. M. BAERLEIN, for "Improvements in dyeing, sizing, &c. thread."—Dated 4th February, 1876.—Belgian patent.

38,794. TOUSSAINT, LÉVY, and Co., for "Processes and apparatus for bleaching cotton on pirns, bobbins, and in skeins."—Dated 4th January, 1876.—(French patent, 2nd February, 1876.)—Belgian patent.

45. K. GÖHRING, of Stuttgart, for "Improving the quality of yarn on cops by bleaching, dyeing, or otherwise."—2 years.—Dated 3rd April, 1875.—Bavarian patent.

Finishing Processes to Wool Treatments.

3553. ROBERT DUTTON and WILLIAM RENSHAW, both of Oldfield Road, Salford, in the county of Lancaster, Machinists, have given notice to proceed in respect of the invention of "Certain improvements in Machinery or apparatus for finishing velvets, velveteens, and other pile fabrics."

3570. JOHN SCHOFIELD, HENRY GLEDHILL, and HENRY WATSON, in the employ of the firm of Wm. Edleston & Co., of Sowerby Bridge, in the county of York, Dyers, Stovers, and Fnishers, have given notice to proceed in respect of the invention of "Improvements in means or apparatus for finishing woven fabrics."

215. MAXIMILIAN ZINGLER, of 19, Buckland Crescent, Belsize Park,

in the county of Middlesex, has given notice to proceed in respect of the invention of "Improvements in the manufacture of varnish, applicable also to sizings and waterproofings for textile fabrics."

242. GEORGE HENRY NUSSEY, and WILLIAM BRADSHAW LEACHMAN, both of Leeds, in the county of York, for the invention of Improvements in machinery or apparatus for pressing woollen and other woven or felted fabrics."—Provisional protection has been granted to this patent.

498. ANDREW MITCHELL TORRANCE, of the firm of Miller, Son, and Torrance, of Cannon Street, in the city of London, for the invention of "Improvements in the numerical marking of piece goods and other materials and fabrics sold by length and in apparatus therefor."—Provisional protection has been granted to this patent.

945. GEORGE RYDILL, of Southampton Buildings, London, for the invention of "Improvements in preparing woollen, cotton, silk, and other such like fabrics, for extracting vegetable fibres therefrom, and for cleaning the same."—Provisional protection has been granted to this patent.

1129. WILLIAM BISHOP, of Stroud, in the county of Gloucester, for an invention of "Improvements in processes or modes of chemically cleaning or freeing wool or woollen textures from vegetable matters, to be employed more especially previous to or in connection with the process of dyeing."—Dated 16th March, 1876.

546. JOHN SCHOFIELD, Crabber, in the employ of Wm. Eddleston and Company, of Sowerby Bridge, in the county of York, Dyers and Stovers, and WILLIAM MELLOR, of Sowerby Bridge, aforesaid, Mechanic, for an invention of "Improved machinery or apparatus for smoothing and pressing textile fabrics."—Dated 13th February, 1873.—This patent has become void.

898. JOHN OLDROYD, MARK OLDROYD, the younger, JOSHUA WOODCOCK, and JAMES COULTER, all of Dewsbury, in the county of York, for an invention of "Improvements in machinery or apparatus employed in dyeing, bleaching, scouring, and waterproofing woollen or other woven or felted fabrics."—Dated 12th March, 1873.—The Stamp Duty of £50 has been paid on this patent.

THE TEXTILE COLOURIST.

No. 5.—MAY, 1876.

1. *Materials for a History of Textile Colouring.*

THE oldest of the manuscripts translated in Mrs. Merrifield's "Original Treatises, etc., on the Arts of Painting" is that of Eraclius; two ancient copies of it are known, one written on vellum is now in the British Museum *(Egerton MSS., 840 A)*, the other forms part of the manuscripts transcribed by Jehan le Begue in 1431, concerning whom some account was given in the last number of this Journal. The manuscripts of Eraclius are written in Latin, a portion in verse, and the rest in prose. Of his history nothing is known, and the exact date of the manuscripts is uncertain, but the vellum manuscript in the British Museum is of the latter half of the thirteenth century. There is very little in Eraclius which throws light upon the employment of colouring matters in dyeing; it will be seen that many chemicals were known, and in use, but their employment in dyeing textiles is very briefly alluded to, that not being the special intention of this or any other of the manuscripts in the Merrifield collection, and whatever there may be found of interest to the dyer in them, may be considered as so much gained from sources where it had previously lain buried in a mass of matter having no concern with the art.

In the second of the metrical receipts, which is to make colours from flowers, we are told to gather them early in the morning, and grind them up with raw gypsum, so that they may be preserved in a dry state, and "if you wish to change

their colour, mix lime with the flowers, and they will become green ;" this evidently refers to the common corn-flower. In the eighth it is noticeable that the juice of ivy is said to gradually assume a blood-red colour upon drying, and to be used for dyeing the skins of goats and sheep a rose or pink colour ; and this statement is to be found in several other of the later manuscripts. A method of making verdigris, or a solution of acetate of copper to give a green ink is found in the eleventh ode ; and in the seventeenth a green colour is obtained from the leaves of the black nightshade *(Solanum Niguum;* in the original *Morella)* ground up with white chalk. It may be mentioned that in the fourteenth of the prose receipts (253 in Jehan le Begue), the process of gilding by means of quicksilver is described. In the xxvi. (280) receipt, we have a method of preparing linen cloth so as to apply colours to it, which runs as follows :—

XXVI. [280] *If you wish to paint a linen cloth, and to lay gold upon it, prepare it thus.*—Take parchment, or clippings of parchment, and put them into a jar with water, which must be placed over the fire, and made to boil as before directed ; then dip a cloth into it, take it out immediately, and stretch it out on a wet panel, and let it dry. Then burnish or polish it all over with a glass muller, and stretch it out, fastening it on to a wooden frame with the thread. You may then paint upon it with colours distempered with size, or egg, or gum.

[The Roman numerals are according to the older manuscript, the figures in brackets are the corresponding numbers in Jehan le Begue's manuscript.]

The receipt numbered xxxiii. [258] is interesting as giving a method of dyeing leather with madder by means of mordanting with alum ; it runs as follows :—

How Cordovan Leather is Dyed.—Take the leather which is called "Cordovan" not dyed with colour, but pure and white, and wash over the sides on which the hairs grew with alum. Then take madder *(Waranciam),* and heat it over the fire in a brass vessel with wine or with water so that you can just bear your finger in it. Then dip the aforesaid leather into the vessel and

take it out; see if the colour is sufficiently deep; if it is, well and good; if not, dip it in again. Then spread it out on a smooth table, burnish it with a piece of boxwood; and then take fat, and grease the skin all over, and suffer it to dry.

In the receipt next following, we have the method of making an aluminous lake from Brazil wood, in which lime, and probably ammonia from decomposed urine, assist in forming the compound.

XXXIV. [277] *How to make use of Brasilium.*—Take a brass dish, and scrape as much brasilium into it as you may think necessary; then fill it up with urine, add powdered alum to it, and so let it remain for a night. The next day set it upon the coals, make it boil up once or twice; remove the dish from the fire, and put a little quicklime with the brasilium and alum, and stir it up, and so let it stand till it settles thick and the water floats on the top; then throw away the water and let the remainder dry in the sun, and keep it as long as you like. You may use this colour both on wood and on walls; but with greater brilliancy on parchment.

Among other things, we see that at this date the method of making red lead by calcination of white lead was well understood; and in the fifty-second receipt we have "folium" mentioned, about which there is some difficulty of identification, but is most probably some lichen of the archil sort. Then there is "dragon's blood or sandis" mentioned, with the addition, "id est garancia," as if dragon's blood and madder were the same. "Indicus," (indigo) a blue pigment, by its name shows whence it is brought" (India).

In the fifty-fifth receipt [245] purple colours are said to be made by straining boiled madder roots, if "cocta rubea radice" will bear that translation; and several herbs are mentioned as yielding colours, but their names are obscure, and their modern equivalents uncertain.

Eraclius must have been one of the most credulous of men if he had any faith in some of his receipts which, not being connected with dyeing, we are happily not called upon to criticise, but the existence of which seems to weaken all the

rest. The curious reader may refer to IX., X., and XI. in the prose part (Nos. 235, 236, and 254 in Jehan le Begue), with many similar ones, and he may be induced to think he has found some of the lost arts of the middle ages.

The next manuscript in point of antiquity is that of Petrus de S. Audemar (Peter of St. Omer?), who was a native of France. The date of the manuscript is doubtful, but according to the opinion of good judges it cannot be placed later than the end of the thirteenth or beginning of the fourteenth century.*

In the earlier receipts many methods of making green colours are detailed. They are all based upon verdigris ; in some of them saffron is added, and in others it would appear from the use of soap that a fatty salt of copper must have been obtained. The method of converting white lead into minium or red lead is given here (No. 154) ; in Nos. 162 and 164 reference is made to the herb folium, which is said to be used by the English, "in whose country it is prepared, and who call it *worinæ*," for dyeing wool. The preparation simply consists in treating the herb with alkaline leys, or with urine, and it was employed as a lake or used to dye cloths, from which the colour could be afterwards extracted for the purpose of painting. Folium is in other places called "turnsol," again said to be the fruit of the mulberry tree, and again the juice of the croton tinctorium, or turnsol. It will be found mentioned further on. In No. 165 we find that saffron was esteemed as a yellow colouring matter, and that the best quality came from Italy or Spain. In making an azure colour from a copper basis by the action of fermenting grape skins upon the metal, it is repeatedly stated that unless strips of pure silver be placed in the copper vessel the colour will be inferior, and have a greenish hue. The colour is deposited as an effloresence upon the silver, and is probably a mixture of carbonate and acetate of copper, the silver acting as one element of a couple in what would be a sort of electrical combination. In No. 172 a method of blackening skins is given,

* Merrifield, i., p. 112. All the facts and translations of this article are taken from Mrs. Merrifield.

in which the elements are oil, scales of iron, and charcoal; but in the receipt following we seem to come upon a forgotten method of dyeing with elm bark. The atramentum mentioned is most probably lamp black, but it may be some other black matter.

173. *Also of another mode of making Black.*—Take the bark of the wood which is called elm, and cut it into small pieces, and put it into a vessel to boil with water, and take the rust which is at the bottom of the water under a workman's grindstone and mix it with said bark, in order that they may boil over the fire together, and add to them atramentum distempered with the aforesaid water of the bark; afterwards, if you wish to dye anything, put it in while the water boils, and so leave it from morning until the third hour of the day (*i.e.*, from 6 to 9 a.m.) until it is diminished to a third of the quantity; and if what was put into it is not well dyed, put it in again and add a little atramentum, in order that that which is put into the composition may be better dyed.

Various processes are given for making vermilion, called also sinopis; and then in No. 181 is a method for making a lake from brasilium or Brazil wood, which runs as follows:—

181. *How Lake is made.*—Take filings or scrapings of Brazil wood, and let them boil over the fire in a clean vase with red wine; then add lake distempered with urine, and let them boil together, and having done this, strain and squeeze them; then take alum and mix with the other ingredients in the vase over the fire and and stir it a little; then remove it from the fire, and pour the contents into a basin; then grind it well upon a stone, and collect the lake together and let it dry in the sun. Afterwards preserve it in a box.

The use of gum of ivy for dyeing skins red is alluded to several times, it is called lac in No. 183, and a method of making an imitation of sinopis or vermilion with this lac and madder is given; in No. 184, the method of preparing the ivy lake is given.

184. *Of Lake.*—In the month of March, cut branches of ivy crosswise in various places, or pierce them with a bodkin and

there will exude a liquid, which you must collect every third day; this is boiled with urine, and turns to a blood colour, which is also called lacha, with which the skins, commonly called parcia, are dyed with alum. The above-mentioned liquid is useful for many purposes.

We may note in passing, that the quality of tin is said to be best judged of by placing "a strip of it to your ear, and bend it too and fro several times with both hands, as if you wished to know whether it was broken, and if it rings, that is, creaks or crackles, it is good." No. 189 is a receipt for ink made from the bark of the blackthorn, but it is clear that this bark is only used to yeild a mucilage to suspend lamp black or some other sort of carbon in, for no chemical substance is added, and as earthen vessels are prescribed, no metal could accidentally find admission. The following, however, seems a chemical kind of ink or colour, and it is interesting again to find the English name referred to, and from the mention of cloth we may suppose that this was one of the compositions used by the cloth stainers, or imitation tapestry makers, the reference to gum as preventing the running of the colour, is also suggestive of some advance in the art.

199. *Of Black, and Ink, and of a Black and Green Colour.*—Take ripe berries of honeysuckle, that is, in English, galetrice, and pound them well in a mortar; afterwards, boil them carefully in wine, adding also some rust of iron to the decoction. This is a green and brilliant ink. If you wish to colour a cloth or a skin green, paint it over with a paint brush; but if you wish it to be black, add ink to the composition as usual.

200. *Gum prevents the Ink from running.*—If you wish to prevent the above-written, or any other ink from running when you are using it, add the gum of a plum or of an apple in the boiling, and boil them together.

The headings of the two last receipts are in the original "*De attramento et incauste*," &c., and "*Quod gumma cum prohibit fluxum incausti;*" incaustum in the text has a wider

meaning than ink in English, and might be translated "colour."

The manuscript of Audemar gives little more than is contained in the foregoing extracts which has any bearing upon dyeing processes; it is free from the extravagant receipts contained in Eraclius, and would appear to be the production of a man who had tried most of the things he wrote about.

There is a short manuscript among those copied by Jehan le Begue which was written by Alcherius, as he states, on "Thursday, the 8th day of August, 1398," in Paris, and consists of receipts taken down from the dictation of and old man named Anthonio de Compendio, who was apparently a maker of colours for artists; among the receipts are some for the preparation of lakes from Brazil wood. No. 301 is for a green colour for painting upon linen made from verdigris, and the juice of the herb which is called in French, *flamma* (English, *cornflag;* Latin, *gladiolus communes);* tempered or thickened with gum water. In this manuscript Alcherius gives a receipt for making writing ink which he knew previous to the year 1382, it is made from galls as in the following receipt, which is selected as being the shortest.

Good Ink is thus made.—Take 1½ lb. of pounded galls, soak them in warm rain water, or warm wine or vinegar, of the quantity of 10 phials, and so let it stand for a day or more; then boil it until the said water, wine, or vinegar, is reduced to one-third, and let it be taken off the fire, and a phial or two of wine or vinegar be immediately added, and let so much water be added as was boiled away from the said mixture; when it begins to boil let it be removed from the fire; when it is only just warm, strain it and add to it 1½ lb. of gum arabic in powder, and 1 lb. of Roman vitriol, and mix the whole together.

From the remarks made by the writer it is reasonable to conclude that this method of making ink was new, and from the occurrence of contemporary receipts for making writing ink from mucilaginous liquids and lamp black, it would seem that both kinds of ink were at this time in use, and that the modern ink had not supplanted the ancient. Some other

receipts are given in the latter part of the manuscript, but they were added by Jehan le Begue himself, and the date cannot be fixed any earlier than 1431, the year in which the copy was made. There is one receipt however worth extracting, in which alum appears as a mordant for dyeing in much the same way as in modern dyeing.

326. *To make Skins and all other things of a Red Colour, or any other Colour.*—First put the skin in alum water which has been boiled with some bran, and then skim it well and let it settle, and when the heat of the water is so reduced that it is just tepid so as not to burn the skins, throw them in. After this you must dry them, then boil some Brazil wood in the above-mentioned water, and when it is well boiled sew your skins into the form of bags and fill them with the said water while tepid, and not boiling, as in that case the skins would burn; they will thus be well coloured; and in this manner you may stain anything with any colour.

The next manuscript, called the Bolognese manuscript, is preserved in the library of the convent of S. Salvatore, in Bologna; its date is not mentioned, but from internal evidence it can be fixed as not later than the middle of the fifteenth century. There are additions to it by another hand which may be half a century later; the extracts from the later additions are distinguished by the letter B prefixed. For a discussion of the dates, authorship, and language of the manuscript, reference must be made to Mrs. Merrifield, ii., p. 326.

The earlier part of the book is taken up with detailed accounts of the preparation of ultramarine blue from the lapis lazuli; the first receipt shews how linen was made to take up a colour, to concentrate and extract it so that it might be afterwards dissolved out for purposes of the artist. The equivalent of the word "chacabassia" was not known to the translator. The colouring matter was evidently one modified by the fumes of ammonia, though apparently not fixed by them; the curious method of measuring time will be frequently found in receipts of the middle ages.

63. *To Dye Linen Cloth Blue with Juice of Herbs.*—Take the berries of the "chacabassia," and bruise them well on a thick

and white, but not new, linen cloth, on both sides of the cloth. Then take a vessel full of urine, and put the cloth over it so as not to touch the urine, and let it stand for three or four days. Then take it up and it will have become blue; and when you want to use it, take a small piece of that cloth, put it into a shell, add a little gum water, and let it stand to soak for the space of one *miserere*; then press it, and with what you press out, paint what you like on paper, on miniatures, or elsewhere, and it will be a fine colour.

In Nos. 73, 74, and 75, receipts for preparing indigo to be used as a pigment are given, in one case it is to be extracted direct from the herb woad, but the process is impossible as written unless some other meaning be given to the word woad. In No. 75, the method is more intelligible, for the directions are to take "flower of woad, which flower is collected in the dyers' vat when they are boiling woad," which may be understood as the scum or froth of indigo, but confusion soon follows when we are told to "bake it well in an earthenware shovel until it is well burnt, and then grind it fine, and mix it with white earth;" perhaps for "burnt" we should read "dried." Several other receipts speak of the "flower of woad" as the source of indigo, and as obtained from the dyers' vat. The indigo imported from India was known under other names, "bagadon" or "bagadel." Under this name it is referred to in No. 87, where it forms the blue part of a green pigment, the yellow of which is orpiment, and here we may see how near the old artists were to making the preparation of indigo well known to calico printers under the name of "pencil blue." Pencil blue is a very old colour, and it has often puzzled young chemists to know how it came about that the old colour mixers should have discovered its method of preparation. But it is easy to conceive its origin when we find that a mixture of ground indigo and orpiment was a favourite green pigment; we have only to imagine the accidental mixture of this pigment with lime or strong leys, and he must have been a dull worker who would not have observed and profited by the reaction which would take place.

The berries of blackthorn *(Rhammus catharticus)* are employed along wlth alum in No. 89 to produce a green lake; and in No. 97 we have a colour of some interest. If we were to read French berries instead of French beans (the original commences "*Havve fagioli maturi*, and perhaps the translation is incorrect), we should have a steam yellow applicable to cotton. The translation runs as follows:—

97. *To make a Green Water for Painting on Canvas.*—Take ripe French beans, and put them into a small bag of strong canvas, place the bag in a press, extract the juice, and set it to boil, and let it be reduced one half. Then add some powdered roche-alum, and remove it from the fire, and it will be a good and fine colour.

The receipt No. 105 may be compared with No. 89; ripe berries of buckthorn are employed with alkali and alum to give a "splendid yellow finer than orpiment;" it would appear that the names green and yellow are sometimes confounded in the manuscript.

There follow a number of receipts for making lakes of an aluminous basis, the process was to take clippings of woollen cloth which had been dyed with "grana," that is kermes, and put them "in a very strong ley made of ashes, such as the dyers use, in a new glazed jar, and set it on the fire to boil, and boil it slowly for the space of two *paternosters;*" the strained liquor was then precipitated by alum.

The following receipt for making a lake from lac shews a modification of the method. Lac from the insect was known and used in Italy before the date of this manuscript, and there is no doubt that is what is meant, although as we have seen, there was a lac from ivy.

131. *To make Lake by another Process.*—Take urine, pour it into a new-glazed jar, and put it over the fire; make it boil well, and while it is boiling take off the scum which arises with a stick, and let it boil until one-half is consumed; afterwards put the gum lac into the urine and let it boil with a small quantity of gum arabic and a little alum zucharino or roche alum. When it has boiled for the space of one hour strain the liquor through

a thin linen cloth, and let it settle in a glazed jar and the lake will sink, that is, will go to the bottom; then pour off the urine which remains upon the lake, taking care not to pour off the lake also, and let the lake dry by itself and not by the fire, nor in the sun, and it will be good and perfect lake.

The next two receipts give different methods of making a lake from Brazil wood, which is here called verzino. It is mentioned in a note to a previous receipt that Marco Polo, the Venetian traveller, says the best Brazil wood, or as he calls it, verzino, grew in the Isle of Ceylon.

B. 132.—Take of verzino, scraped with glass or with a rasp, whatever quantity you like; and if you have a drinking-glassful of scrapings, reserve half of the verzino and put the other half to soak in so much ley as just to cover the verzino. Let it soak for the space of one night, then put it to boil slowly over the fire, and when it has boiled while you can say one *Ave Maria* take some of the verzino which you reserved and put a small quantity, little by little, upon that which is boiling, and continue to do this as long as you have any left, always waiting a little after each time; and when you have no more left, and the verzino is reduced to one-half, stir in as much roche alum (and it must be well powdered) as you think sufficient, and immediately take it away from the fire and let it rest and cool; then strain through a thin piece of linen that part only which comes away of itself, without pressing out the dregs; put it into a well-closed glass phial and place it in the heat of the sun for a day or two, and it will be fine and perfect verzino for writing. And if you wish the colour to be darker, add to it, when it boils, a piece of quicklime as large as a bean and it will be done.

B. 133.—Take one ounce of verzino, scraped with a rasp or with glass, put a third part of the verzino to soak in sufficient spirits of wine to cover it for the space of one natural day, and add to it the weight of one quattrino of roche alum in powder; put it over the fire and let it boil for the space of one *paternoster*, strain it and keep it in a phial, and also put by the verzino; then take the rest of the verzino (that is, the other two-thirds), and put it to soak in very clear vinegar, and add to it a quattrino or

more of alum and a quattrino of gum arabic and a good half-drinking-glassful of vinegar; let it soak for eight or ten days, and then soak in this liquid the verzino which was taken out of the spirit, adding it to the other two-thirds, in the sun; then add to it another quattrino of pounded alum, and let it stand in the sun in a glass vase for four or six days; then put it away in a phial after straining it. When you wish to use the colour, take some of the verzino that was in the spirit, which will be almost yellow, and mix it with one-tenth part of the verzino which was in the vinegar and write with it, and it will be fine. And if you wish to have it darker, put more of the verzino made with the spirit into it; and if lighter, less. And the verzino will be better if made in this manner, viz.:—Take the scraped verzino as before; then take a tumbler of vinegar and let it boil for the space of one *paternoster*, and put into it two or three quattrini of pounded alum (because when the vinegar is boiling the alum dissolves and liquefies sooner, and if it does not all dissolve it is of no consequence); then put the verzino and the gum to soak in it, and place it in the sun for eight or ten days, and it will be good, and mix it with the other verzino steeped in the spirit, and it will be light or dark as was before mentioned.

The employment of sumach in combination with iron to give black was known at the date of this manuscript, as may be seen from the following receipts. In No. 338 it is said to be without iron, in contradistinction to B 134, where a quantity of Roman vitriol is prescribed, but it is evident that the grindstone dust is of no use except for the iron which is in it, and the acidity of old sumach liquor would be sufficient to act upon and dissolve the finely comminuted iron in the dust.

B. 134. *To make a perfect Black.*—Take a small jar of the juice of sumach, and put it to boil until reduced by one-fourth, and add to it a good ladleful of dirt from a grindstone, and reduce it two fingers more; and then add of Roman vitriol in powder 3 oz., and 3 oz. of powdered galls, and when you have added these things, make it boil till it is reduced by two fingers' breadth.

338. *To make a Black Dye for Dyeing Skins, that is to say, Fine Shoemakers' Black, without Iron.*—Take a boiler-full of the juice of sumach, and add to it some dust from a wheel (or grindstone), and let it boil until reduced by two fingers' breadth in depth, and when it is cool you may dye the skin with this dye, and every hour it will be a finer dye.

In No. 174 we find archil mentioned *(Auricellam)* as having a purple colour, and methods given of preparing it for colouring. The following is one of those receipts where indigo and orpiment are mixed to make a green, afterwards modified by ochre and white, and is a curious illustration how various very different matters were brought together in pigments, and the way prepared for making colours of quite another character.

192. *To make Flesh Colour.*—Take indigo mixed with orpiment, and it will make green, which, mixed with ochre and white, makes flesh colour.

In B 198, gum tragacanth is mentioned as being employed to thicken something to serve as a paste, probably for taking impressions or for modelling. We give receipt No. 210, on account of its title, though there is some mistake in it, or something wanting, the result of distilling the three salts (salgem being pure rock salt) at a high temperature would probably be a sort of aqua regia, which very likely would give a yellow mark on silk. No. 211 would give a yellow colour having some degree of fastness on woollen.

210. *To make a Water for Painting on Linen or Silk.*—Take 2 oz. salammoniac, 2 oz. of salgem, and 1 oz. of saltpetre, pound the whole together, and then distil it, and keep the water until you need it; you may paint on whatever cloth you like.

211. *To make a Yellow Water for Drawing and Painting on Linen or Woollen.*—Take of roche alum 1 oz., of saffron 2 oz., and a little ley, and boil all these things together till reduced by one-third, and it is done.

In No. 271, manganese is mentioned in connection with glass staining. If this be the mineral now known by that name it is an early mention of it. At No. 323, there commences a

number of receipts more immediately referring to dyeing. The first is for dyeing kid skins with verzino or Brazil wood, the other materials employed being lime water and alum. We give No. 326 in full, as shewing a knowledge of the use of gall-nuts in dyeing along with alum and Brazil wood, and as illustrating the old method of colouring the skins of animals. Galls were used also in tanning, but there is no doubt that in this case they would powerfully help the formation of a coloured lake upon the skin.

326. *To Dye Sheep Skins Scarlet on the Side of the Hair to make Shoes.*—Take the skins, well washed and cleansed from lime, and 4 oz. of galls well pounded, and boil them (in water) until reduced one-third, and let them become tepid. Put the skins into this water and gall and wring them well, and then let them remain in the water for a night; then take them out and let them dry, and when they are nearly dry give them the stroppa, and then take ½ oz. of roche alum to each skin and make it boil in a vessel with a small quantity of water, and soak the skins in this alum water, and squeeze and wring them so that all the water may run well out; then take a piece of lime which has not been slaked, put it into a basin, and add to it enough water to cover it by one finger's breadth, and stir it well so that it may be perfectly dissolved; then let it settle, and when it has settled for one night take off the scum or crust which the lime forms on the top of the water, and then take two bocali of fresh water and pour them into a pan, and when the water boils put into it 2 oz. of verzino well pounded, and boil it until it is reduced one-half, add to it a little pounded gum arabic and remove it from the fire, and when it is tepid take away the skins and sew them up all round so that the side of the flesh may be outside, and leave the neck open, and pour in the dye through the neck, and stir and shake it well four or five times in the dye, so that the dye may cover the whole of the skin. And if you wish to have a fuller colour, add to it for its maestra, as in the last recipe, a yolk of egg well beaten up, adding it a little at a time to the dye until the colour appears full enough; then pour it into the skin and shake it all over it so as to touch every part. When the

skins are dry polish them on a smooth bench with glass and they are done.

No. 328, also for dyeing skins, introduces for the first time sandal wood, and is interesting as prescribing madder. *Fogliecto* was the name of a measure for liquids used at Florence.

328. *To Dye Scarlet.*—Take ½ lb. of sandal wood and ½ lb. of madder, boil them together with plain water until reduced to one-half, and then add half a fogliecto of ley for its maestro to make the colour deeper, and a piece of quicklime, and boil it until reduced to one-third, then prepare the skins for dyeing as in the other recipes.

In the receipt immediately following the above, which is "for dyeing a very fine scarlet," the materials are verzino (Brazil), quicklime, alum, and fenugreek.

In No. 335 we have a process of mordanting which is quite suitable for silk (and would answer for wool less completely) to serve as a basis for dyeing many colours, but in this instance the colour is green from verdigris, which is only a poor colouring material.

335. *To make a Green Dye for Dyeing Cloth, Thread, or Silk.*—Take roche-alum, and dissolve it in a boiler, and let it boil till it is well dissolved, then take it off the fire, and let it cool so that you can bear your hand in it, and then put the cloth, or silk, or thread into it, and let it remain for a day and a night, and then take it out and let it dry well. Next take a little verdigris, and make it boil in the water, and then remove it, and when the water is become tepid, put the cloth into it, and work it well in your hand, and let it dry, and if you give it another wetting with a little roche alum, it will become of a brighter colour. If you wish it to be darker, add more verdigris.

The receipt No. 357 is more detailed and satisfactory, and might have been written four centuries later, for the same materials and process are in use at the present day.

357. *To Dye Silk or Cloth Red.*—Take 1 lb. of silk and 4 oz. of soap and put them into a cauldron with water, and let it boil until you see the silk appear starred. Then take it out and

wash it well in clear water until the silk becomes white; drain it well and wring it with your hands, and spread it out, and this is done when the silk is not boiled. Then take 4 oz. of alum in another small vase and boil it, and dissolve it in clear water, and when it is dissolved, take another larger vase, and fill it with fresh water, and put the alum into it, and then put in the silk, and let it remain three days and three nights, and then wash it and stir it about well in fresh water, wringing it well with your hand until the alum is washed out. Then take a little of fresh water, and 3 oz. of powdered verzino, and let it boil until reduced one-third; then fill it up with fresh water, and boil it again, till reduced one finger's breadth. Then take it off the fire, and divide the water into two portions, and into one of these put the silk, and let it stand till it is cold. Then wring it with your hands, and put it back into the other water which you reserved, and let it be as hot as you can bear your hand in it. Then drain it and wring it well, and spread it out in the sun, and it will be fine.

In No. 358 there is a process for dyeing silk saffron colour or yellow. The silk is alumed, and then dyed in "herba rocciæ," a material of which the modern name is not known.

No. 359 is for dyeing silk purple, and that is done without aluming and with archil *(oricello)*.

No 361 is for dyeing silk black. The silk is first boiled in decoction of galls, then dried in the sun and air. A mixture is made of shoemakers' blacking (probably sumach and iron), gall liquor, and dust from a grindstone; to this vitriol is added (green copperas) and some oil; the silk is boiled for half an hour in this, and left in the liquor for a day and a half.

The receipt No. 362 for dyeing silk green, is of high interest as being the only clear and undoubted instance of the use of a real indigo vat in dyeing in all the collected manuscripts. The lime, honey, and finely divided indigo would cause a reduction of the blue indigo to the colourless state, for honey acts just as grape sugar, which was employed by Fritsche some years ago to reduce indigo, and is essentially the same

as the glucose which was employed by Ward, and patented 8th December, 1857, as a reducing agent. We give this receipt in full.

362. *To Dye Silk or Thread Green.*—First make the silk yellow with "panicella," as was before directed for yellow silk; and then take 1 lb. of silk and 4 oz. of indigo and put it into a saucepan, with a little water, to boil for half an hour or less, and then take it away from the fire and cover it for half a day with a cloth, and if the indigo is not dissolved, rub it up with your fingers in the water and let it clear itself; then separate the water from the leys, and put the water into a vase that is fit for dyeing. And when you wish to dye it, take the solution of indigo and put it to warm, and when it is hot take a lump of quicklime as big as an egg and ½ lb. of honey to every 1 lb. of indigo; then put one-third part of the lime into the water, and when it is hotter put in another third part, and when it is nearly boiling add what remains, and then remove the water from the fire, because if it were to boil it would boil over the saucepan; then pour the decoction into a vase, and let it be well covered over like a stew, and when it is cool enough to bear your hand in put in gently the yellow silk, which must at first have been dipped in fresh water and well wrung; then put it into the solution of indigo and warm it gently, and if it is but slightly coloured, put it back again into the dye; and you may repeat this several times with the dye as long as any of it remains. If you preserve it, and when you wish to dye anything, put in fresh indigo and honey, but not in such quantity as before.

The following receipts for dyeing silk are connected with the foregoing. We are unable to say what "panicella" is, and the translation gives no help.

363. *To Dye Silk a Dark Green.*—Take the silk dyed with a purple or violet colour, and when you have taken it out dip it in alum, and then dye it with "panicella" as was before directed for a yellow dye; and when it is so dyed you will do as before directed for a green colonr, and you will have a dark green.

364. *To Dye Silk or Thread Blue.*—Take the silk boiled and

washed as before directed for boiling silk white and without alum, put it into the indigo dye, and you will have a fine light blue.

A method of dyeing thread of a red colour by the process of first steeping in galls, washing, mordanting in alum, and dyeing in Brazil wood, is given in No. 366; a red from madder and Brazil wood is given in No. 367.

367. *To Dye Thread with Red.*—Take some madder, well pounded, and put it into a little ley made from vine ashes and let it boil, and put the thread to boil in the ley for some time; then remove it from the fire and let it dry; when it is dry alum it, and then boil it in a little verzino well boiled with water and ley mixed together; then dry it in the wind without sun, and it will be fine.

We conclude our extracts from the Bolognese manuscripts with a receipt for dyeing black on cotton and silk. Cotton is hardly ever mentioned in the manuscripts. The word rendered by cotton is "guarnello" in the original. In another receipt cotton is directed to be dyed black with galls and Roman vitriol (green copperas), 5 lb. of each for 10 lb. of "pignolato," which in a foot note of the translator is said to be a sort of cloth made of linen or hemp; at the heading of the receipt (No. 370) the term used is also "guarnello," the exact meaning of which it would be desirable to ascertain.

368. *To Dye Cotton or Silk Black.*—Take 1 lb. of iron filings, 2 oz. of galls well pounded, 1½ oz. of Roman vitriol, rinds of pomegranates, bark of the roots of walnut tree, 2 oz. of verzino, well ground, and strong vinegar; boil all together until reduced to one-fourth, and let the decoction cool and put in the sun for three or four days, stirring it eight or ten times every day; then strain it, and when you wish to dye silk or cotton set the decoction to boil, and boil the silk or cloth in it for a quarter of an hour; then dry it in the shade, and the more you dip it the finer and more beautiful it will be.

2. *On the Manufacture of Carmine, or Extract of Indigo.**

BY M. MAX ROESLER.

WHEN we began a few years ago to devote our attention to the preparation of carmine of indigo, we looked in vain for detailed accounts of this manufacture. It is this which has induced us to describe in a detailed manner, and especially the practical portion of it, the process which we have been led to adopt, and which so far has proved a success. Carmine of indigo (sulphindigotate of soda or potash) is prepared, as is generally known, by treating indigo with sulphuric acid; to the solution is added an alkali, the compound is then precipitated and the precipitate is collected. This process then comprises the following operations; the pulverization and washing of the indigo; the precipitating and filtration of the carmine; and lastly the washing and compression of the latter. Before describing these various preparations, we shall say a few words on the indigo itself. The question has often been asked, whether, in the manufacture of carmine, it is preferable to use indigo of a better or inferior quality. It is quite evident that the strength alone of commercial and pure indigo should have some effect in the manufacture of carmine. If indeed the prices of the various qualities of indigo were in proportion to the amount of pure indigo each contained, then it would be a matter of indifference what kind of indigo was used. But in the first place, this is not always the case; and on the other hand, the presence of a certain amount of impurities in the principal article, by causing the preparation of carmine to be more difficult and to require longer time, naturally increases the cost of it. Therefore there is no advantage in using indigo of an inferior quality. The better indigos from Bengal or Java should be used in preference. In making use of the inferior qualities from

*From Dingler's Polytechnic Journal, in Moniteur Scientifique, (3) vi., p. 394.

Bengal or Guatemala, a great deal of time is liable to be lost, because the sulphuric acid solution must be allowed to settle and afterwards filtered. The characteristics of indigo of a superior quality are well known. In choosing indigo care should be taken that it is light, porous, and of a bright colour. It is always advantageous to procure whole chests of indigo, as they come from the country where it is produced, and to ascertain the strength of the article by the analysis of an average specimen. For this analysis, Mohr's method is both the most rapid and the most certain. When ready for the market, carmine of indigo should form a uniform paste of a reddish copper colour. When placed on a sheet of glass and viewed by transmitted light, it should be of a pure blue bordering a little on violet. But especially it should be perfectly uniform, and no grains should be visible in it. As an average standard, 1 gramme of carmine of indigo should correspond to 5 or 5.5 cubic centimetres of a solution of permanganate of potash, 55 cubic centimetres of which are decolourised by 10 cubic centimetres of normal oxalic acid. We shall now devote our attention to the various stages of the process.

Pulverization of the Indigo—There are many arrangements for this operation, some of which are probably more practicable than that which we are about to describe; but we only give the following as an example. The maximum quantity of indigo to be taken at a time is 5 kilogrammes, this with 3 balls of iron, each about 3 kilogrammes, is put into a wooden drum which is tightly shut up. As a certain quantity of indigo powder will always make its way through the joinings of this vessel, it is placed in a large box which can be closed up, and in which it can turn on its own axis by means of a handle. This axis does not coincide with the axis of the drum, so that there is an eccentric motion. At the end of three hours the indigo is in a powder fine enough to be taken out and passed through a sieve. This sieve is formed by a hollow wooden prism, over the faces of which is stretched a fine silk gauze, a gauze of a hundred threads per square inch is quite sufficient. The sieve is also placed in a well en-

closed box, and it is made to turn rapidly round on its axis by the means of a handle outside. In quarter of an hour all the indigo powder will be in the box. Then the pieces of indigo which remain in the sieve are added to a new lot which is about to undergo the same treatment. The powder is then dried. For this it is placed in large flat basins which are placed in a sort of oven heated to 60 or 70 degrees by the means of the waste heat from a fire. This process of drying is necessary, for if sulphuric acid is poured on damp indigo, too great a heat would be produced.

Dissolving.—When dry, the indigo is allowed to cool, and then is weighed out in portions of determined weight for the process of dissolving. Too much care cannot be taken regarding this operation if good results are to be expected. We have been induced to treat small quantities at a time. By using small quantities the manipulation is simpler, and in cases of accident the loss is less considerable. It has often been asked whether it is better to pour the sulphuric acid on the indigo or to introduce the indigo into the acid. The last of these methods is the one most commonly used, and generally a considerable quantity of indigo is operated upon. However, experience has shewn us that by this method the mixture gets more heated, that it disengages sulphurous acid, and that the dissolution takes place in a less complete manner, or to say the least, more slowly than when the opposite course is adopted. Nor are all agreed upon the question as to whether one should use English sulphuric acid, fuming acid, or a mixture of both. In all cases it should be ascertained that the acid contains no nitric acid (the fuming acids from the factories of Bohemia generally contain it). A small addition of sulphate of ammonia removes the inconveniences which might be caused by the presence of ever so small a quantity of nitric acid. The use of English sulphuric acid has not given us satisfactory results, so we have tried a mixture of the two acids, and the results have been better in proportion to the amount of fuming acid. We have ceased to employ the latter alone, and we actually use a mixture of 2k.250 of fuming acid to 0k.500 of acid at 66° Beaumé. This

mixture is about 68° in strength. We should remark that, independently of the yield, the weaker the acid is, the more violet is the carmine obtained, when it is viewed by transmitted light on a sheet of glass. Then, in a capsule of about 6 in. in depth, and of 12 in. in diameter above, and 6 in. diameter at the bottom, 500 grammes of dried powdered indigo is placed. This is kept in a bath of cold water in order to moderate the heat produced by the addition of acid. A mixture of 2k.250 of fuming acid, and 0k.500 of English acid is divided into two equal portions, and the first portion is poured rapidly on the indigo, causing the acid to flow along the vessel; then it is stirred with a thick glass rod, at first gently, then with greater speed, in order to incorporate by degrees all the indigo with the acid, taking care that no lumps are formed. This operation cannot be better compared than with what cooks do in the preparation of certain dishes; they put some flour in a dish, form a hollow place in the flour, pour into it a mixture of milk and white of eggs, and by degrees incorporate the flour with the mixture. Although it may seem somewhat puerile to treat at such a length of a similar operation, still it is important that the workman should acquire great skill in performing it, for the final result depends upon the precision with which the mixture is made. It is mixed continually without stopping for half an hour. The indigo and the acid then form a uniform paste almost black and ropy. Then is added the second portion of the liquid, and it is stirred more slowly than before, but the stirring should be continuous. It is a bad sign when during the first part of the operation the compound froths and disengages a great quantity of the sulphurous acid. It is on the contrary a good sign when the solution completed and left to itself, is covered with a thick layer of small bubbles, and becomes more and more dense by standing. We readily admit that this treatment of the solution is long and tedious, for by this method a workman can hardly treat more than 5 kilogrammes of indigo a day. But the indigo is not yet quite dissolved, as is very evident from the considerable residues left undissolved if the process is continued at once.

The dates on which the solutions were made should be written on the capsules which are afterwards covered up, to place them in a warm place and keep them free from dust. At the end of eight days the liquid is frequently stirred, and at the end of this operation it is gently heated on the plate of a stove. At the end of a fortnight the solution is complete, the mixture is become very thick, and on the surface there is a layer of a less dense liquid. It is always advantageous to leave the mixture in this state as long as possible.

Precipitation.—Once again the contents of the capsules are stirred at a gentle heat, then five of them are emptied into an elevated vessel. Each vessel contains then 2k.5 of indigo, and 13k.750 of acid. For each kilogramme of indigo there is added 50 kilogrammes of pure cold water; and a saturated solution of common salt is then gradually poured into the vessel until all the colouring matter is precipitated. (The marine salt solution should be in density 23° Beaumé, or 1·17.) For 1 kilogramme of indigo there should be about 10 kilogrammes of marine salt. Formerly we precipitated with a solution of caustic soda, but this was much dearer, and it produced a troublesome froth. Afterwards we discovered that common salt was both less expensive and more convenient for use. On the other hand, as the liquid then contains chlorhydric acid, which quickly injures tissues, we have had to change our filtering apparatus. We generally use a cheap kind of salt, such as is used for industrial purposes or for cattle, and by the means of a very simple process we always have at our disposal a clear saturated solution. This is obtained by the means of an elevated cask placed upright and kept constantly full of water. At the top of this cask is fixed a large filter of felt, which is always kept full of salt. This filter should be cleaned from time to time. By this process one can always have a solution of sufficiently uniform strength. The following method is resorted to to discover quickly if the precipitation of the carmine is completed. A drop of the liquid is let fall on some filter paper, if the edges of the stain are colourless, or at least if they are not blueish, it is certain that the operation is finished, and that it is ready to filter.

Filtering.—This first filtration should in preference be made in a filter of the shape of a box. This filter is made with a double bottom pierced with numerous holes; channels put obliquely on the bottom allow the filtered liquid to escape. The filtering material rests on the double bottom, and its edges extend over the edges of the box. The filter is first moistened, and the liquid and the precipitate which was obtained by the last operation is poured on it, then it is left to drain, care being taken to frequently return to the filter portions which pass the first, until the tissue ceases to allow any of the precipitate to pass. The filtered liquor is of a blackish green colour. Ten cubic centimetres of this liquid should correspond at the most to 0·3 or 0·5 c.c. of the solution of permanganate of potash previously alluded to.

If the precipitation is made by soda, in all cases the filtered liquor should be collected in large earthenware basins, and left to evaporate in the air and to crystallize. If instead of marine salt chloride of potassium is used, sulphindigotate of potassium is obtained; but this substance is rarely used on account of its very slight solubility, although owing to the atomic weight of potassium, it would be very advantageous to the seller. When all the liquid has run out, the precipitate is taken out in the cloth and is subjected to a slight compression between planks weighted with stones. In many cases the carmine thus prepared is sufficiently pure, and in commerce is found under the name of extract of indigo. It is used for the production of the less brilliant shades of green. To obtain a pure and beautiful product the precipitate should undergo repeated precipitations and washings.

Washing.—When taken from the filter, the precipitate (corresponding to 2½ kilos. of indigo) is placed in a vessel similar to those that have been previously described, and for each kilogramme of indigo 50 litres of boiling water are poured in; it is then stirred with a large wooden spatula, and 2k.500 of English acid are added. If the liquid acid does not suffice to redissolve all the precipitate, there is always sufficient to bring it to a state of great division, and on the other hand, to cause all the soluble impurities to dissolve, which on a second

precipitation remain in the liquid. This second precipitation is made with a concentrated solution of 2k.500 of carbonate of soda at 90 per cent. for each kilogramme of indigo, and a concentrated solution of common salt, corresponding in weight of chloride of sodium, to that of the carbonate of soda employed. After having added the above liquids to the indigo solution, the whole is well mixed, left to cool, and then poured upon the filters. In order to filter more quickly, it is usual to employ woollen filters having a surface of four square metres, fixed upon frames of a proper size, and arranged one upon the other like a scaffolding. In this case again, care must be taken to return to the filter the first portions which pass through. The filtered liquor is of a dirty green colour; 10 c.c. of this liquor should correspond at the most to 0·2 or 0·3 c.c. of a solution of permanganate of potash.

The contents of the filters are often stirred with wooden spatulas. At the end of two days the filters are completely drained. The colouring matter is subjected to a second treatment similar to the one just explained, unless the liquid after the preceding treatment presents a clear blue shade. When this has been effected, the carmine of indigo may be considered quite pure and ready to be pressed. In most cases, to obtain a very brilliant product, it is well to make another final operation. This time the filters are again emptied into the vessel, and 30 litres of boiling water are poured on the product; the addition of sulphuric acid is omitted, and the precipitate is effected with a concentrated solution of salt; it is well mixed, left to cool, again filtered, and left to drain as well as possible. It seems very unpractical to remove the precipitate so often from the filter, but in this way we have always obtained better results than by washing it in the filter itself.

If indigo of an inferior quality is used, the washing should be repeated three or four times, until the liquid passes through of a clear blue colour. Then the substance in the woollen tissue is there placed and compressed in presses made for the purpose. The carmine is then ready for the market. It is then in the form of a paste, 10 parts of which should cor-

respond to 1 part of indigo. To prevent the carmine from drying too fast, it is mixed with a small quantity of common glycerine. From time to time the filtering cloths and those which are used for the compression should be washed. Then the blue liquid thus obtained can be used in the washing or or other processes.

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3. *Critical and Historical Notes concerning the Production of Adrianople or Turkey Red, and the Theory of this Colour.**

BY THEODORE CHATEAU.

Corresponding Member of the Industrial Societies of Mulhouse and Amiens, etc. etc.

Process used by Messrs. Koechlin Bros. in 1811.—The cloth was first cleansed with soap to prepare it to receive the white baths in an even manner. The proportion of soap would be about 5 per cent. of the weight of the cloth if the cloth was bleached, and double that quantity if unbleached.

For oiling 100 pieces (about 2,500 yards in length and of an average weight of 520 lb.), there was taken about 275 lb. of emulsive oil *(huile tournante)*, this was placed in a vessel, and then 45 gallons of water, and afterwards 9 gallons of water containing in solution about 70 lb. of carbonate of potash, gradually added and stirred up with the oil until a perfectly milky or creamy solution was obtained. If the oil was of good quality none of it would rise to the surface of the fluid upon standing in repose.

The first operation consisted in padding the pieces with a padding machine in this white liquor, and if the weather permitted, putting them out on the grass. In bad weather the pieces were hung in a drying stove, heated to about 120° F. When dried, the pieces were again padded in the same liquor, and again dried, and these processes repeated until the cotton

* Abstracted and condensed from "Moniteur Scientifique," vi., (3) p. 401.

Continued from p. 231, Textile Colourist.

was sufficiently impregnated with fatty matter, which required generally eight successive passages. The time and number of paddings were regulated according to the shade of colour required, the quality of cloth, and the season of the year.

M. Koechlin considered that dew favoured the combination of the fatty matter with the cloth. It is as well to note in this place, that if exposure to sunlight contributes to the development of Turkey red, it has also an injurious effect upon the strength of the calico; we may add also, that when water or an old white liquor is added to liquor in the padding machine, these liquors should be first warmed to prevent a separation of the oil.

After oiling and drying, the next step is to place the pieces, say 100 in number, in a beck, with a sufficient quantity of water to cover them, in which 4½ lb. of carbonate of potash has been previously dissolved, the pieces remain in steep twelve or eighteen hours, and passed through squeezers to preserve as much as possible of the emulsion removed and then carefully washed.

The mordanting was effected by padding the pieces in a mixture of equal parts of mordant and water, the mordant being composed of 10 gallons of water, 40 lb. alum, 4 lb. crystals of soda, and 40 lb. acetate of lead, the whole was slightly thickened with gum Senegal. The pieces being dried were then dunged, rinsed, and washed; they received three ends in a warm water containing 15 to 18 lb. of chalk.

The dyeing was divided into two operations, the quantity of madder required being divided into two equal portions, and a portion of chalk being added to the first dye, which took two and a half hours. The second dyeing had no chalk, and took the same length of time. The pieces were well washed at the conclusion of the dyeing.

The brightening was accomplished by means of soap, carbonate of potash, and a small quantity of crystals of tin, for the first boil, which was given in a close vessel provided with a safety valve, and the boiling maintained for eight hours. For the second soaping the carbonate of potash was omitted, using only soap and tin crystals, in the proportion of 1 part

of tin crystals to 15 of soap; the boiling was kept up for eight hours. The pieces now were well washed and boiled in bran, and lastly passed through a very weak solution of chlorinated potash, or else exposed on the grass. Unless the red was very brown, a third soaping was never given*.

Process described by J. B. Vitalis in 1827.—Before treating of the existing methods of Turkey red dyeing, we think it will be useful to describe the processes given in great detail by the learned J. B. Vitalis in the second edition of his "*Elementary Course upon Dyeing*," published at Rouen in 1827.

The cotton was first cleansed by boiling it for five or six hours in a solution of soda, at about 1½° Tw., left to drain, washed well, and dried in the air.

"The next operation has for aim the *animalising* of the cotton, as it may be called, and to communicate to it as much as possible the properties enjoyed by animal substances of entering easily into combination with colouring matter, and forming permanent or durable compounds with them." "Sheep-dung is used, which contains a certain quantity of albumen, or a peculiar animal matter. It is usual to take 25 or 30 per cent. of the weight of the cloth."

[We think it quite unnecessary to follow the description of Vitalis, which is lengthy, and simply transcribed from very old authorities, such as Schæffer, le Pileur d'Alpigny, Chaptal, and Berthollet, and has nothing interesting about it.]

Process described by Dumas, 1846.—This description is contained in the treatise of "Chemistry applied to the Arts" of this celebrated chemist, and it will be found that it contains some theoretical speculations, which now make their appearance for the first time. The author says this dye is distinguished from others by the fatty mordant which is upon the cloth and the treatment with galls to which the cloth is subjected. This fatty mordant is nothing more than oil, to which a small quantity of alkali is added, to render it emulsive, and which in this state effects a more complete

* This process is taken from Persoz, iii., p. 188. We have, however, followed M. Chateau, with a few additions and corrections.—*Ed.*

penetration of the fibre that it could otherwise. This action is only accomplished by the exercise of affinities of a feeble order, and can only be completed by frequently repeating the operations.

Although experience has shewn that the gall treatment is useful, it is scarcely known how it operates.

It is found that unbleached cotton dyes up better shades than cloth which has been bleached in the usual manner, and that Egyptian cotton takes the dye better than other growths.

The brightening operations have the effect of dissolving away the brownish colouring matter of the madder and leaving the pure red. They consist in subjecting the cloth to the action of light, alkalies, soap, and salts of tin. It is to practice and experience alone that we owe the methods in use, which differ very much one from another as employed in different works, and there is much variance of opinion as to which process gives the best result. Some dyers still continue to use ox blood and cow-dung in their operations.

The following is a list of the different processes employed for single-colour Turkey reds :

(1.) Boiling out of the cotton cloth.

(2.) Oiling by means of emulsion of oil formed with emulsive oil and soda ; two, three, or four times repeated. After each oiling, the cloth is dried at a temperature of 104° F., and left some time.

(3.) Removal of excess of oil by steeping six or twelve hours in a warm and slightly alkaline bath.

(4.) Application of gall-nuts and alum, and dunging.

(5.) Dyeing in madder at the boiling point ; a repetition of galls and alum, and a second dyeing in madder.

(6.) Brightening by exposure on the grass, and boiling for six to twelve hours in a solution containing soda, soap, and bichloride of tin, which treatment is repeated three or four times.

We now proceed to the detailed description of these operations.

Boiling or cleansing the cloth is effected as usual in wooden vats heated by steam, or else in the vessels that are used

for soaping, a sufficient quantity of carbonate of potash added, the boiling maintained for five or six hours, and the pieces afterwards well washed. A previous steeping of unbleached cloth in warm water for four or five days is often practised; the size is much easier removed after the steeping. The cloth must be dried before the oiling process.

The emulsion or white liquor is made with oil, water, and solution of carbonate of potash at about 4° Tw., and the cloth padded in it by the padding machine, and then dried at a heat of 145° F.; sometimes cow dung is added to the first oil treatment. The padding and drying are four times repeated; four or five more paddings are given with intermediate dryings with the weaker liquor which was squozen out of the first treatments, diluted with water; some days afterwards, the removal of the excess of oil is removed by steeping the pieces several hours in warm water, expressing the liquor, washing, and drying; the liquor squozen out is used in the preparation of new oil emulsions. The process of removing the excess of oil requires much care, and upon its being properly carried out depends the success of the dyeing. If the water is used too hot, it takes off too much of the fatty matter, and then the dye is thin and bare; on the other hand, if the cloth is not sufficiently freed from fatty matter the colour looks heavy and dull.

The so-called gall treatment consists in passing the dried cloth from the last treatment into a hot decoction of about equal parts of gall-nuts and sumach, and then drying in the stove. The dye is more uniform if the galls and sumach be applied at twice instead of by a single treatment.

The alum liquor is prepared by adding 5 pints of a solution of carbonate of potash at 14° Tw. to a solution of 35 lbs. of alum; the goods are padded in the solution which is slightly warmed, then dried in the air, and lastly in a warm stove. It is remarked that frost injures the alumed cloth, by causing the alum to crystallize and fall off in the following operation.

After several days' ageing, the alumed cloth is passed into warm chalk and water, and well washed, and is now ready for dyeing without being dried.

The dyeing is done with madder, a little sumach and ox blood, and is completed in two hours and three quarters; the goods are washed.

The brightening processes are performed in a close boiler two-thirds filled with water. For 20 or 25 pieces of calico, there are taken 7 lbs. of Marseilles soap, and 4 lbs. of carbonate of potash; these are boiled, and then a solution of 5 oz. of salt of tin saturated with potash added, with vigorous stirring; the dyed calico is introduced into this liquid, the cover placed on the boiler, and the whole boiled for six or seven hours; then taken out and washed.

A further brightening is given by taking for 40 pieces of calico, say 12 lb. of soap dissolved in water heated to the boiling point, and while boiling there is added a solution formed of ½ lb. of tin salt, and 1½ lb. of strong nitric acid; this solution being previously saturated with potash, and employed as in the first brightening operation; the cloth is boiled in this mixture for three or four hours, then washed and put on the grass for some days.

M. Dumas gives an estimate of the cost price of dyeing 200 pieces of calico Turkey red, in a works in Switzerland, in the year 1846. The dimensions of the pieces were 22½ ells long, by 24 inches wide, the cost for materials, labour, fuel, and general charges is put down at 1,754 francs 83 cents; and the selling price as 2,192 francs, leaving a profit of 237 francs 17 cents. Such published estimates have at most an historical interest.

To the process given by Dumas, follows the process given by Persoz in his well known work, dated 1846; the same process being given in Schützenberger's treatise upon colouring matters (1867), it differs very little from the process just described, and we shall only give it in abstract.

The oiling process is repeated seven or eight times, and the excess of oil removed with a weak alkaline solution; the galls and alum are applied twice, and the goods are dyed in madder after each application of these mordants. The galling is not given separately, but in combination with the alum, and there is no alkali prescribed to be mixed with the alum solution.

The pieces are dried in hot stoves, and then passed in a strong bath of heated chalk and water. The brightening process does not differ in any essential particulars from that described by Dumas. It is added that long experience has shewn that the oil fixes better upon the cotton when the drying is gradual.

Fries' Process.—This is also taken from Persoz (iii., p. 198), and presents some modifications of treatment. The calicoes are cleansed by treatments with lime, acid, and soda ash, much the same as in ordinary bleaching. The oiling does not present any important differences from the foregoing processes, the pieces are exposed on the grass after each oiling, and lastly stove dried, the temperature of the stove being gradually raised after the last oiling; the pieces are stoved eighteen or twenty-four hours at a temperature of 120° F. The excess of oil is removed by water without addition of alkali, after which the pieces are washed and treated with galls and alum together. Fries differs from others in using a small quantity of acetate of lead with the alum, about 3½ parts of acetate to 50 parts of purified alum. Three days after mordanting the pieces are passed in hot chalk and water, then dyed with addition of a small quantity of sumach to the madder, washed, dried, and spread out on the grass or dried in the air. The galling and aluming are repeated with the difference that the heat of the solution must not exceed a hand heat, the dyeing is again repeated. The brightening operations are practically the same as those given in the two preceding processes.

[*To be continued.*]

4. *Note upon Albumen.*

It is well known that egg albumen becomes injured by time, the whole or a portion of it passing into a state in which it is insoluble in water, and consequently unfit for printing pur-

poses. This change takes place very slowly in well-stoppered glass bottles, perhaps does not take place at all, since samples ten years old have not been found affected; but in packings pervious to air, such as barrels or boxes, the change appears to commence at the outside and gradually penetrates the mass in the course of one or two years, even when the store place is dry and cool, more quickly if the atmosphere be warm and moist. M. J. Wagner, of Serpouchoff reports that he has found that pepsine renders insoluble albumen fit to be used. In his communication to the Industrial Society of Mulhouse,* M. Wagner speaks only of albumen injured by heat, and does not refer to injury by age, and treats it as follows:—To 10 gallons of water add 1 lb. of strong hydrochloric acid, and 3 lb. of calves' stomach previously washed in cold water and cut into small pieces, then add 35 to 40 lb. of the damaged albumen, and leave the whole to digest for two hours at a temperature between 86° and 104° F. Strain through a coarse strainer to remove the pieces of stomach, and then through a fine strainer, and add a slight excess of ammonia. This solution was used as the best albumen, and the colours resulting were nearly identical with those obtained from the best albumen. Several thousand pounds of injured albumen which, without this treatment could only be used with difficulty, were thus successfully treated. Upon caseine the same solution has no action.

M.M. Brandt and Dupuy were instructed to report upon M. Wagner's communication: their experiments are far from confirming his results. It was previously well known that acid solutions of pepsine converted albuminous matters into soluble peptones which were not coagulable by heat, and yet to yield fast colours it must be supposed that in M. Wagner's experiments, the albumen had not lost its coagulating properties. The reporters acted upon coagulated albumen according to M. Wagner's process, they found it was partly dissolved, but the solution had no viscosity, and was not coagulated by heat; experiments upon a variety of injured albumen samples gave the same results. It is remarked that

* Bulletin for February-March, 1876, p. 121.

as there is no coagulation, the colours cannot be as fast as when made from good albumen, but colours made from the solution, it is admitted, are more solid than with any other thickening matter except albumen, and that it may be used in styles where perfect fixity is not required, and further that M. Wagner's process does dissolve insoluble matters in poor albumen which it is difficult to remove by straining, and thus renders it possible to utilize them.

In this conflict of testimony, the Editor thinks it not improper to say that M. Wagner has had great experience in albumen colours, and when he states that by a certain process he has been enabled to use with advantage thousands of pounds of albumen which would otherwise have been impossible or difficult to use, it is worth the while of those similarly situated to try the process.

5. *Notes upon Aniline Black.*

M. GUYARD, along with whose name is associated that of Hugo Tamm, has communicated a paper to the "*Moniteur Scientifique*" upon recent progress in the application of aniline black. He quotes the receipt for Vanadium black, as given in the "*Bulletin de la Societé Chemique de Paris*," with the old mistake of 18·5 parts of salt of vanadium to 150 parts of aniline salt, instead of 0·125 part to the 150 of aniline. There is something new in this paper, for it is said that though the introduction of vanadium is the greatest improvement in aniline black as far as regards the formation of the colour, there is another discovery here for the first time announced, which is the greatest improvement yet introduced in the application of aniline black in either printing or dyeing. This discovery consists in the use of what is called "preservative salt of Casthelaz," to which the most extravagant praise is given. It permits the development of the colour to

be pushed on with any degree of rapidity without danger to the cloth. Colour for printing mixed with this salt is said to be "perfection itself," the application of the salt to have crowned the edifice so laboriously built up, and at the same time solved all the difficulties which attend on the application of the aniline mixtures. "In fact, this remarkable substance "has the valuable property of absorbing or neutralising all "acids, chlorine, and chlorine compounds which may be "liberated during the development of the black, without in "the least hindering the production of the colour, and of "rendering absolutely harmless the aniline black mixtures, "whatever they are. The salt is perfectly soluble, and mixes "with the greatest ease with all the pastes for blacks. Its "triple action consists in protecting the tissue or fibre against "the action of chlorine and acids preventing the formation "of aureoles (or white edges), and protecting in a wonderful "manner the colours near to the aniline black from the action "of chlorine." Much more is said in praise of the salt, but not one word of its composition, nature, or origin, and we are sorry not to be able to give the information. The body of the paper of M. Guyard is only a repetition of what appeared in the "*Bulletin*" of the Paris Chemical Society a couple of months ago, with interpolations in praise of the preservative salt. It is not said that this salt is patented, nor that its proprietors or discoverers wish to keep its composition secret, which of course could not be done if it once got into the hands of the trade; neither is it said that the black colour is to be sold ready-made, in which case there would be a possibility of puzzling the analytical chemist; in fact, the notice is not clear enough for an advertisement, nor candid enough for a scientific article, and is only calculated to excite curiosity.

M. Guyard gives the following as a standard bath for dyeing aniline black. It is applicable to all fibres which require no preparation beyond being well freed from grease or dirt.

Water	1 gallons.
Muriate of aniline	13 oz.
Chlorate of soda or potash...	6 to 6½ oz.
Chloride of vanadium	1 to 7 grains.

The materials to be dyed are impregnated in an uniform manner with the solution, and then exposed for some hours in an ageing room, at a temperature of 60° to 70° F., and afterwards to a temperature of 86° to 104° F., and kept at this heat until the goods are well dried. If the black is deep enough, it is then passed through a solution of bichromate of potash, containing about 1 per cent. of salt.

When the black is not deep enough, a second or a third impregnation with the aniline mixture must be given, but it is advisable to rinse or wash the goods between the processes, to remove the salts which might hinder the proper penetration of the additional coating of black.

Silk takes the aniline black better than wool or cotton, and requires no preparation beyond cleansing; generally a single dip is sufficient to give a fine black. There is however, a great advantage in introducing a quantity of gum arabic in the aniline mixture, say about half a pound of gum to a gallon of the mixture. The mixture being thus slightly thickened, the silk takes up a larger quantity of the black, which is very evenly deposited, and the fibre retains all its brightness and lustre.

Of the advantages of vanadium in aniline black for printing, M. Guyard says: "The vanadium black does not contain any sensible quantity of metallic salt, for the minute portion of chloride of vanadium present does not exercise any chemical action upon the doctors. It has an advantage over sulphide of copper black, by having an homogenous composition, owing to the solubility of the vanadium salt, and it may be said to have all the valuable properties of Lightfoot's original colour, without any of its inconveniences."

The colour is prepared from two pastes, the one containing 12 to 13 ounces of chlorate of soda or potash per gallon, and the other about 26 ounces of muriate of aniline per gallon, and 14 grains of chloride of vanadium. Equal measures of the pastes are mixed to make the colour, which is strained and immediately used. As this black developes very rapidly, no more must be mixed at one time than is strictly necessary. It is best to commence the ageing at a low temperature, and

keep it low until chlorine ceases to be liberated, and then raise the temperature. In dyeing, the choice of the particular chlorate is of no importance, but the best blacks are obtained with chlorate of potash. The only objection to this chlorate is its sparing solubility, and it is found preferable to use mixture of equal weights of chlorate of potash and chlorate of soda. Chlorate of potash is dangerous in printing because it is apt to crystallise on the surface of the colour, and work badly in consequence. The chlorate of soda answers perfectly in every way for printing.

6. *M. Michel de Vinant on Dyeing, Printing, and Bleaching.*

THIS work, though bearing the date of 1872, is but little known in England, and it is only lately that a copy came into our possession. It is worthy of notice, for it is evident that the author is a practical and intelligent man, and does really know what he is writing about. From the author's own words, and from internal evidence, it appears that he has worked at dyeing in various countries, principally France, Bohemia, and England, and possesses a varied and extensive, if not deep knowledge of many styles of work. The book has more than 800 pages, and consists for the most part of receipts for dyes and colours, and as these have an air of originality and practicability about them, we propose to translate a selection, so that practical men in this country may see what is the present state of some matters on the continent, and compare them with their own processes.

Silk Bleaching.—The old method of boiling silk in sacks would seem to be discarded, and the method of steaming employed. The steaming box is about 10 ft. long and 3½ ft. wide, provided with a steam-tight cover; in the interior of the box there are a number of rollers covered with woollen which can be put in motion from the outside. The box is

suitable for treating either woven or unwoven silk, and has the advantage of boiling them without friction or rubbing. The author saw this apparatus working at Lyons, and speaks highly of it. The goods to be treated are saturated with a soap solution containing 60 lb. of Marseilles soap and 1½ lb. of carbonate of soda to 50 gallons of water, at a heat of 120° to 140° F. In saturating hanks care must be taken to keep up the strength so that the whole lot shall be equally impregnated. Foulards are winced in the soap for ten minutes, or twice padded in the liquor. The goods are exposed to the action of the steam for six hours, washed, and a second time treated in the same way. Foulards for white are exposed to sulphur fumes, without rinsing, for forty-eight hours ; then rinsed, and blued with aniline violet and a little aniline blue in a bath containing sulphurous acid, and then rinsed. Corat, which the author worked much with in England, could not be bleached without two steepings in soap, but the Lyons fancy foulards were bleached at one operation. The silk in hanks, if meant for general dyeing, is only once soaped and steamed, but if for white or delicate colours, the operation is repeated, and they are sulphured without rinsing for twenty-four or forty-eight hours. Those for white are rinsed and blued, those for light shades of dye are steeped in muriatic sours at 1° B., and well rinsed.

Tussah Silk, so-called Wild Silk.—This curious product presented great difficulties in treatment, but good results were obtained by M. Guinon by the process of steeping it at the boil in very strong caustic soda for fifteen minutes, washing and sulphuring, and then passing in hot soap. The Tussah silk by this treatment is rendered nearly white without losing its elasticity or strength, and can be dyed in all colours except the lightest. To avoid the risk of destroying the silk by the strong alkali, the author endeavoured to modify the action by mixing the alkali with roasted starch and with rosin, and also with woollen rags, but it does not appear that he was successful, and it is very doubtful whether M. Guinon's process can be considered to have practically solved the question.

Wool Treatments.—The scouring and bleaching of wool,

as described in the work, is nearly the same as it has been for many years past: we have made some notes which seemed worthy of extracting, Urine is still in use at Elbeuf, but its employment is diminishing, and it is always mixed with soda crystals. For wool which has to be dyed in indigo, it is deemed necessary to give several successive scourings at considerable intervals, the wool being dried between each process. The author found nothing better as a cleansing agent, than a solution of rosin in caustic soda, employed at a temperature of 120° F. The solution was made by dissolving at the rate of 5 lb. of rosin in 50 gallons of caustic soda at 5° Tw., after the rosin treatment the wool was passed in a weak bath of crystals of soda, slightly warmed.

For merinos and delaines, the sulphuring is still carried on in stoves, using 5 lb. sulphur for 100 lb. wool, the operation being continued for thirty-six or forty-eight hours. It is remarked that wool bleached by sulphurous gas always becomes yellow by exposure to air, this can be avoided by an immersion of the wool in a mixture of sulphite of soda and hydrochloric acid for a longer or shorter time. The sulphite is put into the vessel in large crystals, so that it is gradually dissolved and decomposed by the acid present, the wool has time to absorb the liberated sulphurous acid, and the bleaching is more effectual. The yellowest and poorest wools become beautifully and permanently bright by this treatment.

The author speaks highly of the quality of the wool bleaching which he saw practised in Bohemia at the works of MM. Franz Liebig. The sulphurous acid is made on the works, and passes direct into the bleaching vats; when the water has absorbed a sufficient quantity of the gas, the stuffs to be bleached are introduced and left to themselves for thirty-six or forty-eight hours, drained and blued with aniline violet mixed with a little aniline blue.

A method of bleaching delaines in which ammonia is used instead of soap, and soda is said to give good results.

Black on Silk in Skeins or Hanks.—This is called weighted Lyons black. First, the silk is passed in acetate of iron at

25 or 30 per cent. and washed; secondly, passed in hot soap, that which has been used for boiling-off the silk will do, if too poor in soap it should be freshened up; thirdly, pass hot in prussiate bath at 22 per cent. and wash slightly; pass again in the iron and wash; the fifth operation is to leave twelve hours in catechu of 125 to 130 per cent, wash well; lastly, pass in a fresh bath of soap at 25 per cent., adding logwood according to the shade required; if the silk is to have a crackling feel (craquante), the final treatment with lemon juice or vinegar must be given.

English Black weighted to 200 per cent.—The silk being well wrung or extracted, receives nine dips in sub-acetate of lead at 50° Tw.; wring out and leave covered up five or six hours, then pass into sulphuric acid at 8° Tw. in the cold, and wash well. Next, steep in a 10 per cent. solution of soap at 140° F., rinse and ring out, give nine more dips in the sub-acetate of lead, leave six hours and pass as before in sulphuric acid, wash well, and pass in logwood with addition of 5 per cent. soap; wash. Next, leave the silk five days in iron liquor at 40° Tw., and wash out and dye in logwood and fustic with addition of soap. Rinse and steep in a gallic solution (?), at 50° Tw., for six days; wring, and finish with logwood, fustic, and soap; wash and soften in an oily mixture made with caustic soda at 3° Tw., and sufficient quantity of olive oil, so that none swims on the top. This mixture must be carefully made, and as much as required added to warm and very pure water. The silk must be dried without washing,

[*To be continued.*]

7. *Upon the action of Red Prussiate of Potash and Alkali upon Alizarine and Madder Colours, and some Compound Styles of Prints which may be produced by this action.*

MR. J. WAGNER discovered that while a mixture of soda and red prussiate of potash (ferricyanide of potassium) exercised a powerfully destructive action upon reds obtained from

Pocket Calendar, 1885.

Days of the Month.					Jan.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sep.	Oct.	Nov	Dec.
1	8	15	22	29	Th	S	S	W	F	M	W	S	T	Th	S	T
2	9	16	23	30	F	M	M	Th	S	T	Th	S	W	F	M	W
3	10	17	24	31	S	T	T	F	S	W	F	M	Th	S	T	Th
4	11	18	25	—	S	W	W	S	M	Th	S	T	F	S	W	F
5	12	19	26	—	M	Th	Th	S	T	F	S	W	S	M	Th	S
6	13	20	27	—	T	F	F	M	W	S	M	Th	S	T	F	S
7	14	21	28	—	W	S	S	T	Th	S	T	F	M	W	S	M
No. of Days					31	28	31	30	31	30	31	31	30	31	30	31

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extract of madder, the same mixture was almost without action upon reds made with artificial alizarine. He communicated these observations to the Industrial Society of Mulhouse, in the hope that they would be useful either in practical styles or as a means of chemically distinguishing between the two colours. Mr. Tatarinof repeated these experiments, and arrived at the same conclusions.

The finished reds were printed with thickened solutions of red prussiate at the rate of 1 lb. per gallon, and also at 2 lb. per gallon; afterwards, when dry, passed in cold caustic soda solution at 14° Tw., then in boiling water, and lastly in soap.

Mr. Wagner suggested that it was the purpurine in the extract of madder which had suffered or been destroyed by the oxidising action of the chemicals.

Mr. C. F. Brandt was requested by the Industrial Society to report upon this observation, and a note from him will be found in the March number of the Bulletin of the Society, p. 125. He corroborates the statements of Mr. Wagner, and gives a table of the effects of the reaction upon the various matters which are in use at present with madder. He considers the phenomena of great interest, and likely to lead to some profitable applications. We give the Table in full.

TABLE

*Shewing the effect produced by Printing a Concentrated Solution of Red Prussiate of Potash upon various Shades from Madder and its Derivatives, and the Artificial Substitutes of Madder.**

1. Upon Colours not Soaped.

Flowers of madder.....	All the shades slightly acted upon, the light purple more than the pink.
Schaaf and Lauth's green alizarine	All the shades but slightly acted upon.

* Though not mentioned in this heading, the subsequent passing in caustic soda must be understood. The omission is no doubt owing to inadvertence.—*Ed.*

Meister and Lucius' alizarine No. 1.	None of the shades acted upon.
Artificial alizarine for reds	Slightly acted upon; the alumina mordants less acted upon than the iron mordants.
Garancine	All the shades strongly acted upon, the pink and light purple nearly bleached.
Meissonier's extract of madder	Action nearly the same as upon garancine colours.
Schaaf and Lauth's purpurine	A stronger action than in any of the other trials; all the shades nearly bleached.
Purpurine extracted from Meissonier's extract..	The action not so strong as upon Schaaf and Lauth's purpurine.
Pernod's extract of madder purpurine ...	Nearly the same action as upon the purpurine extracted from Meissonier's extract.

2. Upon Soaped Colours.

Artificial alizarine for red	Not acted upon.
Meissonier's extract of madder	Strongly acted upon.
Schaaf and Lauth's purpurine	Completely bleached.

M. J. Depierre was prompted by Mr. Wagner's observation to make some experiments to obtain discharge and resist red effects on indigo styles, and communicated the results to the Industrial Society of Rouen which we give here in abstract.*

The effects produced by the super-position of two colours has been from time to time employed in calico printing. When two colours fall one upon another, the result is generally a third colour composed of the elements of the two constituents, this is a simple effect of super-position; but when the resulting colour is a different one, the effect is called one of conversion. Most of the colours thus produced are not of practical application, but they possess some interest. Several examples are to be found in Persoz, one consists of adding

* Bull. de la Soc. Ind. de Rouen, iv., p. 17.

catechu to a pink mordant, and printing over it chromate of potash; wherever the two fall one upon another, the catechu is fixed, and a brown colour results, but where the chromate does not fall upon the pink mixed with catechu, the latter is not fixed, and is washed out in dunging so that a pure pink dyes up.

If a solution of catechu in acetic acid be added to an alizarine steam pink and steamed, it will be found that the catechu has very little influence upon the shade when soaped; but if previous to washing off, bichromate of potash, or what is preferable, a solution of copper salt be printed so as to fall on the pink, the catechu becomes fixed without the whites being injured. Copper salts are preferable in this case to bichromate because with the latter it is necessary to steam the cloth to fix the catechu, but copper only requires some hours' ageing to fasten the colour.

Colours on prints dyed in an indigo vat generally take as much blue as the white parts, this occurs if a finished alizarine red be dipped in a blue vat.

But if the red be only steamed and not washed off, then dipped in indigo and afterwards soaped, the red will be found to have resisted the blue, and to shew a pretty pure shade of colour; the same effect occurs with both extract of madder and alizarine red.

If this blue ground with red object be padded in chrome, and printed with a design in a discharge made with oxalic acid, both the red and the blue will be discharged wherever the acid colour falls; but if instead of this discharge, a solution of red prussiate of potash be printed, and the cloth afterwards passed in caustic soda, another effect is obtained, the blue only is discharged, the red resting intact. This is a confirmation and application of Mr. Wagner's experiments. Another effect is found if the cloth after printing with red prussiate is steamed before passing into the soda, the red is coloured by the red prussiate, while the blue is discharged.

If cloth printed with red from artificial alizarine is steamed, soaped, and dyed in an indigo vat, then printed with red prussiate and passed in caustic soda, another and different

effect is obtained. The blue dyeing upon the red gives rise to a chocolate colour, and the discharging agent at the same time destroys the blue and brings the red back to its primitive shade, producing a design in chocolate, red, blue, and white.

Three specimens of print are inserted in the text, and fully sustain the statements of the writer.

8. *Upon the Theory of the Formation of Aniline Black.**

BY M. A. ROSENSTIEHL.

OF the three substances whose concurrence is essential to the formation of aniline black,—chlorates, aniline salts, and metallic salts,—the latter have attracted the most attention on account of the special action which seem to belong to them.

For the blacks which are developed by ageing, and which are those now under consideration, the metal which has been employed in preference to others since the first discovery of the colour is copper.

The first theory which was propounded to explain the special action of this metal, is based upon the property which this metal has of forming two series of salts, the one corresponding to the cupric, and the other to cuprous oxide. It is supposed that the contact of an aniline salt with the salt of copper at the higher state of oxidation passes to the lower state by yielding oxygen to the aniline which is in this way changed into aniline black.

The salt of copper thus reduced returns to its state of maximum oxidation by contact with the chlorate, and is thus in a condition to go through the same transformations so long as there is aniline to be oxidized, or chlorate to be reduced. I shewed more than ten years ago† that this theory, so

* Bull. de la Soc. Chemique de Paris, xxv., p. 356.

† Bull. de la Soc. Ind. de Mulhouse, xxxv., p. 481.

attractive by its simplicity, was not justified by the phenomena. I presented a theory of the formation of aniline black which, not agreeing with the ideas then entertained, was not favourably received. Several experiments which I have lately been induced to make have so fully confirmed the conclusions that I drew from previous ones, that it seems to me all doubts should be removed in this respect; these experiments lead to a theory of aniline black which is of great simplicity.

Before detailing these experiments, it will be useful to give an account of my former ones in order to shew the state of the question in 1865, when the work to which I have referred was published; this seems the more necessary as the papers in the Bulletin of the Industrial Society of Mulhouse appear to be but little known. The receipt given by John Lightfoot in 1863, for the production of aniline black upon cloth, contained, as is well known, a large quantity of soluble copper salts which were the cause of great difficulties in printing. The importance of the result to be obtained stimulated many processes intended to surmount these difficulties.

Besides the capital improvement introduced by M. Lauth of substituting the insoluble sulphide of copper for the soluble salts of the metal, other mixtures were proposed in the intention at least of their authors to make the black without the assistance of copper.

The first known to me is that of M. Paraf. It consisted in adding fluosilicic acid to a mixture of aniline salt and chlorate of potash, with the aim of liberating the chloric acid. According to M. Paraf, the production of the black was due to the action of chloric acid and other oxygenated chlorine compounds of possible formation upon the salt of aniline. In support of this statement, M. Paraf cites the following experiment:—If a solution of neutral chlorate of aniline be prepared by double decomposition between crystallized fluosilicate of aniline and chlorate of potash, and heated to ebullition, there is no change, but if a few drops of muriatic acid be added, an abundant precipitate of black is immediately produced.

The idea which led M. Paraf to this theory is partly right,

as will be seen further on; but the facts are not precisely as he supposed, for in practical operations chloric acid does not suffice to transform a salt of aniline into black. In the production of black in Paraf's process there was an intervening agent, the action of which escaped the observation of its author. I fell into the same error as M. Paraf, when a month later I wrote a notice "upon the production of aniline black, and upon chlorate of ammonia as an oxydising agent."*

Looking for the cause of the formation of the black in the products of the decomposition of chloric acid, I employed the chlorates known to be unstable, neutral chlorate of aniline employed alone or mixed with muriate of aniline in various proportions, and especially chlorate of ammonia. The last salt, decomposing spontaneously into water, nitrogen, oxygen, and chlorine, or compounds of chlorine, seemed to me especially likely to convert the salts of aniline into black without the help of copper.

I actually obtained fine blacks, with very little injury to the cloth, by printing a mixture of muriate of aniline and chlorate of ammonia; and not having put any salts of copper in the mixture, I drew the conclusion that the metal was not indispensable. There was, however, a cause of error in my manner of working, which I was not long in discovering.

I printed the same mixtures for comparison by both block and roller, and found that the block colour did not develop, while the roller colour, where it had been in contact with the brass or copper roller, gave an intense black.

I extended this experiment to M. Paraf's black, and having varied it in many ways, I found that the presence of a small quantity of copper was indispensable for the production of the black, whether containing free chloric acid or a chlorate.†

Struck by the remarkable action exercised by such small quantities of copper, I studied its part, and I found all at once that the theory admitted up to the time when I com-

* Bull. de Mulh., xxxv., pp. 345, 436.

† A good result is obtained by taking a quantity of copper salt equivalent to 1 part of metal for 100 parts of aniline, and the equivalent of 50 parts of chlorate of potash, the whole measuring 1000 parts of colour.

menced this work was not in agreement with the facts. The theory supposes in reality that there is a reduction of a cupric salt into a cuprous one. The presence of cuprous salts in a mixture can be easily recognized, for they possess the property of absorbing carbonic oxide, and I satisfied myself previously that aniline salts did not prevent this reaction. Using this gas as a re-agent, I ascertained that neither at the ordinary temperature, nor at the temperature of the ageing rooms, was there any reciprocal action between the cupric chloride and muriate of aniline; it is only at the boiling point that there is formation of a black precipitate, and that carbonic oxide is absorbed.

Again, by printing mixtures of salts of copper at the maximum with salts of aniline, no black is obtained, which ought to be the case if there had been any reduction by the aniline salts, for it is known that cuprous salts absorb oxygen from the air. The following experiment serves to shew that the copper salts do not act as intermediary agents between the aniline salt and the oxydizing matter. I hung bits of stuffs steeped in aniline salts in vessels containing air mixed with ozone, antozone, and chlorine. Black was rapidly developed. From comparative experiments made with aniline salt mixed with copper salt, I saw that the black was developed in both cases, as if the copper was absolutely without action. Both MM. Coquillion and Goppelsrœder have since confirmed this observation by preparing aniline black from the electrolysis of aniline salts. From what is said above, it is demonstrated:

(1.) That in actual calico printing there is no action between the alkaline chlorates or the chloric acid and the aniline salt.

(2.) There is no action even between the latter and the metallic salt.

It only rests to ascertain what passes between the copper salt and the chlorate. It is by examining into this that I have found the solution of the whole question.

To imitate the practical processes, I steeped bits of stuff in pure chlorate of ammonia and in the same chlorate contain-

ing a little copper salt. After the stuff was dried, I dosed the quantity of chlorate contained in a square decimetre of the stuff by Bunsen's method (solutions of iodine and sulphurous acid).

Suspending these bits of stuff in a moist atmosphere at a known temperature, I afterwards estimated the chlorate present, and found

(1.) That the chlorate of ammonia either alone or mixed with copper salt is not changed at the temperature of 60° F.

(2.) That at a temperature of 95° F., both were decomposed, but in a different degree; in a quarter of an hour the unmixed chlorate had lost 5½ per cent., and the chlorate with copper had lost 46 per cent.

From these experiments it is seen that the chlorate of ammonia is decomposed more rapidly in the presence of copper salts.

Pursuing my experiments, I found that the decomposition is owing to the formation of chlorate of copper, which upon fibre is decomposed at the temperature of 95° F., and at a higher temperature when alone. Heated in a flask to 140° F., the salt begins to give off yellow-coloured gases (chlorine and oxygenated chlorine compounds), and a basic salt is left.

The following experiment illustrates very well its remarkable oxidizing powers:—Steep a sheet of paper in a strong solution of chlorate of copper, and dry it upon a steam stove; the paper suddenly bursts into flame; if the chlorates of potassium and ammonium are used in the same way, the paper is not acted upon.

In contact with salts of aniline, the chlorate of copper decomposes as easily as if it were separate.

If mixtures of muriate of aniline in solution, and different chlorates are heated in the same water bath, when the temperature approaches 86° F., the flask containing copper chlorate begins to form black, while the other mixtures remain uncoloured. All these facts shew that chlorate of copper is the least stable of the chlorates mentioned in this paper, and that it acts upon the aniline salts at a lower temperature and more energetically than even chloric acid.

My paper "upon the part which copper takes in the formation of aniline black" stopped at this point, concluding that:

(1.) Contrary to the generally admitted theory, copper did not act as an oxidizing agent.

(2.) That aniline black could be obtained without chlorate and without copper by the action of ozone, antozone, or chlorine upon muriate of aniline.

(3.) In presence of a chlorate copper is necessary; it forms chlorate of copper, which decomposing at a higher temperature acts more rapidly than other chlorates upon the muriate of aniline.

My idea was that the products of the decomposition of chlorate of copper transformed the aniline salt into black; however, this consequence was not explicitly stated, nor directly demonstrated in the paper of which I have given a synopsis, unless it might be in shewing the formation of aniline black by chlorine gas. This circumstance was doubtless the reason why my conclusions were not generally accepted.

In reflecting lately upon the subject, I saw the gap which it was necessary to get over in order to shew that it is the relative instability of the chlorate of copper which is the cause of the formation of aniline black.

The products of the decomposition of this salt being partly gases, I experimented in the following way:—I took four flasks, at the bottom of the first I placed some grammes of dry chlorate of ammonia, the most easily decomposed of all the alkaline chlorates; in the second, a mixture of this salt with a little sulphate of copper; in the third, chlorate of copper; and in the last a mixture of chlorate and salt of vanadium.*

I suspended in each flask a bit of stuff impregnated with salt of aniline containing excess of base; each of the three

* I included vanadium salts because attention has been lately directed to this metal, which has been the occasion of reviving the old theory of two states of oxidation. If this theory can be applied to vanadium, it cannot to copper, as I have demonstrated; at the same time, what I have said upon the instability of chlorate of copper is also applicable to vanadium.

last flasks contained everything necessary for the development of the aniline black, but the different bodies not being in contact, no action could take place.

I placed the four flasks in a water bath so that the parts containing the chlorates only were in the water, and heated the bath. The black developed first in the flask containing the vanadium salt, next in the flask containing the copper salts; in the flask containing the chlorate of ammonia alone the black was not developed.

It may be reasonably inferred from these experiments that it is the gaseous products emanating from the chlorates under the influence of the salts of copper and vanadium which caused the formation of the black upon the bits of stuff.

As a corollary to this experiment I prepared aqueous solutions of chlorine, hypochlorous acid, chlorous acid, and hypochloric acid.

I poured some cubic centimetres of each of these solutions on the bottom of a flask, in which as in the previous experiment, I suspended some stuff dipped in salt of aniline. The action was very rapid. Under the influence of the chlorinated gases which were diffused in the atmosphere of the flasks I saw the black gradually forming, and was able to follow the different phases of its production. The tissue was first coloured green, then became darker and darker until it was a black-blue, and at this point the maximum of intensity and solidity is attained. Not more than eight minutes were required to obtain this result. If the action is permitted to continue, the black-blue becomes purplish, assumes a reddish shade, and then acquires that rusty colour characteristic of aniline black which has been submitted to the action of an hypochlorite, a phenomenon well known, and which has been studied in detail by M. Camille Koechlin.*

Thus all the gaseous bodies produced by the deoxidation of chloric acid from hypochloric acid to chlorine itself, are capable of transforming aniline salt into black at the ordinary temperature, and without contact of any metal. The best black is formed with the chlorous and hypochloric acids;

* Moniteur Scientifique, viii., p. 769.

chlorine and hypochlorous acid act too powerfully, and are difficult to regulate, so that the black becomes purplish, and even brown in places, while with the other gases it is scarcely formed. By means of these chlorinated gases, the colour can be obtained upon wool and silk as easily as upon cotton.

The various phases of the development of the black so easily observed in these experiments have a certain significance in practice, and deserve a moment's consideration. I am led in this to refer to a question upon which the Industrial Society of Rouen has published numerous and excellent observations which will find a confirmation, if not a common link, in what follows.*

The green substance which is first formed becomes black-blue, as we have seen, by the regulated action of the gases which have produced it: it undergoes the same transformation more rapidly by a short immersion in a weaker solution of the same gases, and it is known that chromic acid and bichromate of potash have the same property of changing the colour.

It follows from this, that substances which are acid and dehydrogenizing change this dark green substance, called "emeraldine," into blue-black, which is aniline black proper. On the other hand, we know that the same emeraldine changes to blue-black by the action of alkalies. Do these two blacks, resulting from opposite influences, possess the same properties? Evidently not! for while the latter becomes green by the weakest acids, the first is not changed by acid fluids unless they are concentrated, or, like sulphurous acid, of a reducing character. M. Zürcher, in a recent communication to the Industrial Society of Mulhouse, considers that emeraldine is in a state of lower oxidation than the real aniline black, and this opinion receives support from what has just been stated.

I may add that aniline blacks as they come from ageing have a dark greenish-blue colour, that is, the colour of a mixture of emeraldine and aniline black; they only become black after treatment with an alkali. The aniline steam

* See Bulletin of this Society, 1874, M. Witz, p. 98 and 172.

blacks from the steaming are of a darker colour, and may be considered as containing less emeraldine, and it is known that they are less subject to undergo that disagreeable change known as "greening." The simultaneous existence of two different blacks constituting the commercial aniline black has been already noticed by M. Brandt,* and he shewed the advantages of using chlorate of aniline instead of chlorate of potash. He describes these two blacks, one as being very permanent and resisting all chemical agents, he considers it as formed by a chlorine derivative of aniline ; the other, which may be the result of the oxidation of aniline, is much less permanent and easily becomes green by the action of weak acids, but is perfectly fast in soap, and M. Brandt believes that a mixture of the two blacks is necessary to give the best colour.

This description accords very well with the characters of emeraldine and the real aniline black. If it were possible to govern the action of the chlorous and hypochloric acids, both of which are deleterious, and when pure, explosive, the problem of the rapid production of aniline black capable of resisting acids would be solved.

I must, however, confine myself to the limits traced, which go no farther than the theory of the formation of aniline black, and conclude

(1.) That this black is formed at the ordinary temperature whenever the salt of aniline is placed in a dehydrogenizing medium, such as active oxygen, chlorine and its oxides less oxygenized than chloric acid.

(2.) That the mixtures of chlorates and metals employed for aniline blacks are only commodious means of producing upon the spot and slowly the chlorinated gases named above, and which is effected by the easy decomposition of the chlorates of these metals.

Mulhouse, 8th April, 1876.

* Bull. de la Soc. Ind. de Mulhouse, xlii., p. 354.

A Statistical Account of all the Print Works in England, Printing Silk, Woollen, Cotton, and Mixed Fabrics, excepting Carpets, in 1851.

NAME OF FIRM.	NAMES OF WORKS.	Machines.	Tables.
Thos. Hoyle and Sons ...	Mayfield.....	25	50
Schwabe and Co.....	Rhodes	25	66
Edmd. Potter and Co	Dinting Vale.....	24	...
Strines Printing Co	Strines Hall	13	130
Jas. Bennett	Birch Vale.....	11	215
James Clarke	Hayfield.....	5	...
Kinder Company.....	Kinder	4	...
Jas. Ingham	Watford Bridge.....	4	...
Charles Yates	Rock Mill	3	...
John Walsh	Whaley Bridge	4	...
Ditto	Furnace	4	...
Bradshaw Hammond	Levenshulme.....	10	...
Heald, Wilson, and Co ...	Strangeways	14	...
Seedley Company	Seedley	13	...
Bailey and Craven	London Place	10	...
C. and J. Brenand	London Vale.....	7	...
Edwin Bailey	Pendleton	1	31
Dean and Woodburn	Broughton	6	...
Jno. Burd and Son	Mount Zion	16	90
Hutchinson	Ratcliffe.....	9	...
Hardman and Price.....	Belholt	5	180
Thos. Gorton	Kirkless Wood	6	...
Saml. Knowles.....	Tottington Mills ...	8	103
Wm. Grant Brothers	Ramsbottom.....	7	50
Greg Wilson.....	Rose Bank.....	4	30
John Lash and Co.....	Baxendale	6	200
Butterworth and Brookes...	Sunny Side	15	...
Baxendale Printing Co ...	Lough Clough	16	...
Margerison	Burnley	12	186

NAME OF FIRM.	NAME OF WORKS.	Machines.	Tables.
Gillet Foster	Sabden	9	205
Jno. Dugdale	Lower House	9	160
Jas. Grimshaw	Plantation Mills	6	47
Reddish Bickham	Brook Side	6	20
Greenhalgh	Stubbins	8	70
Young and Littlewood	Foxhill Bank	18	99
Jno. Watkinson	Oakenshaw	6	99
J. Ripton and Co	Ditto	6	25
Grafton and Co	Broad Oak	16	88
Fredk. Steiner	Church	2	...
Dewhurst and Co	Bell Mount	4	101
Farrer and Co	Kemp Mill	2	...
Aitken Brothers	Low Mill	6	...
Ditto	Denham Springs	5	25
McNaughtan	Birkacre	14	127
Swainson	Bannester Hall	...	54
Bentley and Co	Blackrod	1	...
Horwich Vale Co	Horwich Vale	19	...
John Seddon	Ainsworth Mill	2	...
Hardcastle	Bradshaw Hall	7	70
Whyatt	Bowker Bank	8	50
J. Dickens	Middleton	...	21
R. Kay and Co	Castleton	5	...
Belfield Hall Company	Belfield Hall	11	51
Stansfield Hall Co	Handle Hall	4	...
McGregor	Gorton	1	...
Wardley	Darwen	7	...
Burford and Co	Know Mill	5	...
Brazil and McKinnel	Ardwick	10	70
Wood and Wright	Bank Bridge	17	217
Taylor, Hampson, and Co.	Clayton Bridge	7	30
Christr. Wood	Brinscull Hall	4	12
Calvert	Bucton Vale	4	...
Kennedy and Co	Hartshead	9	...
Neville	Harpurhey	7	...

NAME OF FIRM.	NAME OF WORKS.	Machines.	Tables.
Matley	Hodge Mill	11	154
Andrews and Co	Compstall	11	...
Dalton and Co	Hollingworth Mill	7	...
Syddall and Co	Chadkirk	6	12
Marsland	Stockport	7	60
Marsland and Hall	Ditto	6	...
Jno. Ferneyhough	Cheadle	8	25
Symmonds	Handforth	12	...
J. Brien	Bollington	9	...
Smith and Co	Langley	...	44
Newton Bank Co	Hyde	8	...
Butterworth and Son	Junction	6	...
S. Giles	Matley Hall	1	30
Dewhurst	Huddersfield	5	19
Edwd. Robinson	Bridge House	1	17
Spencer	Barnsley	3	...
Wm. Robinson	Leeds	...	25
Applegarth	Crayford	...	18
Swainsland	Ditto	5	100
Evans and Co	Ditto	...	70
Keymer and Co	Dartford	...	26
Keyss	West Ham Abbey	...	132
Wilson	Hoxton	1	...
Littler	Merton Abbey	1	36
P. Dempsey	Mitcham	...	42
J. Davidson	Ditto	...	16
Jas. Murphy	Merton	...	17
Henderson	Wandsworth	...	20
Welch	Merton	...	23
Wagland	Garret Lane	...	21
Kean	Slough	...	40
	Total	640	3939

Strong Goods Printers.

NAME OF FIRM.	NAME OF WORKS.	COUNTY.	Machines.
Ramsey and Son...	Ancoats Vale ...	Lancashire ...	5
Worrall Brothers...	Ordsall Lane.....	Ditto ...	9
Lancaster	Springfield Lane.	Ditto ...	4
Clemson and Co...	Red Bank	Ditto ...	3
Dewhurst	Adelphi.....	Ditto ...	4
Langworthy	Greengate Mills...	Ditto ...	4
Ashton	Salford	Ditto ...	3
Whitehead	Elton.....	Ditto ...	3
		Total.....	35

Printworks Standing.

NAME OF FIRM.	NAME OF WORKS.	COUNTY.	Machines.
Thompson and Co.	Primrose	Lancashire ...	13
Ainsworth Sykes..	Barrow Bridge ...	Ditto ...	8
Millington	Edgworth	Ditto ...	8
Kershaw Leese ...	Ardwick	Ditto ...	...
Ditto ...	New Garrett.....	Ditto ...	...
		Total.....	29

NOTE.—This list is from a manuscript which has been in the Editor's possession for many years. It is evidently a copy not very carefully made from its original, the names of firms are not always correctly spelled nor given in full, but we have thought it better to let the matter stand without correction. In the manuscript there are columns for machines, flat presses, long tables, short tables, machine blocks, shawl tables, surface machines, and French machines. Thomas Hoyle and Sons is the only firm which has machine blocks, 25; John Burd and Son have four French machines, probably Perrotines; this firm has also five surface machines, and Brazil and Mc.Kennil have other two. No other firms have either French machines or surface machines. There are seventy-three flat presses, nearly all in the London District. All the tables have been put under one head.

9. British and Foreign Patents, from the Commissioners of Patents Journal, March 21st to April 18th, 1876, inclusive.

Colouring Matters and their Application.

44. JUSTUS WOLFF, of Wyke, near Bradford, Consulting and Engineering Chemist, and RALPH BETLEY, of Wigan, Analytical and Consulting Chemist, for an invention of "Improvements in the production of colouring matters capable of being employed for the purposes of dyeing and printing."—Dated 4th January, 1876. This patent has passed the great seal.

313. JUSTUS WOLFF, of Wyke, near Bradford, Consulting and Engineering Chemist, and RALPH BETLEY, of Wigan, Analytical and Consulting Chemist, for an invention of "Improvements in the production of aniline dyes."—Dated 26th January, 1876. This patent has passed the great seal.

1068. HENRY EDWARD NEWTON, of the Office for Patents, 66, Chancery Lane, in the county of Middlesex, Civil Engineer, for the invention of "Improvements in the preparation of colours or pigments which by vitrification are rendered permanent."—A communication to him from abroad by Robert Jean Phillippe Van der Haeghen Limelette, of Brussels, in the kingdom of Belgium. Provisional protection has been granted to this patent.

1229. JOHN HENRY JOHNSON, of 47, Lincoln's Inn Fields, in the county of Middlesex, Gentleman, has given notice to proceed in respect of the invention of "Improvements in obtaining colouring matters suitable for dyeing and printing."—A communication to him from abroad by Heinrich Caro, of Mannheim, in the empire of Germany, Chemist to the Badische Anilin and Soda Fabrik, of Mannheim aforesaid (Grand Duchy of Baden).

1489. JOHN HENRY JOHNSON, of 47, Lincoln's Inn Fields, in the county of Middlesex, Gentleman, for an invention of "Improvements in the production and treatment of colouring matters."—A communication to him from abroad by Edward Croissant and Louis Marie François Bretonnière, both of Paris, in the republic of France.—Dated 24th April, 1873. The £50 stamp duty has been paid upon this patent.

The following are French Patents.

109,423. GRAWITZ, for "Manufacturing a series of colours derived from anthracine or alizarine.—Dated 1st September, 1875.

109,421. GONIN, for "Mordant for dyeing and printing."—Dated 30th August, 1875.

109,598. SCHMIDT, for "Preparing textile substances for vat-dyes."—Dated 13th September, 1875.

108,780. CLEIS and Co., for "A direct process of painting stuff or tissues."—Dated 6th July, 1875.

108,990. GONIN, for "Applying fast dyes by dyeing and printing on cotton."—Dated 28th July, 1875.

108,990, GONIN, for "Applying fast colours on cottons by dyeing and printing."—Dated 19th August, 1875. A certificate of addition.

109,193. LERICHE, of Lisieux, for "Applying, in dyeing, coppered dark blue cotton, coppered dark brown cotton, &c., with oxidized sulphate of aniline."—Dated 23rd August, 1875.

Rollers and Printing.

4134. JAMES HUMMERSTON, of Leeds, in the county of York, has given notice to proceed in respect of the invention of "A new or improved machine for printing on paper, floor-cloths, and woollen or other woven or felted fabrics."

4515. HENRY WILDE, of Manchester, in the county of Lancaster, Engineer, for an invention of "Improvements in the manufacture of metal rollers for printing calico and other textile fabrics, part of which is applicable to the refining of copper."—Dated 28th December, 1875. This patent has passed the great seal.

1036. LEON GODEFROY, Son, of the firm of Vve. L. Godefroy and Son, of Puteaux, near Paris, Printer, for the invention of "An improved process of printing or ornamenting woollen or other similar textile fabrics." Provisional protection has been granted.

109,613. JANARD, for "Photographic impressions on tissues, and on the textile substances employed for their manufacture."—Dated 24th September, 1875. French patent.

39,004. J. ROULE, of Verviers, for "A machine for printing tissues with variegated designs.—Dated 3rd March, 1876. Belgian patent.

29. H. JAHN, of Fünfhaus, for "A machine for printing fabrics."—1 year.—(Public.)—Dated 28th October, 1875. Austrian patent.

In the matter of Letters Patent for the United Kingdom of Great Britain and Ireland granted to WILLIAM IRELAND, of Buckhaven, in the county of Fife, North Britain, Manufacturer, for the invention of "Improvements in printing textile and similar fabrics, and in the machinery or apparatus employed therefor, dated the 10th day of August, 1874, No. 2757.

Notice is given that the said WILLIAM IRELAND has applied by petition to the Commissioners of Patents for leave to enter a Disclaimer and Memorandum of Alteration of certain parts of the Specification of the said Letters Patent, and any person intending to oppose such application must leave notice thereof at the Office of the Attorney General, 6, Crown Office Row, Temple.

Singeing, Bleaching, and Steaming.

3517. WILLIAM HOLT, of Halifax, in the county of York, Dyer and Finisher, for an invention of "Improvements in apparatus for steaming textile fabrics and yarns or warps."—Dated 9th October, 1875. This patent has passed the great seal.

250. WILLIAM MATHER, of the firm of Messieurs Mather and Platt, of Salford, in the county of Lancaster, Engineer, for an invention of "Improvements in apparatus for steaming printed fabrics."—Dated 21st January, 1876. This patent has passed the great seal.

1174. WILLIAM MATHER, of the firm of Messieurs Mather and Platt, of Salford, in the county of Lancaster, Engineer, for an invention of "Improvements in apparatus for steaming and ageing printed fabrics.—Dated 18th March, 1876. Provisional protection has been granted and notice to proceed given.

1422. EDWARD KEIGHLEY, of Bradford, in the county of York, Dye Works Manager, for an invention of "Improved means or apparatus for singeing woven fabrics and other fibrous substances."—Dated 3rd April, 1876.

The following are French Patents.

108,715. BICKEL, for "Bleaching spun cotton on bobbins."—Dated 9th July, 1875.

109,246. CUYLITS-LATOUR, DE KINDER, and HOUPIART-DUPRE,

of Lille, for "A chemical process for retting textile substances, and powder and liquid for disaggregating, bleaching, glazing, and strengthening such substances and their products."—Dated 2nd September, 1875.

109,329. MOISON, of Paris, for "Means of and apparatus for scouring tissues in pieces or made up, yarns, and skins by volatile solvents, such as sulphide of carbon, hydrocarbons, &c." —Dated 24th August, 1875.

Treatments of Silk and Wool.

4211. WILLIAM SHAW NICHOLS, of Globe Mills, Manningham, Bradford, in the county of York, Engineer, for an invention of "Improvements in machinery or apparatus for scouring or washing wool or other fibres."—Dated 6th December, 1875.

1129. TO WILLIAM BISHOP, of Stroud, in the county of Gloucester, for the invention of "Improvements in processes or modes of chemically cleaning or freeing wool or woollen textures from vegetable matters, to be employed more especially previous to or in connection with the process of dyeing."

The following are French Patents.

96,284. PIERRON and DEHAITRE, for "A machine for dressing woollen, silk, and other fabrics."—Dated 14th August, 1875.

103,790. NIEL, for "A machine for scouring tissues."—Dated 5th June, 1875.

109,032. RICHARD and PUTHOD, for "A machine for washing and wringing silk."—Dated 9th August, 1875.

109,033. RICHARD and PUTHOD, for "A machine for unfolding and drawing dry or wet silk."—Dated 9th August, 1875.

109,102. TESSIE DU MOTAY, for "Bleaching raw silk and animal fibres."—Dated 4th August, 1875.

109,346. CHEVALIER, of St. Thomé, for "A chemical for superseding cashoo in galling silk."—Dated 23rd August, 1875.

109,366. SIRTAINE, for "Applying hydro-extractors for disacidifying wool and other similar substances."—Dated 26th August, 1875.

109,500. TRIBOUILLET, of Tourcoing, for "Processes for washing wool, extracting the various substances contained in suds, and in the spent water of scouring silk."—Dated 15th September, 1875.

109,536. ANFRY, for "Bleaching wool and other filamentous sub-

stances in pieces, rags, or thread."—Dated 17th September, 1875.

109,718. GILLET, Jun., for "Treating smooth silk in dyeing."—Dated 29th September, 1875.

The following are Belgian Patents.

38,765. C. HAMMELRATH, for "A process for ungreasing wool."—Dated 1st February, 1876.

38,795. J. T. WAY and G. JONES, for an imported invention of "Detergent compounds for washing wool, silk, and for other purposes."—Dated 4th February, 1876.—(Original patent, 5th August, 1875.)

38,977. J. RAULIN, for an imported invention of "Improvements in the treatment of wool, chiefly applicable for cleaning by sulphuric acid, and generally for chemical operations on wool by means of liquids or gases."—Dated 1st March, 1876.—(French Patent, 22nd February, 1876.)

Finishing Processes.

3,512. ROBERT BURLISON, Mechanic, and JAMES WHITAKER, Commission Agent, both of Bradford, in the county of York, for an invention of "Improvements in tentering and drying machines."—Dated 9th October, 1875.

3,553. ROBERT DUTTON and WILLIAM RENSHAW, both of Oldfield Road, Salford, in the county of Lancaster, Machinists, for an invention of "Certain improvements in machinery or apparatus for finishing velvets, velveteens, and other pile fabrics."—Dated 13th October, 1875.

3,570. JOHN SCHOFIELD, HENRY GLEDHILL, and HENRY WATSON, in the employ of the firm of Wm. Edleston and Co., of Sowerby Bridge, in the county of York, Dyers, Stovers, and Finishers, for an invention of "Improvements in means or apparatus for finishing woven fabrics."—Dated 14th October, 1875.

3,571. JOHN WALSH, of Halifax, in the county of York, Presser, and CHARLES WILLIAM STEAD, of the same place, Machine Maker, for an invention of "Improvements in machinery or apparatus for 'papering' piece goods or woven fabrics for pressing and taking the papers out after pressing."—Dated 14th October, 1875.

4,454. WILLIAM KEMPE and ARTHUR KEMPE, both of Holbeck Mills, Leeds, in the county of York, for an invention of "Im-

provements in raising the nap upon cloths and fabrics, and in apparatus employed therein."—Dated 22nd December, 1875.

215. MAXIMILIAN ZINGLER, of 19, Buckland Crescent, Belsize Park, in the county of Middlesex, for an invention of "Improvements in the manufacture of varnish, applicable also to sizings and waterproofings for textile fabrics."—Dated 19th January, 1876.

The above Patents have passed the Great Seal.

498. And ANDREW MITCHELL TORRANCE, of the firm of Miller, Son, and Torrance, of Cannon Street, in the city of London, has given the like notice in respect of the invention of "Improvements in the numerical marking of piece goods and other materials and fabrics sold by length, and in apparatus therefor."

844. To LUKE SMETHURST, Presser, SAMUEL SHAW, and THOMAS SHAW, Manufacturers, all of Holywell Green, near Halifax, in the county of York, for the invention of "Improvements in or applicable to machinery or apparatus used in the pressing of woven or felted fabrics."

1,222. To JOHN DITCHFIELD, of the borough of Salford, in the county of Lancaster, Bleacher, Dyer, and Finisher, for the invention of "Improvements in machinery for doubling and measureing cloth and other fabrics."

1,015. WILLIAM HENRY HACKING and THOMAS HACKING, both of Bury, in the county of Lancaster, Machine Makers, for an invention of "Improvements in machinery for plaiting or folding and measuring woven fabrics."—Dated 19th March, 1873.

The following are French Patents.

109,037. TALCOTT, for "A method of measuring and indicating the quantity of stuff in rolled goods."—Dated 29th July, 1875.

109,605. CAFFIN, for "Improvements in machines for finishing stuffs."—Dated 17th September, 1875.

109,620. LYONS, for "Applying distinct marks on pieces of fabric of any length."—Dated 22nd September, 1875.

Unclassified.

108,705. PRAT, for "Decolouring serum and destroying the blood globules."—Dated 3rd July, 1875. French Patent.

109,726. PERNOD, of Avignon, for "Manufacturing a sub-product of madder, called 'madder gum.'"—Dated 29th September, 1875. French Patent.

THE TEXTILE COLOURIST.

No. 6.—JUNE, 1876.

1. *Effect of Chemical Treatments upon the Tensile Strength of Cotton.*

BY CHARLES O'NEILL.

THE experiments detailed in this paper were made several years ago, and an abstract of the results communicated to the Literary and Philosophical Society of Manchester at the time, which abstract was printed in the proceedings of the Society. A complete account of the experiments has not been previously published, and it seemed desirable to make a record of them in this Journal.

The apparatus employed to ascertain the weight required to break either the threads or the separate cotton hairs was one invented by the writer, and figured and described in the proceedings of the Literary and Philosophical Society for 1863-64, vi., p. 186. It consists of a weighted cylinder floating vertically in a vessel of water. One end of the fibre to be tested is secured to the cylinder, and the other to a fixed point above. By drawing off water the weight of the floating cylinder was gradually thrown upon the fibre until it broke. The quantity of water drawn off is an accurate measure of the strain required to break the fibre.

Strength of Threads in Grey Calico.—The first experiments were made upon the warp and weft threads of grey printing

calico. This calico was said to be made from American cotton and specially for printing, the warps were believed to be dressed without any view to weighting, the size was upon the threads when subjected to the testing apparatus.

Thirty Experiments upon the Tensile Strength of Warp Threads from Grey Printing Cloth, No. 1; eighteen threads to the quarter inch.

No.	Length of Thread. Inches.	Grains required to break.	No.	Length of Thread. Inches.	Grains required to break.
1	0·25	4000	16	0·30	3900
2	0·30	2700	17	0·30	3000
3	0·30	2500	18	0·35	3200
4	0·30	2900	19	0·28	2750
5	0·30	3300	20	0·33	3000
6	0·30	3550	21	1·85	2800
7	0·30	3000	22	2·00	3000
8	0·30	3900	23	2·00	3130
9	0·30	3000	24	2·10	3100
10	0·30	4180	25	2·00	3400
11	0·30	2350	26	2·00	2900
12	0·28	2930	27	2·00	3600
13	0·30	2650	28	2.00	3600
14	0·30	2600	29	2·10	2940
15	0·30	3600	30	2·10	3700

The mean is nearly 3140 grains.

NOTE.—These experiments are three different series. Nos. 1 to 10 being from short lengths from one part of the grey, Nos. 11 to 20 upon short lengths from another part of the grey, and Nos. 21 to 30 upon longer lengths from still another part. The different means for the three series are as follows:—

First series, Nos. 1 to 10 = 3303.
Second „ 11 to 20 = 2898.
Third „ 21 to 30 = 3217.

Thirty Experiments upon the Tensile Strength of Weft Threads from Grey Printing Cloth, No. 1; eighteen threads to the quarter inch.

No.	Length of Thread. Inches.	Grains required to break.	No.	Length of Thread. Inches.	Grains required to break
1	0·3	2100	16	0·28	1600
2	0·3	2250	17	0·30	1650
3	0·35	2080	18	0·30	1450
4	0·30	2400	19	0·26	1500
5	0·30	1800	20	0·26	1550
6	0·30	1750	21	1·60	1500
7	0·35	2630	22	1·60	1250
8	0·35	2580	23	1·70	1550
9	0·30	2050	24	1·70	1100
10	0·34	2800	25	1·50	1330
11	0·30	1800	26	1·50	1100
12	0·30	1500	27	1·60	1000
13	0·30	1800	28	1·60	1500
14	0·30	2200	29	1·60	1200
15	0·30	1600	30	1·60	1200

The mean is 1714 grains.

NOTE.—These experiments, like the corresponding thirty experiments on the warp threads, constituted three different series of ten each, and the results shew a great variation in the tensile strength of the weft at different parts of the cloth, the respective means being as follows:—

First series, Nos. 1 to 10 = 2244.
Second „ 11 to 20 = 1625.
Third „ 21 to 30 = 1273.

A close examination of the results so far obtained was very discouraging, the differences between one experiment and another, even the differences of the means of each series were so considerable that it was evident that the threads were of very various and irregular strengths. The investigation seemed surrounded with unsurmountable difficulties. Still it was determined to push on the experiments under the belief that something at least would be learned.

Strength of Threads in Bleached Calico.—The piece from which the foregoing experiments were made was now sent on

to be subject to the regular process of bleaching for best madder work. It was singed twice on the face side and once on the back, boiled in lime, treated with weak acid, boiled in soda and rosin, treated with bleaching powder, and again with acid according to the usual method of bleaching; it formed one piece of a batch of a thousand, all of which were well bleached by the low-pressure system. A number of weft and warp threads were separated from different parts of the piece, and their breaking weights ascertained with the results as shewn in the following table:—

Forty Experiments on the Tensile Strength of Threads from the Warp and Weft of Printing Cloth, No. 1, after having been Bleached for Printing by the Low-pressure Process.

Weft Threads.			Warp Threads.		
No.	Length of Thread. Inches.	Grains required to break.	No.	Length of Thread. Inches.	Grains required to break.
1	0·3	3000	1	0·30	3450
2	0·3	2300	2	0·35	3450
3	0·34	3800	3	0·35	3600
4	0·30	2340	4	0·34	3000
5	0·30	2000	5	0·30	2900
6	0·35	2450	6	0·30	3300
7	0·30	3350	7	0·30	3400
8	0·30	3170	8	0·32	2700
9	0·30	2800	9	0·32	2500
10	0·30	2700	10	0·34	2200
11	2·0	3400	11	2·00	3260
12	2·0	2700	12	1·90	3400
13	2·0	3300	13	2·10	2800
14	2·2	3450	14	1·90	2150
15	2·0	2500	15	1·80	3200
16	2·1	2200	16	1·80	2750
17	2·1	3300	17	2·00	2700
18	2·3	2950	18	2·20	2800
19	2·1	2000	19	2·00	2400
20	2·1	2000	20	2·00	2450
Mean = 2785 grains.			Mean = 2920 grains.		

NOTE.—These weft and warp experiments are each in two series of ten each, one series being on short the other on longer lengths, but they came out nearly the same.

Weft threads; mean of short lengths = 2800.
„ „ long lengths = 2780.
Warp threads; mean of short lengths = 3050.
„ „ long lengths = 2790.

These experiments shew a much greater regularity of strength in the threads than the first tables, and if their indications are to be accepted as true, the warp threads have become weaker by about one-fifteenth part, while the weft threads have become stronger by 60 per cent. That the warp threads should become weaker was to be expected, because the cloth becomes elongated in the bleaching process and the warps stretched out. That the weft threads should become stronger was also to be expected, because the cloth becomes narrower in bleaching and the threads thicker, but an increase of strength of 60 per cent. cannot be credited. The error is not in the experiments, but in the matter experimented upon, which is evidently of a very irregular nature.

The experiments were extended to two other samples of printing cloth from different makers called here Nos. 2 and 3. They were of good quality and had sixteen threads to the quarter-inch. Only the warp threads were taken from these two pieces. The bleaching was done at another place where the machinery was of an older kind, and the pieces not so much pulled in the direction of their length. The results of the experiments are shewn in the following tables:—

Warp Threads from No. 2 Cloth in the Grey.

No.	Length of Threads. Inches.	Grains required to break.
1	0·33	2260
2	0·34	3370
3	0·40	3810
4	0·35	3230
5	0·35	3430
6	0·34	4530
7	0·35	2870
8	0·40	3400
9	0·40	3770
10	0·40	3400

Mean = 3407 grains.

Warp Threads from No. 2 Cloth after Bleaching.

No.	Length of Thread. Inches.	Grains required to break.
1	0·3	3400
2	0·3	3270
3	0·4	3200
4	0·33	2600
5	0·35	3490
6	0·36	4880
7	0·33	4000
8	0·33	5070
9	0·30	3375
10	0·38	3800

Mean = 3708 grains.

Warp threads from No. 3 Cloth in the Grey.

No.	Length of Thread. Inches.	Grains required to break.
1	0·3	3310
2	0·38	3250
3	0·4	3650
4	0·35	2930
5	0·30	4000
6	0·33	3230
7	0·30	4020
8	1·26	3700

Mean = 3512 grains.

Warp Threads from No. 3 Cloth after Bleaching.

No.	Length of Thread. Inches.	Grains required to break.
1	0·3	4360
2	0·3	3850
3	0·32	3580
4	0·35	4270
5	0·3	3520
6	0·28	3960
7	0·37	4600
8	0·32	4060

Mean = 4025 grains.

The mean of the determinations of the strengths of the threads from the three pieces before and after bleaching may be summarised as follows:—

	Before Bleaching.	After Bleaching.
No. 1 cloth, weft threads	1714 grains.	2785 grains.
No. 1 cloth, warp threads	3140 „	2920 „
No. 2 cloth, warp threads	3407 „	3708 „
No. 3 cloth, warp threads	3512 „	4025 „

It is seen that in two cases out of three the warp threads are stronger after bleaching than before, and in one case a little weaker. All that can safely be concluded from these numerous trials is that the tensile strength of cotton yarn is not injured by a careful but complete bleaching, and probably it may be strengthened by the wetting and pressure causing a more complete and effective binding of the separate cotton hairs or filaments, the twisting together of which makes the yarn.

The piece of No. 1 calico was printed with black and acid, covered with purple and padded, afterwards dyed and treated for madder purple and lightly starched. In this state twenty experiments were made upon the strength of weft and warp threads taken from the cloth with the following results:—

Twenty Experiments on Warp and Weft Threads from Printing Cloth, No. 1, after having gone through all the Processes of Bleaching, Printing, Dyeing, &c., required to produce Madder Purples.

Warp Threads.

No.	Length of Thread. Inches.	Grains required to break.
1	0·3	4340
2	0·3	3000
3	0·32	4000
4	0·3	3300
5	0·3	3400
6	0·3	3300
7	0·3	3500
8	0·3	3800
9	0·3	3700
10	0·28	3350

Mean = 3569 grains.

Weft Threads.

No.	Length of Thread. Inches.	Grains required to break.
1	0·34	2450
2	0·34	2000
3	0·34	4120
4	0·35	3300
5	0·30	2300
6	0·30	3340
7	0·32	2080
8	0·32	2200
9	0·30	2600
10	0·30	2300

Mean = 2669 grains.

If these figures be reliable, we must conclude that between the bleaching and the finishing, the warp threads have not only recovered the strength lost in the bleaching, but have gained something more, while the weft threads have kept very nearly at the same strength that they shewed after bleaching.

Effects of Mordants upon the Tensile Strength of Cotton.—It is well known that the late Mr. Walter Crum sustained a theory of dyeing which attributed all the phenomena of colouring fibrous materials to physical attraction or retention of the colour by the fibres, and refused to consider them (cotton at any rate) as exercising any chemical action whatever upon the mordants or colours. Besides his actual demonstrations of sections of cotton hairs and other arguments, he laid some stress upon the fact that wherever there was chemical combination and subsequent decomposition by the action of other chemical agents there was destruction of form or disintegration; but if the so-called combination of alumina or iron with cotton be destroyed by removing the iron or alumina, the cotton does not dissolve or fall to powder, or suffer any visible change whatever. This always struck me as a strong argument against the chemical theory of dyeing, and one which

might be explained away but not refuted. In other places I expressed doubts as to its applicability as well as to its exactness, for at one time I had the responsibility of the discharging of all the spoiled pieces on a large printworks, and was often troubled with soft and tender pieces coming up with sound ones in the same partie, having all gone through the same process; and it seemed clear to me that though cotton might not be visibly changed by being mordanted and unmordanted, that there was a change which affected its strength. The following experiments were made to obtain if possible some exact information upon this point. The cloth experimented upon was some which had been printed by block in broad stripes with several mordants, and was such as is used in testing the strength of dyestuffs on the small scale. It had been long printed and cleansed ready for dyeing. In the first of the following determinations of tensile strength the method employed was to submerge the cloth, parts of which were mordanted and parts unmordanted, in dilute hydrochloric acid until the mordants were nearly all dissolved out, then washed well to free the cloth from acid. Threads were then drawn from the mordanted parts and their strength tested against an equal number of threads taken from contiguous non-mordanted portions.

Strength of Threads, Warp and Weft, from Iron-mordanted parts of Calico where the Mordant had been Dissolved out by Acid.

Warp Threads.

No.	Length of Thread. Inches.	Grains required to break.
1	0·3	4860
2	0·3	4630
3	0·28	2350
4	0·35	2320
5	0·30	3030
6	0·32	3380
7	0·33	3700
8	0·3	3160
9	0·3	2260
10	0·3	3810

Mean = 3450 grains.

Weft Threads.

No.	Length of Thread. Inches.	Grains required to break.
1	0·32	1770
2	0·33	2600
3	0·35	2270
4	0·35	1870
5	0·30	2450
6	0·30	2250

Mean = 2201 grains.

Strength of Warp and Weft Threads from the same Piece of Calico where there had been no Mordant.

Warp Threads.

No.	Length of Thread. Inches.	Grains required to break.
1	0·32	3330
2	0·32	3280
3	0·39	3860
4	0·30	3400
5	0·28	3100
6	0·35	4270
7	0·38	4190
8	0·30	4050
9	0·35	4350
10	0·35	3320

Mean = 3715 grains.

Weft Threads.

No.	Length of Thread. Inches.	Grains required to break.
1	0·25	2950
2	0·275	3870
3	0·33	2520
4	0·3	2920
5	0·32	2180
6	0·27	3000

Mean = 2906 grains.

These results shew that the iron-mordanted threads of the warp have suffered a diminution in strength of about 7 per cent., and those of the weft a diminution of 23 per cent. The experiments were repeated upon a different piece of cloth, but similarly printed in broad stripes, and in the following tables there is given the strengths of threads from the mordanted and unmordanted parts after the cloth had been dyed in garancine and then treated with dilute acid to remove the mordant, the colouring matter in great part being left in:—

Strength of Warp Threads from Mordanted and Unmordanted parts of a Piece of Calico after treatment with Acid.

No.	Red Mordant.	Unmordanted.
1	1600	1510
2	2220	2050
3	1910	2400
4	2100	2250
5	2140	2020
6	1530	1440
7	1680	2080
8	1960	1830
9	1880	2230
10	2040	2320
	Mean 1906 grs.	Mean 2013 grs.

No.	Black Mordant.	Unmordanted.
1	1480	2700
2	2400	2320
3	1660	1730
4	1590	2400
5	1440	2040
6	1470	1810
7	1380	2500
8	1660	2140
9	1760	2320
10	1470	2640
	Mean 1631 grs.	Mean 2260 grs.

There are two columns for unmordanted threads, because the red and black stripes being several inches apart I thought it possible there might be a change in the warp at that distance, and therefore took ten contiguous threads lying alongside each of the mordants.

In this case the alumina-mordanted threads suffer a dimintion of strength of 6 per cent., and the iron-mordanted threads a diminution in strength equal to 28 per cent. I was desirous to make some experiments upon single cotton hairs taken from the threads, and the few experiments in the following table were made in consequence:—

Strength of Single Hairs of Cotton taken from Mordanted and Unmordanted Warp Threads of Calico after treatment by Acid.

Mordanted Hairs.		**Unmordanted Hairs.**	
No. 1	60·0 grains.	No. 1	76·1 grains.
2	60·5 ,,	2	79·5 ,,
3	101·4 ,,	3	86·6 ,,
4	65·7 ,,	4	57·1 ,,
5	57·1 ,,	5	58·5 ,,
6	42·8 ,,	Mean =	71·6 grains.
7	40·4 ,,		
8	89·0 ,,		
Mean =	64·6 grains.		

These shew a loss of strength in the mordanted hairs equivalent to nearly 10 per cent. I did not pursue these experiments upon the single hairs any further, for I found some were not dyed, and some only partly dyed, so that it was evident the mordant itself had not actually penetrated to every hair. I then proceeded to mordant some cotton in the wool to try the experiments upon hairs more satisfactorily. Before leaving these thread experiments I may say that they represent about the extreme case of mordanting which can happen in calico printing; being printed by block the mordant is driven quite through the cloth, and the threads consequently saturated with it. The red and black mordants were the strongest in use, being intended for dyeing the darkest

colours, and they had been upon the cloth at least twelve months.

Cotton Mordanted in the Wool.—To ensure a thorough mordanting of the cotton for my experiments I saturated parcels of New Orleans cotton with commercial acetate of iron and commercial acetate of alumina, expressed out the excess of liquid, dried the cotton at a gentle heat, and left it twenty-four hours in warm and damp air. Afterwards washed each parcel well in lukewarm water to remove unattached mordant, and dried. Then to remove the mordant I digested portions in dilute hydrochloric acid, taking care to digest some of the original cotton in the same acid, so that if the acid itself had any effect it might not invalidate the results. The mordant having been removed, the cotton was carefully washed and dried. The following tables give the results of thirty experiments upon the cotton hairs:—

Strength of Single Hairs of Cotton Unmordanted and Mordanted with Acetate of Iron and Alumina after Treatment with Acid to remove the Mordant.

No.	Unmordanted. Grains.	Alumina Mordant. Grains.	Iron Mordant. Grains.
1	205·2	108·1	105·2
2	179·0	48·1	57·1
3	117·1	80·9	107·6
4	145·2	52·8	64·7
5	124·7	66·6	122·8
6	159·5	151·4	106·6
7	120·4	94·8	143·8
8	83·3	122·8	94·3
9	138·6	80·9	112·8
10	166·2	134·2	53·3
	Mean = 143·9	Mean = 94·1	Mean = 96·8

The iron-mordanted cotton has lost nearly 33 per cent., and the alumina-mordanted cotton nearly 35 per cent. in strength. So far as these experiments go, then, it seems demonstrated that in the act of mordanting and unmordanting cotton the fibre suffers a very appreciable loss in strength, but whether this points to a chemical combination or not I shall not now stop to enquire, since many other facts and experiments can

be brought to bear upon that question which deserves separate consideration.

Strength of Gun Cotton.—Gun cotton is perhaps the only unquestionable chemical combination into which cotton enters without change of form, and it is interesting to ascertain how its tensile strength is affected. Some New Orleans cotton was treated with a mixture of sulphuric and nitric acids in equal volumes. The resulting gun cotton was of the variety that is soluble in alcoholised ether, it had gained 66 per cent. in weight and burned pretty well but rather slowly. I ascertained the lengths of the hairs, and found upon twenty measurements the mean only differed from that of twenty hairs before treatment by one thousandth of an inch, which is within the limits of error, and consequently the length of the hairs may be said not to be affected. In the following tables the measurements and the results of the breaking of twenty hairs are given.

Lengths of Twenty Hairs of New Orleans Cotton when changed into Gun Cotton.

No.	Inches.	No.	Inches.	No.	Inches.	No.	Inches.
1	1·05	6	1·10	11	1·00	16	1·20
2	0·90	7	0·95	12	1·05	17	1·20
3	0·85	8	1·00	13	0·85	18	1·20
4	0·90	9	1·05	14	1·00	19	1·1
5	0·85	10	0·80	15	0.90	20	1·0

Breaking Weights of Ten Hairs of Gun Cotton made from New Orleans Cotton.

No.	Lengths.	Breaking weight. Grains.	No.	Lengths.	Breaking weight. Grains.
1	0·15	100·5	6	0·12	50·0
2	0·12	47·6	7	0·11	112·9
3	0·13	73·3	8	0·12	100·9
4	0·11	107·1	9	0·13	114·3
5	0·13	73·3	10	0·17	74·3

Mean = 85·4 grains.

The same cotton, according to the experiments detailed in a preceding paper, had a mean strength of 138·1 grain.

The results shew that there is a diminution of strength to

the extent of 38 per cent. in the gun cotton. My experiments have not been carried beyond this one sample, but I think it very likely other samples differently prepared may shew somewhat different results.

Mercerised Cotton.—The fact that cotton undergoes a change in dimensions, and acquires a greater tensile strenth by treatment with concentrated solution of soda is well known, and its application has been practised and applied by its discoverer, the late Mr. John Mercer. I treated some New Orleans cotton with a solution of soda, sp. gr. 1·250, and made some experiments upon the strength and length of the hairs, which are given in the following tables.

Length of Twenty Hairs of New Orleans Cotton after Treatment with Soda.

No.	Inches.	No.	Inches.	No.	Inches.	No.	Inches.
1	0·75	6	0·85	11	0·9	16	0·8
2	0·80	7	0·75	12	0·95	17	0·7
3	0·65	8	0·90	13	0·70	18	1·0
4	1·05	9	0.95	14	1·05	19	0·95
5	0·90	10	0·75	15	0·85	20	0·90

Breaking Weights of Ten Hairs of New Orleans Cotton after Treatment with Soda.

No.	Grains.	No.	Grains.
1	142·8	6	171·4
2	126·2	7	139·0
3	195·2	8	153·3
4	145·2	9	133·8
5	187·6	10	146·6

Mean = 154·1 grains.

The mean length of twenty hairs before treating with alkali was found to be 0·996 inch, the contraction therefore amounts to 0·139 inch, or about 15 per cent. The mean strength before treatment is 138·1 grains, an increase of 16 grains having taken place, or nearly 12 per cent.

It may be objected to these conclusions that the matters upon which the experiments were made, whether single hairs of cotton or spun yarn, are themselves so unequal in strength in different parts that no precise knowledge can be acquired in

this direction, and the labour has consequently been thrown away. I do not think so, for though I frequently paused in the course of experimenting upon these ungrateful matters, and asked whether it was worth continuing, I was encouraged by finding that there was a certain amount of reliance to be placed upon the results. Ten experiments gave a mean which could be used with safety, for if a second and a third series of ten were made, the mean of different series were found to be the same. Until we have further light upon these matters I shall believe that the experiments here detailed do correctly indicate the conclusions drawn.

2. *Materials for a History of Textile Colouring, No. 2.*

In the year 1844, M. Isaac Koechlin, of Lœrrach, in the Grand Duchy of Baden, presented a quarto manuscript of 300 pages to the library of the Industrial Society of Mulhouse. This manuscript, which is a valuable record of the earliest days of calico printing in Switzerland, was written in French by M. Jean Ryhiner, of Bâle. It was commenced in 1766, and the last dates in it are 1783. M. Dollfus-Ausset printed the manuscript in the second volume of his work entitled "Materiaux pour la Coloration des Etoffes," which appeared in 1865, and from this publication we make the extracts which follow.

In a brief sketch of the history of calico printing which precedes an account of his own family, the writer says that the Dutch, and their neighbours of Bremen and Hamburg, were the first to make prints in Europe, and had a large business; their styles seldom consisted of more than two colours, red and black, which were called Patnas, and single-coloured reds and purples called Surates, from the names of places in India where similar goods were previously obtained.

The European printed goods being much cheaper than the imported Indian goods, were in great demand, so that the printworks in Amsterdam increased greatly in number. It is remarked that the Germans did not take up this business, for the Dutch made a secret of their processes, and it was thought for a long time that it was a most difficult art, and that no one could succeed in it who had not been initiated in its mysteries. It appears that the cotton printed upon was mostly of Indian manufacture, which was imported into Holland in the bleached state, and the printers worked for merchants who purchased the calico and indicated the design required, the printers being paid so much per piece, according to the number of colours in the design.

There were at this time (about the year 1700), three commercial firms at Neufchatel, Schafesheim, and Bâle, who did an extensive business in Indian goods, and they were in the habit of sending to Holland to purchase cloth and get it printed. One of these firms, Emmanuel Rhyiner's Widow, and Co., placed a relative, Samuel Rhyiner, the father of the writer of the manuscript, in a house of business at Amsterdam, to acquire a knowledge of trade, and at the same time to act as their agent. The firm of Fæsch, in which Samuel Rhyiner was occupied, acted as agents for many foreign houses, who bought prints through them; this gave him daily opportunities of being in the printworks, and of acquiring a knowledge of the manufacture. The author supposes that similar circumstances enabled the other two Indian merchants mentioned above to set up small printworks, for in the year 1716 or 1717, there were places in existence respectively at Neufchatel, Schafesheim, and Bâle, for printing; the first-named works printed goods in many-coloured designs, the others in single colours only.

These establishments were on a very modest scale; that of the Rhyiners' consisted of a field for bleaching, in which was constructed a small wooden house, and there, with three or four tables and a capital of 6,000 francs (£240), they printed sufficient for their own trade in Indian goods, the annual sale price of which amounted to 30,000 francs, of which the value

of the prints amounted to 7,500 francs. The works gradually increased in size, and in 1732 the firm confined themselves entirely to printing. The author says—

"The demand for prints was very large, and if at this time, and for thirty years afterwards, the business had been pushed, great fortunes might have been made. But our predecessors were satisfied with moderate advantages, did not care to trade upon borrowed money, and were very cautious in giving credit, satisfying themselves with a modest and not a brilliant fortune. The purchasers waited upon them, they had the choice of their customers, and dictated the credit they would allow, they made their own prices, and altogether it may be said that this trade was the best existing. They printed chiefly upon common cloth, but also upon Indian cloth, which was printed in several colours; the easy sale caused a disregard for improvement, for everything could be disposed of. It was only at Neufchatel that the printers sought to combine glory with profit, and to make goods imitating the English and Indian prints; for the English had closely followed the Dutch in printing, and soon surpassed their teachers in excellency."

The author regrets that the Swiss were not more enterprising and did not extend their production, for there were not prints enough to meet the demands. He says that in 1750, Rhyiners sold 80,000 francs worth.

"If at this time we had accepted borrowed capital, and extended our business, we should have made a fortune, and prevented the establishment of works in Mulhouse. The Mulhousiens finding in their town a crowd of print buyers who were always complaining that they could not get supplied at Bâle, and knowing also that money was abundant in Switzerland, and worth no more than 2¾ per cent., took advantage of these circumstances. Koechlin and Schmalzer, two Mulhousiens without capital, established the first printworks at Mulhouse with money which they obtained at Bâle at 5 and 6 per cent., and were so successful that others soon followed them. Dollfus, Anthès, Hofer, Risler, and others established works, and at this day (1750), there are in this little town, sixteen printworks, and more than 500,000 francs of capital lent by residents of Bâle."

Mulhouse at this date was a republic, and not commercially a part of the French kingdom; the French were the largest purchasers of prints; complaint was made that the trade of Rouen suffered by the importation of prints, and so heavy a duty imposed upon them by the French government that it was impossible for the cheaper kind to bear it. Smuggling was established on the frontier, and though some of the finer prints passed through the custom house, the ordinary goods had forged seals attached, and the professional smugglers undertook to convey them into France, at first for six, and afterwards for three livres per piece, the legal duty being fifteen livres per piece. But smuggling became unprofitable after a while, and the Swiss continuing to produce low class prints found themselves shut out of France. The Mulhousiens gradually gave up making the lower qualities, and confined themselves to many-coloured prints on fine calico, which were well executed and could pay the heavy French duty, and are said to have had a prodigious trade. The Swiss meantime pushed their lower class of goods in other directions, and the author says not without reason:

"It is astonishing that a corner of the earth which produces no raw material, nor anything else required for its manufacturers, should make nearly all other countries tributary to it for so important a production; for besides the trade in ribbons, bonnetry, paper, linen and hemp cloths, silks, &c., it is reckoned that in Berne and Toggenburg half a million of pieces are annually printed. The labour of a piece is set down as follows:—

Spinning	3 fr. 00.
Weaving	1 „ 50.
Ordinary Printing	3 „ 22.
Manufacturer's profit	2 „ 25.
	9 fr. 97c.

which for 500,000 pieces shews a gain of 4,985,000 francs."

Further on it is remarked that the cost of printing for superior styles is as high as 9 francs per piece; but, as might be expected from M. Rhyiner's lament for the good old

times of his father in 1716, he finds the state of affairs in 1760 very indifferent. The simplicity of life and rigid frugality of the Swiss workman made him at one time the cheapest labourer in Europe; but things were changed in 1760, and only in the villages was labour low enough to enable the manufacturers to maintain their advantages in foreign markets.

"But the luxury of the towns is gradually gaining upon the country people, and will soon bring them down to a level with their competitors. As to the manufactures in towns things have quite a new complexion, and the Switzer who in the past inculcated economy by example now gives lessons in extravagance. From the first of the merchants down to the lowest of the labourers each one lives beyond his means, and spends more than needful upon his table, his clothing, and his dwelling; along with that the assiduous attention to work is nearly altogether gone. In France and elsewhere the working class is not nearly so corrupted as it has begun to be in Switzerland. . . The floating capital required in business becomes daily greater and greater on account of the slowness with which payments are made. Sales are made at nine months terms, and the capital only returns upon an average in fifteen or eighteen months. The time the cloth is on hand in the winter, before it can be put into work, the time necessary in the manufacture, and the time the goods remain in the warehouse before they are sold consume in interest the profit to which the manufacturer has a right. We have invested in this business a sum of 500,000 francs, and our yearly sales scarcely amount to 180,000 francs, hardly the third part of our capital. Twenty per cent. upon the cost is reckoned as the sale price, but sales are often made at 15 per cent., which only yields 5 per cent. on the gross capital. From this it can be imagined how those contrive who manufacture and trade upon borrowed capital, for even those who possess money have to learn to economise, especially on account of bankruptcies, which take away still another portion of the profits. The cheaper prints are those which yield least return and require the largest capital, but the demand for them is more regular, and the risk of sale not so great. This is why the Bâle printers, who work upon their own money, have kept to that branch, while the Mulhouse printers have abandoned it. However, the sale for common prints

can only be general when their price is moderate; the demand exists on the single ground that it is impossible to find any other material with which clothing can be so cheaply made."

M. J. Rhyiner frequently alludes to, and cordially praises the skill of the English calico printers. Such testimony to the excellence of printing in England at so early a date as 1716 to 1760, as is contained in the following extract, if not quite satisfactory is at least interesting.

"It was reserved for the English to attempt an imitation of the best Indian work in prints, and to arrive at a degree of perfection which one would have thought impossible. All the world knows this people, whose industry and plodding patience in overcoming every kind of difficulty exceeds all imagination. This nation cannot flatter itself with having made many discoveries, but it may glory in having perfected all that has been invented by others; whence the saying, '*to have a perfect thing it must be invented in France and worked out in England.*' If the English have not been able to make their prints so perfect in fastness of colour, because they have not the drugs, they at least surpass in the elegance of their designs, and the neatness of their execution. They have, moreover, the advantages of making their prints upon linen, which renders them more durable.

When it was seen from the English prints that it was possible to make them in these countries of an excellence approaching to those of Indian manufacture, the attempts to imitate them became general. Holland, France, Germany, and Switzerland set to work with more or less success, but none of them could equal the English, who maintained in this, as in all other manufactures, that superiority which results from their accuracy and patience. However, Holland and Switzerland went far beyond France, and the pieces which have been printed in Switzerland with all possible care did not differ much from English work."

In another part of the manuscript, the author defines in what particulars the English are superior to the Swiss and other nations in the year 1760. One of the principal reasons why the English work was not more nearly approached in the previous epoch, was the belief general on the continent that

they employed different methods of printing, and drugs unknown to others. Acting upon this idea, time was wasted in following up a false track; but at length it was found that the English methods and materials were essentially the same as those used abroad, but applied with more skill, more exactness and precision. In 1760, the English were unapproachable in their plate work, printed from engraved copper; the subjects being frequently pastoral, and containing human and animal figures. M. J. Rhyiner says that the only thing they were short of for this style was to know how to thicken the mordants so as to work from engraved plates; time would give them the secret which the English themselves had only known a few years. In concluding this part of his subject, the author says that the productions of Scheule, of Augsbourg, are an exception to his general remarks, for they surpass those of the English even in the finish.

Under various heads, the author then gives a sort of treatise upon the practical part of calico printing. It is impossible to read a page without feeling convinced that the writer was not only perfectly acquainted with what was then known upon the manufacture, but that he knew a great deal more than was known to some authors who wrote fifty or a hundred years after him. There is an air of decision combined with modesty and candour in his observations upon work and workmen, which indicate a thoroughly practical and experienced printer, who had learned in the only school that can really teach anything worth communicating to others, that is, in the manufactory itself. The English language is very deficient in treatises upon dyeing and printing written by practical men, and in the few books of this kind which do exist, the writers prefer to enlarge upon scientific points which they do not well understand, and confine their practical part to a bare routine of processes, of weights and measures, temperatures and strengths, with no attempts at generalization, or broad views of the subject. Perhaps even this is preferable to the treatment which practical dyeing and printing receives at the hands of some writers of the scientific class; with little aptitude to seize the salient points of a manufacture strange

to them, they have less modesty, and pretend to understand and generalize things which no one understands and no one can generalize, and hide their scanty knowledge of practice in a cloud of false theory, which, while it seems to convince and satisfy them, instructs nobody, and advances nothing. There have not been many in the trade who could have written so plainly and so correctly as M. J. Rhyiner has done. As the manuscript was not printed until a hundred years after it was commenced, it is doubtful whether it was intended for publication or not. Its tone would lead to the belief that it was composed for the instruction and direction of some younger member of his firm; it is so candid and straightforward in its language, and exposes so plainly and familiarly the duties and the faults of certain positions in a works, that it seems more fitted for private perusal than for general criticism. We give as an example what he says about the '*coloriste*,' which designation has nearly the same meaning in this manuscript as *colour mixer* in English.

"The qualities required for this occupation are very various. Considered from a proper point of view, the individual ought to have an extensive theoretical knowledge of general chemistry, and the kind of work with which he is immediately concerned, as of the nature of the effect and the composition of colours. He ought to have confirmed his knowledge by long practice, and have constructed from his experience a safe and regular system according to which his work should be conducted. But such a colourist would be a phenomenon; at least no such person has made his appearance in our country. Our colourists are for the most part ignorant machines who trust to good luck without knowing why; besides that, they are detestable mountebanks who strive to hide their ignorance under the cover of a jargon of receipts which they do not understand, and with which they are perpetually putting their employers into danger and expense. Numbers of these knaves spend their lives in going from one works to another trying to gain the confidence of their employers, to whom they promise wonders, which for a time satisfies them, during which they profit all they can; and when they see that confidence in their ability is declining they change their place to figure elsewhere. As the

proper regulations of a works are simple enough it is not difficult for them to learn something, but they always want to correct and change until at the last they cannot do the simplest thing with certaintity. They are insane enough to think that the more drugs they can put into a colour the better it will be. The manufacturer who is governed by them walks like a blind man.

This is not the place to give the theory of colours, which belongs to another part. We shall only speak of the duties of a colourist working under a master more enlightened than he is, and who only expects from him that he is able and will carry out punctually the orders which he receives.

I would require of such a man that he should be able to read and write well, that he should be docile, not self-opiniated, industrious, and possess sufficient intelligence to understand the reasons which may be given to him. This granted, such a man would know that he should set about his work in a regular manner, so that one might be sure of obtaining results which had been found good. He should never vary in his methods, give scrupulous attention that there should be no difference in the weights, measures, and quality of the ingredients he uses; keep accurate notes of the way in which each colour was made, and never change without distinct orders; note down exactly the results of trials he has made; be attentive to the changes which he may notice when a newly received drug has been employed, so that he may know whether it is good or not; nor neglect any of the operations prescribed to save himself trouble; in a word he ought to take a pride in being exact and attentive.

Generally considerable quantities of colour are made at once; it ought not to be printed without trial. The effects of different seasons should be attentively watched; very hot and very cold weather sometimes produce considerable changes in colours. Although the colourist may not be well versed in the sciences which have relation to colours, he can by force of experience make useful observations, for instance, upon the quality of the different drugs; gums, galls, starch, and other materials vary in their quality and require changes in the receipts. In some cases the variations can be detected by simple inspection, in others the results of trials will show what they are. Account should be taken of all these things, and all the remarks noted.

A valuable quality in a colourist, and with which I will finish this article, is that he should be truthful, and not strive to excuse or to deny mistakes which he may have made, or to lay the blame upon somebody else, for by this reprehensible conduct he misleads the manager in his efforts to correct bad results. When the manager finds something wrong in the prints he is anxious to discover how it has happened; he questions the workmen, especially the colour mixer and the dyer, and it is generally found that the fault lies with one or other of these two; but if each lays it upon the other the manager does not know how to act, and may lose time and do injury by working in the wrong direction. Instead of that, if a fault has been committed (which might happen with all care), or if a colour is known to be wrong, and the reason not known, the colourist ought to say so, that the cause may be ascertained. The colourist cannot be too strongly impressed with this. I know by experience that nearly all are accustomed to offend in this particular. If a colour is not right they throw it away and try another, and perhaps throw that away also without saying a word, although probably the error could be corrected at once. It is evident that most of the spoiled pieces which come up, sometimes one after another, are owing to the want of honesty in these people. They must be looked after as much as possible, which is the best way of preventing them deceiving us. The proverb is here very true, "*The farmer's eye makes the fields fertile.*" *

In the same style and even in greater detail the author treats of all the departments of a printworks, and as some useful data of an historical nature can be obtained from his pages, we shall briefly note what is most interesting.

In the section upon the choice of cloth for printing, we find that linen cloths were only printed in England; calico imported from India was in use for printing, and it was better than that made in Europe. The principal supply of home made grey calico was from Toggenbourg. At first Cyprian cotton was used, from which an even and well twisted yarn could be spun, but that kind of cotton became scarce, and cotton from Salonica Macedonia, and Smyrna had to be employed, which being shorter in the staple gave an inferior cloth with a velvety

* "L'œil du maître engraisse les champs."

surface, which did not take colours so well as the Indian calico. The Indian cloth came white, but strongly sized with rice; this had to be removed by hot water. The bleaching of the home made calico consisted in several boilings with alkalies and crofting on grass, generally three boilings, three times crofting, and washing after each process. Lime and some kinds of ashes are to be absolutely forbidden in bleaching as being contrary to all colours; souring was practised by some printers, but was held to be dangerous and not always useful.

In the section upon designs, speaking upon the size of the patterns, the author says they should be large enough, so that they should not repeat too often in a small length of cloth. This is admitted to be expensive, but it is for excellence. "The beautiful English prints are all of four or six blocks, that "is, the complete design is composed of six parts which fit "together, so that six blocks compose a single pattern, and the "repetition begins only at the end of six blocks, instead of "each block containing the whole design as in common "prints."

The section on block cutting gives details for the making and cutting of blocks, which are made with pear tree wood. The use of pieces of old hat (felt) to fill up spaces is described, and for fine points and lines the use of copper wire in the block is explained. For entering the colour called English blue (pencil blue) the block is to be cut twice as deep as for other colours, because this colour prints thick and easily chokes up the block.

The instructions to the block printer and his tearer are also minute and practical; careless printers are reproved for thinning down their colours with water instead of sending to the colour mixer for proper liquid, and also for putting wet cloths on the sieve to prevent it drying up in the night, the water gets on the sieve cloth, and the first calico printed is pale and uneven on that account. Of course, our author can only speak of hand printing, nothing else then existing.

In speaking of dyeing and clearing, it is said the colourist and the printer give the soul of the print, it is the dyer who covers it with a body, and the clearer makes the ground white

to shew off one and the other. Printing is only a preparation for dyeing. The next process is to remove all the ingredients which have been used to thicken the mordants, so as to remove everything but the pure salts which compose the real mordants. This is done by frequent washings and beatings, and no pains must be spared to have the cloth clean. The evil effects of a badly cleansed cloth going into the dye are clearly and correctly described. It might be thought, it is said, that too much washing would remove the mordanting salts from the cloth, but it is not so, they adhere by their angles to the surface and cannot be removed. It should be noticed that the use of cow dung and hot water is not mentioned in the process previous to dyeing. There is nothing peculiar in the dyeing process; the clearing of the white grounds is effected by exposing the goods on grass in a moist state; if the whites are bad the pieces are taken up after six or eight days and passed in hot water mixed with *cow dung* or *bran*, and after being washed again laid down upon grass. It is said that sunshine acting upon dry cloth is very injurious to colours, and that the dew is efficacious in bleaching the white parts. There is no mention of the use of soap in the clearing operations.

In block printing the sieve is floated upon a mucilage made of cherry or plum tree gum; the sieve itself is a square frame 2 or 3 inches deep, over which is stretched fine cloth, which on the underside is covered with waxed cloth to make it water tight. For printing English blue no sieve was employed, but the colour put into the box, and a piece of fine canvas stretched over the sieve frame instead of cloth, the sieve being kept at a proper height by cords, the colour rose through the canvas and so furnished the block.

The finished prints were glazed by rubbing them with glass, enamel, or perhaps polished flint, by means of rude contrivances, such as are to be found at the present day in use by small job dyers.

In speaking of the duties of the proprietor or manager of the printworks and upon the question of the purchase of goods for printing, it is recommended to avoid linen or mixtures containing linen, because linen does not take colours so

well as cotton, nor are the colours as fast, while the whites are more difficult to clear. The Indian made calicoes are better for receiving colours than the Swiss made cottons, which themselves vary according to the origin of the raw material. In order to maintain a name for good quality of the native calico the magistrates of Berne ordered that every piece that was for sale should be looked over by a sworn examiner, who, if satisfied of its quality and measurement, stamped it with the city arms; if the piece was not satisfactory it was ordered to be cut up into short lengths. It appears that good results were anticipated from this inspection, but the author laments that it was a failure, the printers received stamped pieces which were bad in quality and short in measure. The Indian calicoes were sold by the East Indian Companies by auction, in just the same way that indigo and other imported goods are sold at the present day. Of three great companies trading to the Indies the French imported the best and finest calicoes, the English medium qualities, and the Dutch the lower class. The manager is instructed upon the theory of mordanting as follows:—

"The mordant is a composition of salts fitted for dyeing, and which makes those places of the cloth on which it is applied capable of receiving and retaining the colours desired. Nothing is more deserving of the thoughts of the calico printer than the theory of mordants, and nothing is more difficult than to give reliable information. What can be said is connected with the knowledge of salts and of their form and figure. If various salts be dissolved in water, and a drop of the solution put on a piece of glass under the lens of a microscope, the water evaporates, the salts crystallise and take regular shapes. Each salt has its own crystalline form, thus common salt gives cubes, alum gives prisms, and so of others. It follows from this that the various salts which are used as mordants insinuate themselves into the vacant places in the threads of the cloth, crystallise there, and form there spaces of their own shape and form, and so make places of a proper form for the colouring matters introduced in dyeing, by which the colouring particles find themselves fitted into cavities exactly of their own shape; they remain fast there and do

not move in the interior of the fibre, and it is this which causes colours to be fast. On the contrary, those parts of the thread which have not been touched by the mordant do not let the colouring particles penetrate, they remain upon the surface and can be easily detached by washing. . . . But it may be objected that the salts are soluble in water, how then can the mordanted parts of the calico retain the mordant when the pieces are steeped and washed in water which dissolves the salts and must consequently destroy the mordants? The answer is that the salts act upon the piece at the moment that the printed mordant becomes dry. For this reason the mordants must be dried as quickly as possible, but at a moderate heat. It is the instant when the water evaporates that the salt in crystallizing fills with its shape and form the pores of the thread; the washing afterwards dissolves the saline crystals and leaves the place they occupied empty. The colouring particles then find an empty place of the right shape for them, which they seize upon and lodge in. This shews why the mordant has no effect if it has not been well dried, for the crystallization not being accomplished the pores cannot be moulded into a proper shape to receive the colouring particles. The salts alone form the mordant, and upon their choice depends the colour which has to be given. This choice is in connection with the different forms of their crystals, as has been said before."

This curious theory, which is somewhat inconsistent with previous expressions of the author, seems to have quite satisfied M. Rhyiner, for he refers to it several times in the course of his treatise as explaining and justifying the necessity of various processes in printing and dyeing; objections to it, other than the one he himself proposes and answers above, do not seem to have occurred to him. It would be interesting to know how he would have explained the fact of the colouring particles of madder, for example, giving in different shaped cavities colours so different, as black, pink, red, purple, and chocolate. As an illustration we give his remarks upon washing before dyeing, for no one understood better than this old writer the importance of the goods going well cleansed into the dye, nor the effects and causes of bad work from ill washed mordants:

"When the mordants have been well dried there is nothing more to

fear. They may be washed and beaten in water to any extent. It is always beneficial to repeat the washings several times; the washing only cleanses the piece from the impurities which come from the thickenings, but it never destroys the effects caused by the crystallizations, on the contrary, the pores keep their shape, and the more perfectly they are freed from foreign matters the better adapted they are to receive the colouring matters which the dyeing introduces into the cloth."

After giving the manager a number of technical hints, the writer passes on to his general duties as director of workmen. In the course of these remarks we get some insight into the interior economy of the printworks of a hundred years ago. At the particular works of which he writes they never worked by artificial light, and it was important to make the most out of the short days in winter. The general hours of working were from six o'clock in the morning until half-past eleven, when there was an hour for dinner. There was another hour for a meal between three and four in the afternoon, and work ceased at eight in the evening, thus giving twelve working hours per day. In winter, work commenced as soon as there was light enough to see, there was an hour for dinner, and then no other rest until darkness put a stop to labour. The manager is told that he ought to be present at each arrival and departure of the workmen, to see that no one comes late or goes away too soon, and that all are punctually at their work; he ought to note those who are absent, and frequently make the round of the works to animate the operatives to industry and care. He must not permit any disorder on the works, nor allow visitors from outside to come and distract the workmen by talking about their personal affairs, and forbid any eating in the hours of work. The manager should be thoroughly acquainted with the capacity of his men, so as to give to each one the work which he can best accomplish. He must have an eye to the discontented, and see that they do not corrupt the others and incite them to opposition against the rules of the works. The expulsion of such persons often prevents much harm, and saves the master from dictation at the hands of his men. For this it is best to choose the winter

time when work is not pressing, and in order to do this the engagements with the men should be made so as to run out at the back of the season, and give an opportunity of getting rid of the unwilling. In proportion as the manager is strict with bad workmen, so should he be mild and moderate with those of good character. He ought to aid them with his advice, protect them against the rebellious, and hold them out as an example to the rest, distinguish them by the respect which their good conduct deserves, so that the others may be induced to follow their example. The manager should further preserve his dignity before his men, cause himself to be respected, to be loved, and to be feared at the same time. This is not easy, but it is possible; an irreproachable behaviour, mildness and firmness employed in proper time and place, with a little care, will bring these feelings about.

This, and much more of a similar nature, is to be found in the pages of M. Rhyiner; but it is time to go more into the technical character of the operations carried out, and we commence by abstracting a list of the drugs known to and employed by the writer, with such brief comments as he made. They are arranged in alphabetical order in the French and we have followed the original:—

Alum.—Of this drug there are four sorts, viz., Roman, Levant, English, and French. It is the mordant for all red colours; other salts are used along with it, but without the alum they would be useless. Roman or Roche alum, which has a reddish colour, was formerly thought the best, it being believed that its redness helped the dye, but that has been proved erroneous.

Adragant or *Tragacanth.*—This appears in several receipts as a thickening matter, but it is not much used because it is difficult to dissolve, and dear.

Agate.—This stone is used to glaze prints, but it is not so good as glass.

Algaric.—A sort of galls obtained from Smyrna, said to be used as common galls, but I do not know how it is used.

Alkanet (alcama).—This drug is used in Egypt for dyeing red, but I am not acquainted with it.

Algatrane.—A sort of pitch or resin which I do not know, perhaps the same as that called Japan resin.

Alkermes or *Kermes.*—A red colouring grain. It grows near Montpelier; it is used along with cochineal.

Starch.—Made from wheat. About twenty years ago gum became so dear that we were compelled to look for some substitute for thickening colours; we found starch to answer very well, and other manufacturers followed our example. But gum gives the best results.

Ammoniac-sal.—Made by burning camels' dung and collecting the fumes. It comes from India and Egypt. It is employed in some of our red mordants, but it could be easily dispensed with.

Antimony.—The crude mineral is used in mordants, but I do not find it any good.

Arabic.—The name of a gum, same as *Senegal* gum.

Arsenic.—There are three kinds, white, yellow, and red. The imaginations of our colourists make it play an important part in our receipts for red mordants. I have proved that it is not of the slightest use, and that it makes these mordants dangerous for the young tearers.

Dyewoods.—These are various kinds of red wood; Sapan, Brazil, Fernambouc, Bimas, Caliatour, also logwood and fustic. All these woods come from the Indies and are purchased in Holland.

Barbary.—Name of a gum from the country so called. It is of a low quality and only used for want of better.

Cendres gravellées.—This is a sort of potash made by burning lees of wine.

Caragne.—American gum. (?)

Lime.—Used for indigo dyeing.

Chaie.—A plant which grows in Golconda. Its root is the madder of those countries and is used for dyeing.

Wax.—This substance is used in finishing. It helps in glazing the prints with glass.

Cochineal.—A Mexican insect. There are three sorts. The common, the mestique, (?) and the sylvester or wild. It serves for the finest red colours in dyeing wool, silk, or cotton.

Chalk.—Chalk is used in the works for red mordants, where it produces a certain swelling and effervescence in the alum and other

drugs, and serves to work them up and mix them. Soda acts nearly in the same way, but we have found chalk works quicker and better.

Cream of Tartar.—This drug is used in mordants but it is not essential. It is thought to give a dark red with alum mordants, but it is one of the drugs which could be dispensed with.

Curcuma or *Turmeric.*—With alum gives a loose yellow colour. No proper solvent is known for it.

Nitric Acid.—This acid is employed in some of our loose colours in order to give them a little fastness. It is generally mixed with water. For loose reds made with red wood it is used with a little tin to raise the colour. For blacks it is used with iron. For yellows it is used alone.

Attention may be drawn at this point to the obscurity which frequently hangs over old receipts, arising sometimes from want of knowledge, and sometimes from want of candour. In the paragraph above the unwary reader might suppose it was nitric acid which fastened or heightened the colour given, while in reality it is the tin and iron which are the effective agents. So it is in many old receipts, especially in those for red mordants, in which arsenic is used. Its presence seems useless, but now and then it is incidentally mentioned as not important that the arsenic should be dissolved previously in soda, then we know that it is the soda and not the arsenic which is the active ingredient.

Tin.—The best tin comes from England. We use it as just stated for imitation reds.

Iron.—This in its rusted state is used for making black mordant. Old horse shoes are the best for this purpose.

Galls.—A most indispensable drug for us. The Aleppo galls are the best; formerly they were used for all reds in printing, at present we only use galls for common prints.

Madder.—Mention is made of seven sorts of madder, but the Zealand or Dutch is the best; the madder of German and French growth is inferior. The best method of dyeing reds with madder is to have a strong bath of it, so that the red appears quite brown when it comes out of the dye, then by the action of the dew and the sun the white grounds can be completely bleached white, and the red is

brightened; but if a weak madder bath is used the red is destroyed by the grassing before the brownish part is bleached out.

The dressed madder *(robée)* has had a part of the epidermis removed because it is believed to be injurious in dyeing, but it does not appear that is always the best, for in taking off the skin a good deal of the colouring matter is lost. The undressed madder is not half the price of dressed, which is not strong in proportion. I should advise the use of a good quality of undressed madder, and to make the dye baths strong.

Gums.—The gums in use are Senegal, Arabic, Tragacanth, and Barbary for thickening mordants. The native fruit tree gum is used to place under the sieves for swimmings.

Grains or *Berries.*—These come from Avignon, and grow also in Languedoc and Provence. Used for yellow.

Indigo.—This is received by way of Nantes or Rochelle. The way in which it is used is described further on.

Kermes.—An insect like cochineal, which lives upon the green oak on the Mediterranean coast. It is used for red colours, but is not so good as cochineal.

Orpiment.—This is used for making the English blue (pencil blue). It is brought from Venice or Amsterdam.

Archil.—This is from the Canaries, from Holland, and from France. It is composed of plants, lime, and urine. It gives a loose red, but we do not use it.

Pastel or Woad.—This is used in dyeing blue. It is a plant which grows in Languedoc. We do not use it.

Pipeclay.—We use pipeclay for composing resists in blue dyeing.

Realgar.—This is a variety of orpiment called also red arsenic. We sometimes use it in red mordants.

Annatto.—A drug from Cayenne which serves to dye a loose red.

Safflower.—The best comes from Turkey. It is used for dyeing pink.

Saltpetre.—This drug is used in black and purple mordants.

Soap.—There is white soap and mottled soap. It is a composition of oil, ashes, and lime. It is very little used in our manufactures. It serves to rub the red stains on prints which will not bleach out upon the grass without this assistance.

Bran.—This serves to clear and bleach the prints by means of passing in it.

Soda.—This is a salt extracted from a plant called *soude* or *kaly*. We get it from Alicante. We use it in the composition of red mordants, but for some time back we have substituted chalk, which has the same effect.

Sulphur.—We do not use this mineral, but there are some manufacturers who use milk of sulphur in their red mordants.

Soot or *Lamp Black.*—It is used to sighten or colour the mordants, so that the printer can see his work.

A Fast Colour (bon teint).—Is a colour which is so dyed as to resist the actions of water and air.

A Loose Colour (petit or *faux teint).*—Is a bright colour which soon loses its brightness.

M. Hellot explains these colours as follows:—In a fast colour the pores of the fibre are dilated in order to admit the colouring particles, and they are retained. In loose colours the colouring particles are deposited upon the surface of the fibres only, or the pores have not been opened sufficiently to admit them completely.

After this catalogue of drugs, which it will soon be found is incomplete in many particulars, the writer proceeds to treat of the processes of printing, and first of mordant for red. Again he says that alum is the base of the red mordant, arsenic and other drugs are added, but they have very little action, and are more used from custom than from necessity. Soda or chalk alone are of any use because they have an elastic power which causes the mordants to boil and agitate the salts, so that they become thoroughly incorporated with one another, and mixed with the water. That the use of cow dung for cleansing the mordanted cloth was not practised we have additional evidence, as also of the writer's knowledge of the injurious effects of mordanted cloth going into the dye without the thickening being completely washed out. With gum thickenings it is possible to dissolve out the thickening matter, but with starch thickenings very difficult, and frequently the thickenings of the last sort are only finally detached in the hot dye liquor, where they produce bad results. Gum colours

are sightened with lamp black, and the disappearance of this colour in the washings before dyeing is a sign that the washing is sufficient, but if starch colours be sightened with lamp black it never washes completely out, and is said to injure the red colour, hence starched reds were sightened with decoction of red woods. The following passage is worth inserting in full:—

"The drugs which enter into the composition of mordants, except alum, are useless or of very little importance; trial has proved the fact. The mixture of different drugs is a deception of *vagabond colourists*, each one of whom, in order to make himself conspicuous, has devised some drug to add to his receipts to make them differ from others. The credulous manufacturer, seeing such a receipt containing one or more new drugs, purchases it without afterwards finding it any better than the one he had before. Some of these drugs do, however, make a small difference:—

(1.) *Alum* alone makes the red mordant; and the greater or less quantity of water gives the shades. The more water the lighter the red.

(2.) A little *calcined copperas* (calcined until it becomes of a brick-red colour) makes the colour browner, but a small excess causes the mordant to run.

(3.) *Sal gem* (rock salt) and *salt of saturn* (sugar of lead) produce slight differences in the shade.

(4.) *Red*, *Yellow*, or *White Arsenic* are simply superfluous.

(5.) *Alicant Soda*, or *Chalk*, or even calcined wine-lees are required to work the colour, for these drugs cause a strong and necessary fermentation, the usefulness of which is known.

* * * * *

(8.) When thickening with starch, more alum ought to be taken, because it is necessary to boil the colour, which causes a good part of the alum to be volatalized and to be lost in fumes." (!)

Here we find rock salt and sugar of lead classed together and as being of small importance in their admixture with alum. It is as well now to pass over a few pages and give the receipts for red mordants used in the Rhyiners' printworks.

M. Dollfus-Ausset notes that he has only extracted those receipts from the manuscripts which bear a date.

Red Mordant in the year 1738.

Water	9/10 gallon.
Brazil wood	½ lb.
Red or Roman alum	1½ „
Soda	½ „
White arsenic	¼ „
Yellow arsenic	⅛ „

Make a decoction of the Brazil wood, pour the hot liquid upon the drugs, and thicken with gum.

The above mordant is the type of the mordants which seem to be referred to by the writer, the only useful elements here being the alum and soda. It is evident that the above mordant would be a bad and irregular mordant, a considerable portion of alumina would fix on cotton from such a composition, but it could not be depended upon, even with the most careful management. The following receipt is quite different:—

Red Mordant in the year 1754.

Decoction of Brazil wood	4½ gallons.
*Red or Roman alum	7½ lb.
*Acetate of lead	2½ „
*Yellow arsenic	⅛ „
*White arsenic	⅛ „
*Red arsenic	⅛ „
*Orpiment	⅛ „
Rock salt	¼ „
Potashes	1¼ „
Saltpetre	¼ „
Vinegar	2½ pints.
Soda	1 lb.

Put the drugs marked * into a wooden tub, and pour upon them one-half part of the decoction of Brazil wood made hot, and dissolve the rock salt in the other half. Mix the liquids, put upon the fire, and add the potashes and the saltpetre. Dissolve the soda in the vinegar, and add to the rest. Stir the whole together for two hours and thicken with starch. This is our regular red mordant.

This complex receipt, though containing a number of useless and perhaps hurtful ingredients, has in it everything necessary to make a good mordant for block printing; but it is with surprise after the reiterated observations of M. Rhyiner upon the theory of the red mordant, that we find in this receipt so large a quantity of acetate of lead and acetate of soda, ingredients apparently despised by him as worthless, but which are actually the soul of the colour, the body being the alum. It seems clear that a hundred years ago, as perhaps at the present day, the practice of calico printing was superior to the theory, for while his hypothetical red mordant made with alum and chalk alone could never by any possibility give good or regular results, the above-quoted seemingly heterogenous mixture, probably supplied by one of the "detestable mountebanks" or "vagabond colourists" he is so hard upon, would form a really reliable and fairly good mordant. The proportion of acetate of lead, being only one-third of the alum, is too small, but it would be assisted by the acetate of soda formed by mixing the vinegar and soda and the excess of acid neutralized by the potashes. Not knowing the strength of either the soda, the potash, or the vinegar, we can only conjecture the ultimate result; but it seems probable that there was too much alkali, and that some alumina would be precipitated which would go for nothing in the dyeing, except, perhaps, to come off in the warm liquors and do some injury. As dyed goods were not at this time subjected to soaping it is probable that such a mordant, containing alumina equivalent to about 1½ lb. of alum per gallon of colour, would yield a tolerably dark red. From the following receipt, dated twenty years later, we find that there is no improvement in the making of the red mordant:—

Dark Red (for Two Reds), 1774.

Decoction of red wood	3 gallons.
*White Liege alum	8¼ lb.
*Acetate of lead.....	2 „
*Orpiment	10 oz.
*Salammoniac	13 „
*Corrosive sublimate	1 „

*White chalk	2 oz.
*White arsenic	8 ,,
*Saltpetre	6 ,,
Verdigris	4 ,,
Vinegar	½ gallon.
Potash	10 oz.
Soda	10 ,,
Spirits of wine	4 ,,

Pour the decoction of red wood in a boiling state upon the drugs marked * and stir well. Dissolve the verdigris in the vinegar made hot, mix the two liquids, and add the potash and soda. Then thicken with starch.

Under the same date we find a receipt for dark red of a much superior character in principle, it is as follows:—

Dark Red, 1774.

Decoction of red wood	¾ gallon.
Alum	1 lb.
Acetate of lead	6 oz.
Potash	3 ,,
Soda	2 ,,

Thicken with starch.

This is very different from the preceding receipt of the same year, and it can only be said that the proportions of the solid drugs to one another and the absence of useless compounds, would seem to indicate a sudden change derived from some exterior source. M. Dollfus-Ausset says in a foot note to this receipt, that in August, 1774, they commenced making acetate of alumina from alum and acetate of lead without adding any other drugs.

In the history of the red mordant it is clear that we must look to some other source than M. Rhyiner to discover when, or by whom the use of acetate of lead was introduced; he evidently looks upon it as no more important than common salt or saltpetre, and seems to have used it under a sort of protest, for nowhere does he retract his often expressed statement that alum and chalk alone are sufficient for the mordant; so greatly

may an acute manufacturer be mislead by prejudice or false hypothesis.

In speaking of the various qualities of madder he gives the preference to Dutch; the Alsatian madder, which had been cultivated for a long time under the name of "*rouge de Haguenau*," he says is worth nothing to us, and he is astonished that the English have not succeeded in the cultivation of the root. It is stated that the works obtained green madder in Switzerland (that is undried) and found it to give very good results, 6 lb. of it being equal to 4 lb. of dry madder.

The use of a sour liquor made from fermented bran water is given as very useful to treat white calico as received from the bleacher previous to printing, and also as an assistant in clearing the whites of dyed work; the use of this sour liquor dates from 1766.

A print containing a ten-coloured design was executed as follows:—The colours being black, three reds, two purples, two blues, green, and yellow. The piece being calendered was first printed with mordant for black, and then with the first red and dried; the second red was then printed and the piece dried; then followed the third red, and after that the two purples; the cloth being perfectly dried after each printing. The cloth was then dyed in madder, grassed for three days with passages in cow dung and bran until the whites were good. After that the first blue was printed, the piece dried and washed off; next the second blue was printed, dried, and washed off; and lastly the yellow was printed, which, falling in places on the blue, produced green.

Methods of dyeing loose ground colours after printing are given, the colours being protected by the following composition:—

Resist Paste for Cold Dyeing, 1766.

Water	1½ gallons.
Best Starch	2 lb.
Gum	2 oz.
Tallow or suet	8 „
White wax	3 lb.
Pipeclay	2 „

The colours dyed are yellow, from *Gelbkraut* (weld ?), boiled up with verdigris and a little potash and cooled. Green, by adding to the yellow some decoction of logwood or red wood. Pearl and grey, by mixtures of verdigris and copperas with red wood.

Dyeing with cochineal is given under date 1766, and a spirit red from peachwood, alum, and nitrate of tin, with a dozen other ingredients is found under date of 1765. Dyeing with safflower is minutely and clearly described under date 1762. The use of annatto dissolved in caustic potash for printing is detailed in 1772.

The black mordant for madder dyeing is made from vinegar and old iron. A spirit black made from logwood, galls, sulphate of copper, salammoniac, and nitrate of iron, thickened with starch, is dated 1738.

We pass now to blue dyeing, which seems at this establishment to have been only or chiefly employed for giving blue grounds to prints previously dyed in mader. There are two kinds of resists used; the first, which is the finest, is used to cover pieces which must have fine whites upon a blue ground. This style is called porcelain. The other composition serves to cover the flowers and sprigs to preserve them from the blue; it must not contain any materials which will act upon madder reds or purples. In English the first is a common resist for dip blue, and the second is a neutral or mild resist. We give both these resists, the receipts for which bear the date of 1738.

Resist for Dip Blue, 1738.

Water	12 gallons.
Tallow or suet	2½ lb.
Starch	10 lb.
Pipeclay	20 ,,
White alum	10 ,,
Sulphate of copper	5 ,,
Oil of turpentine	1¼ lb.

Mild Paste for Dip Blue, 1738.

Water	12 gallons.
Gum	20 lb.

Glue	10 lb.
Bolus	20 „
Tallow or suet	1½ „
Turpentine	3¾ „
Starch	15 „
Rosin	2½ „

The method of dyeing in the vats is given in detail, and a description of the circular or polygonal dipping frame is also found, but it appears that for the styles then worked the hooking on a frame was not found necessary, the pieces were simply passed through the vat by hand, drained, and washed in the river. The blue vat used in 1738 was the hot vat, made with madder, potashes, bran, and indigo, but it was given up in favour of the indigo and copperas vat, which was found more regular, required less skill in the management, and which was worked cold. The following are given as the approximative quantities of materials for such a vat.

Cold Indigo Vat, 1766.

Water	450 gallons.
Indigo	225 lb.
Green copperas	675 „
Quick lime	675 „
Soda	20 „
Bran	50 „

It is remarked that this is a very strong vat and serves to dye the darkest blues. There would seem, however, to be some mistake, for such a vat would be too thick to work with.

Receipts are given for the composition of orpiment blue, known at that time in Switzerland as English blue, and generally known in England under the name of pencil blue.

Pencil Blue, 1746.

Water	18 gallons.
Potash	35 lb.
Quick lime	15 „
Indigo	12½ „
Gum	60 „
Orpiment	12½ „

Make a caustic ley with the water, potash, and quick lime, and let it clear; grind the indigo in the clear liquor, heat the whole, and dissolve the orpiment hot, and thicken with the gum. The sieve for this colour is not made with cloth, but with sheep skin. The pieces after printing are not washed in the river, but placed in a vat with very weak milk of lime, where they are left for some time. The blue becomes green, and then it is washed in running water.

To obtain a light shade of blue along with the dark blue, a sort of half resist is employed composed of fish glue, milk, water, vinegar, soap, gum, and starch; this is printed on where it is wished to have a light blue, and when dried the usual blue is printed upon it, by which means two shades of blue are obtained by one impression of one colour.

The manuscript concludes with calculations of costs of mordants, colours, and workmanship, but the value of money and the methods of working have so much changed in a hundred years that no proper comparison can be instituted between those times and these, and we refrain from giving the statements.

If we were to take our date from the last receipt, 1746, and take into consideration the state of calico printing as it was in 1846, we are astonished to find what little difference a hundred years had made in the materials at the disposal of the printer, and what little change in the methods of applying them, apart from purely mechanical improvements. But that cannot be said of the year 1876; for in the last twenty, nay, even in the last ten years we have seen a greater revolution in materials and methods than ever previously occurred since the first block printer finished his first piece.

*3. Researches upon the Relation of the different Colouring Matters of Madder to one another, and the part they take in Dyeing.**

BY M. A. ROSENSTIEHL.

SINCE the publication of the excellent researches of Messrs. Schützenberger and Schiffert upon the commercial purpurine extracted from Alsace madder by Kopp's process, it is admitted that the root contains four colouring principles, which are—(1) alizarine, (2) pseudo-purpurine, (3) purpurine, and (4) hydrated purpurine.

The part taken by these various matters in dyeing has not been well ascertained ; we do not know with certainty which of them are contained in Turkey red, or in the regular madder reds and pinks, which from their brightness and fastness are looked upon as types of permanent colours. M. Schützenberger, who is an authority in these matters, considers pure alizarine as the colouring principle, and states that the purpurine completely disappears in the soaping and finishing operations,† but this opinion has not been confirmed. In 1867, M. Camille Koechlin, a distinguished practical printer, remarked‡ that when alizarine has been sublimed or superheated in alcohol and water it is incapable of giving fine reds by dyeing with alumina mordants, but that it gives better purples than madder. According to M. Koechlin the high temperature (536°F.) to which it had been subjected had deprived it of one of its most valuable qualities—"the reds and pinks had no longer that *sui generis* carmine shade peculiar to madder colours ; the hues are deficient in yellow and tend towards the violet or claret shade;" and further on he remarks that if the sublimed body is still alizarine, the synthesis of this product, if it ever should be accomplished, would not

* Bull de la Soc. Ind. de Rouen, iii., p. 70.
† Traité des Matières Colorantes, ii., p. 120.
‡ Bull. de la Soc. Ch. de Paris, vii., p. 235.

yield in practice the results expected unless the complete colouring principle should be successfully reproduced.

He also remarks that the body which, owing to its association with alizarine, produces madder red, is not purpurine, for "it forms no part of our finished reds, since it cannot even resist the action of boiling soap." The remark of the able chemist of Mulhouse, relating to the part which alizarine takes in dyeing was confirmed in a complete manner when, at the conclusion of the discoveries of Messrs. Graebe and Liebermann, artificial alizarine was offered to the market, everybody could then discover that though this colouring matter produces beautiful violets it is inappropriate for the production of red. The state of this question cannot be better summed up than by citing the following quotation from the prize list of the Industrial Society of Mulhouse:—"Alizarine by itself does not produce madder colours, and especially the red. We require to know which is the colouring matter, or which are the colouring matters, in madder that are connected with alizarine in order to yield these colours." The care with which this article is phrased, and with which the mention of the immediate principle has been omitted, clearly points out the uncertainty concerning the part taken by the various colouring matters of madder in the practice of dyeing. This uncertainty arises from the insufficiency of our methods, which neither allow the identification of these colouring matters nor their separation when they are once fixed on the cloth. In the present state of science, methods of analysis are inapplicable to madder reds. I have had to content myself by treating the point at issue in a synthetical manner by obtaining each of the colouring matters in a state of purity, and by numerous experiments in dyeing, ascertaining which of those matters produce this beautiful colour. During the preparation of these differing matters I ascertained that some of them underwent interesting changes, the study of which threw some light on the relations they bear one to another, and it is the sum of these observations, made both in a purely scientific view, as well as applied to the manufacture of printed cloths, which forms the subject of this article.

To be certain of the purity of the immediate principles which I employed in my researches I made use of the very delicate method, which enabled me to obtain isomeric rosanilines in a pure state, and which is applicable to all colouring matters. It consists in making comparative experiments in dyeing with consecutive mother liquors obtained in the crystallization of the colouring matter. These crystallizations were repeated until the substance no longer shewed any variation in its colouring properties.

The slightest impurities are detected by the difference in the shades, so are also the differences of solubility by the intensity of the colours produced.

To make my experiments comparable with each other, I adopted from the very outset an uniform method, which is much the same as that employed in a works for the testing of madders. I procured some cloth printed with stripes of iron and alumina mordants of various states of concentration. For a piece of material of an area of 2 square decimetres, I employed a ¼ of a litre of water and 0 gr. 060 of colouring matter (or an equal quantity of the mother liquor). A glass vessel (which may be a flask), containing the dye bath is heated in a water bath. To commence with, the temperature should be 86° F. and in two hours should rise to 194° F., and the latter temperature kept up for thirty minutes. After this operation the dyed specimens are thoroughly cleansed and washed in warm soap water at 2 gr. to a litre. A part of them are submitted immediately to the action of boiling water and soap for twenty minutes. The careful comparison of the shades of red, pink, and violet which are thus obtained, and the resistance which these colours offer to the action of boiling soap and water, allows us clearly to distinguish the different colouring matters, and to perceive with ease a mixture. It is owing to the use of this method strictly applied, that I have been able to ascertain the purity of the bodies I used, and which has prevented errors, and enabled me to acquire confidence in the results which I am about to detail.

(1.) On the Preparation of Pure Alizarine and its Dyeing Properties.—Before the discovery of the synthesis of alizarine,

alcoholic extracts of madder were employed for its manufacture, and later the green or yellow alizarine made from Alsace madder by the process of M. E. Kopp.

This last was formerly the purest matter from which this immediate principle could be extracted. The excellent results of our colleague, Mr. Schützenberger were obtained by this alizarine. Unfortunately it contains purpurine, which neither the processes recommended in standard works, nor sublimation and crystallization in alcohol, or super-heated alcoholized water have been able to eliminate.

The first person who, to my knowledge, has pointed out this error is Mr. Stenhouse *(Annalen de Chemie und Pharmacie, cxxx., p. 341, 1864).* In trying to prepare an amide by the action of ammonia on the colouring matter obtained from the green alizarine of M. E. Kopp, he discovered that this body adhered with obstinacy to the purpurine, which he found it impossible to remove. He remarks that his friend Mr. Stokes had made the same observation. After I had made some synthetical experiments, I found that "the yellow or green alizarine" acts in dyeing as a mixture of 70 per cent. of alizarine, and 30 per cent. of purpurine. With this fundamental error and with very imperfect means of separation, it is evident that all analyses and observations respecting the properties of alizarine which are to be found in the works of this period, refer to a mixture of alizarine and purpurine, and it is this which also explains the reason why the colouring matter extracted from Turkey red, or madder and reds, was considered as formed entirely by pure alizarine. Thus, as I have said before, the discovery of the synthesis of alizarine has enabled us to bring this latter body to a greater degree of purity, but as the manufactured product is always accompanied by a variable quantity of another colouring matter, since separated by M. Auerbach and Mr. Perkins, and which modifies the shades in dyeing, doubts have arisen on various sides as to the identity of artificial alizarine with the immediate principle of madder.

The latter in fact produces better reds than the former.

In the sublimation of the two products, and in their crystal-

lization in alcohol, changes of shades are visible, their differences grow less and less, tending towards a limit which is never reached. Alum mordants always assume brighter colours with the natural than with the artificial product; whereas iron mordants have just the contrary effects. The crystallization in super-heated water, recommended by M. Schützenberger, has scarcely enabled me to obtain the same shades with the two alizarines; but accident enabled me to discover a good method. In fact, after having heated to 400° F. natural alizarine with water in glass tubes for several hours, I obtained similar results in dyeing as with the derivative of anthracene. Yet, by making the same experiments in copper vessels, with the same degree of temperature and length of time as before, I was unable to arrive at any result at all. I had the idea of adding a little caustic soda to the alizarine in the metallic vessel, and then to heat it. The result of the experiment proved that I was in the right. In the first case the water had acted upon the glass of the tubes, which in fact was easy to see, for the liquid contained therein was of a violet tinge. The alizarine of madder then can be purified by heating it with alkalized water in copper tubes at 400° F. The duration of the contact must vary according to the purity of the matter which is used at the very outset. For commercial alizarine about seven hours is required. By this process the purpurine is destroyed much sooner than the alizarine. It causes the formation of brown matters, and a body dyeing cotton without a mordant, a dull but fast blue. Crystallizing it two or three times in alcohol purifies it.

It is easiest to obtain a definite product by acting upon artificial alizarine of the purest possible kind. (The No. 1 quality, manufactured by Meister, Lucius, & Co., at Hoechst-sur-Mein, has given me good results). The impurities it contains are a little anthraquinone, oxyanthraquinone, and isopurpurine, which can be easily separated. This separation is effected by repeated crystallizations in alcohol. I always prefer to sublime the product beforehand, although this process only gives about 40 per cent. It is then easier to obtain beautiful crystals of alizarine by the processes which follow

the alcohol treatment. Pure alizarine, crystallized in alcohol, makes its appearance either under the form of fine yellow needles, or under the form of spangles, which, in colour, are more or less yellow in proportion to their thickness. But for the same dimensions these crystals are constantly less red in colour than those of alizarine prepared by the methods indicated in standard works. The elementary analysis of it has given figures which are a mark of its purity.

0 gr. 1645 of matter dried at 100° in vacuo give 0 gr. 4225 of carbonic acid and 0·050 of water, which makes in a hundred parts—

	Found.	*Calculated.*
C.	70·00	70·00
H.	3·38	3·33

If this analysis be compared with the older ones of Robiquet, Schunck, Debus, and Rochleder *(Gerhardt, Chimie Organ, t. iii., p. 502)*, it will be seen that there has always been found more hydrogen and less carbon, which indicates the presence of a certain quantity of purpurine in the matter which had been analysed. The same observation may be applied to those analyses made since 1864, as may be seen from the following table:—

	M. Schützenberger.		M. Strecker (1.)				MM. Graebe and Liebermann.	
	i.	ii.	i.	ii.	iii.	iv.	i.	ii.
C.	68·70	69·06	69·98	69·86	69·61	69·85	69·44	70·25
H.	3·48	3·52	3·64	3·61	3·53	3·46	3·53	3·43

The first analysis of M. Schützenberger is that of a product twice crystallized in water heated to 500° F.; No. 2 corresponds to an alizarine twice sublimed and crystallized in alcohol. These figures confirm what I said above; sublimation and crystallization in heated water are powerless for the separation of alizarine and purpurine. The analysis of Strecker, which gave him the formula $C_{14}H_8O_4$ since 1865, correspond better than the preceding ones to the result of calculation. The author does not mention by what process he purified the alizarine which he used in his analysis. The No. 2 of Messrs. Graebe and Liebermann has given better results,

It is true that it was obtained with artificial alizarine, and the rather high figures of carbon and hydrogen seem to prove the presence of a little anthraquinone. Pure alizarine diluted with distilled water does not saturate iron and alum mordants in dyeing. To effect saturation a little carbonate of calcium is required. As this salt is always but slightly soluble in water, it is better to dissolve it beforehand in water mixed with carbonic acid. I made all my dyeing experiments by using a solution of carbonate of calcium of 1 gramme per litre, which I added to the dye baths in various proportions to determine the quantity which produced the greatest result. Natural waters, containing bicarbonate of lime mixed with distilled water, might do quite as well as the solution which I employed, but the other saline substances which these waters generally contain are not without their effects on the shades obtained, and in experiments as the above, where it is required to be known with exactness what the purity of the substance is, I disapprove of their use. In water mixed with carbonate of calcium, the alizarine behaves in a peculiar manner. When exposed to the cold in an open vessel, the two substances slowly act on one another; if heated the action is much more rapid. The carbonic acid is partly displaced, there is formed a calcareous combination of alizarine, which gives the liquid a violet colour. The colour remains for several days, but if it is made to boil so as to displace the carbonic gas, the calcareous lake reunites in a very light violet precipitate, which gradually sinks to the bottom. This only dyes the mordant in an incomplete manner, unless a certain quantity of carbonic acid gas be added to the liquid, which rapidly decomposes this calcareous compound. This acid, which naturally exists in waters, obviously plays an important part in the dyeing process.

The maximum result is obtained with alizarine when there is one equivalent of calcium to one equivalent of colouring matter. All calcium which exceeds this limit causes a loss by the formation of an insoluble *bicalcic lake.*

Alum mordants with pure alizarine take a red of a far greater violet shade than with alizarine prepared by the ordinary methods, which, according to M. Camille Koechlin,

is itself not suitable for the production of a fine red. Compared with the chromo-lithographic circles of M. Chevreul, the shade which the alum assumes appears to be the 0 or 1 red violet one-tenth reduced. Iron mordants dye a shade of 1 violet blue one-tenth or two-tenths reduced. This particular shade of violet, which is often sought for, the resistance the colours offer to boiling soap and water, the manner it behaves in dyeing when in contact with pure water, are characteristic of alizarine and distinguish it from all other colouring matters of madder.

(2.) On Pseudo-Purpurine.—A portion of the pseudo-purpurine contained in the madder can be immediately extracted by washing it in water alkalized with a little carbonate of soda, then in pure water. The residue is allowed to digest in an aqueous solution of alum at a temperature not exceeding 60°. The solution of alum acquires a beautiful cherry-red colour, and acquires a fluorescent yellow reflection. When sulphuric acid is added to this solution, the colouring matter precipitates under the form of yellow flakes.

The *madder lake* which is known in commerce, and which is employed by printers for the production of a beautiful topical pink colour, fast in light and air, but which does not resist the action of soap and water, is for the most part a combination of alum and pseudo-purpurine, which sulphuric acid decomposes in the cold.

The *commercial purpurine* prepared by the process of M. E. Kopp, is the richest source of pseudo-purpurine. It was in this product that M. Schützenberger discovered it. To obtain it in a state of purity, the method recommended by this chemist should be pursued, which is based on the insolubility of pseudo-purpurine in boiling absolute alcohol, while other matters dissolve in it. The residue of this treatment, which constitutes about nine-tenths of the whole substance, still contains non-colouring substances, which are separated by dissolving in boiling benzine, when it settles under the form of crystalline powder. Of all the colouring matters of madder this is the easiest to obtain, but owing to its great instability precautions must be taken. With the greatest of ease it is changed into purpurine.

M. Schützenberger has remarked that sublimation as well as the action of the alcohol at 400° F., causes it to undergo this change. Experience has proved to me that alcohol is not necessary, for the same chemical action is visible when the pseudo-purpurine is heated with water to 400° F., or even without water. In every case a considerable portion of matter is lost. It is not always this change which the colouring matter undergoes at 400° F. which causes errors to arise; but what has given rise to mistakes, is the fact that this transformation can even take place below 212° F. and in the very midst of dissolvents which are regularly used along with madder. Having used boiling 90 per cent. alcohol instead of absolute alcohol to extract the raw purpurine, the whole substance was gradually dissolved, a thing which should not take place, pseudo-purpurine being insoluble or nearly so in this vehicle. One experiment in dyeing convinced me that all was changed into purpurine. I repeated the experiment with pseudo-purpurine previously treated with absolute alcohol. I was able to ascertain that at the temperature of 176° F., it was regularly changed into purpurine. But it is not only alcohol which has this property. An aqueous solution of alum acts in the same manner. At 140° F., it simply dissolves a portion of pseudo-purpurine, another portion forms with the alumina an insoluble lake, difficult to be decomposed by acids. If raised to ebullition, the dissolved portion is rapidly changed into purpurine; whereas the insoluble portion remains unchanged. By treating it with cold concentrated sulphuric acid the pseudo-purpurine is separated from it. I ascertained that a great number of bodies, such as dilute acetic and sulphuric acid, acetate of soda, &c., rapidly change the pseudo-purpurine, and I was uncertain as to what could be the final reducing agent to which this curious chemical action was due until I had succeeded in discovering it by the use of pure water. Three or four hours' boiling was sufficient. The action is slower if the product has been purified by crystallization in benzine than is the case where a raw material is used. In considering the formulas established by Messrs. Schützen-

berger and Schiffert, $C_{20}H_{12}O_9$ and $C_{20}H_{12}O_7$, which are at present written

$C_{14}H_8O_6$	and	$C_{14}H_8O_5$,
Pseudo-purpurine.		Purpurine.

it may be seen that a true reduction takes place, which cannot be conceived without admitting that it has taken place at the expense of a portion of the pseudo-purpurine which is found oxidized. The study of the products of this remarkable reaction will form the subject of a special paper. I only wish here to treat of the colouring matters which are the result. There is then found 1st, purpurine, the chief product; 2nd, hydrated purpurine in a small quantity; and 3rd, purpuro-xanthine in a still less quantity. Besides the three substances just mentioned, I observed the presence of a matter which dyed the alum mordant a bright and saturated yellow-orange, which distinguishes it from purpuro-xanthine which does not saturate mordants. The examination of this body is still unfinished; hitherto I have obtained it in such small quantities that I have found it impossible to make an elementary analysis of it.

The instability of the pseudo-purpurine, as appears from all that which has preceded, shews the impossibility of again meeting with it in madder which has been in contact with a warm and acid liquor. Thus the "flowers of madder" contains less of it than the madder from which it comes. Garancine and garanceux do not contain any of it. It is the same with the various extracts of commercial madder, with the exception of commercial purpurine prepared by the process of M. E. Kopp.

This process, which consists in exhausting the madder in the cold with water charged with sulphurous acid, is not likely to change the immediate principles in the same way as those which place the primary matters in contact with boiling dissolvents. However, it is possible that at the temperature of 140° F., to which the sulphurous liquid is submitted with the previous addition of some chlorhydric acid, a certain quantity of pseudo-purpurine might be reduced to purpurine and purpuro-xanthine. Whatever may be the case, I say with

emphasis that by boiling pseudo-purpurine with water the same colouring matters are obtained as Schützenberger and Schiffert discovered in commercial purpurine. There is no necessity then of stating that madder really contains glucosides corresponding to every colouring matter which has been found in it, since three of these substances are so easily formed at the expense of the pseudo-purpurine; it is more exact to say that these results take place as if the madder only originally contained two, namely, alizarine and pseudo-purpurine, the instability of the latter necessarily including the presence of others.

To dye with pseudo-purpurine dissolving in alcohol must be avoided, because it effects a change. It must be finely ground in tepid water, in which it readily dissolves.

Pseudo-purpurine only dyes mordants in distilled water. Alum mordant assumes similar colours to those which alizarine gives. It is the 0 or 1 red violet of the chromatic circles of M. Chevreul. Iron mordants on the contrary assume so different a violet colour from that of alizarine, that it is impossible to confound them. It is a violet-grey which I consider as being the 5 violet-blue, three-tenths or four-tenths reduced. These colours, as also those produced by the other red colouring matters of madder are distinguished by the fact that the soapings, far from heightening their brightness, rapidly destroy them.

In the presence of water containing bicarbonate of calcium, it also behaves in a quite characteristic manner. The action of the salt is clearly detrimental; its presence impoverishes the dye baths, and when the quantity of calcium becomes a monocalcic lake, all the pseudo-purpurine is found engaged in an insoluble calcareous combination, upon which carbonic acid has no effect and which does not dye at all. Owing to the facility with which this colouring matter forms insoluble combinations, its action in madder dyeing, such as is practised in the trade, is of no importance. And it is necessary that this should be the case, for the little solidity of its colours (proved by M. Schützenberger) can only be injurious in this operation. This is the case, for instance, when Alsatian madder is used,

which contains no carbonate of calcium. Nothing then prevents the fixing of the pseudo-purpurine, which takes place more or less easily, according to the calcareousness of the water in use. Under these circumstances the alizarine contained in the same madder dyes badly. The final issue results in a mixture of aluminous lakes of pseudo-purpurine, purpurine, and alizarine, where the first prevails which neither resists soap nor exposure on the grass. But if before dyeing care has been taken to add to the bath some chalk, the pseudo-purpurine is precipitated and will no longer dye; whereas under these conditions alizarine and purpurine are perfectly fixed. Thus good sound colours are obtained.

The comparative study of the properties of alizarine and pseudo-purpurine leads then to a rational explanation of a fact known for a long time (vide Schützenberger, *Traité des Matières Colorantes, ii., p. 172, and following)*, considered as important, but the explanation of it was unknown. What has preceded allows me to explain still more facts relating to madder dyeing. To be systematic we shall devote our attention to the residue which comes from the operation we have just discussed. The dyeing has been effected in the presence of chalk, whether it has been added to the substance, as in the case of Alsatian madder, or whether it is naturally contained, as in the madder of Avignon. The whole of the pseudo-purpurine is contained in the residue, with the addition of a certain amount of other colouring matters (alizarine and purpurine), accordingly as the chalk has been in excess or not. The presence of these colouring matters was for a long time overlooked, and they were lost.

This residue has only been utilized since 1843, in which year Mr. Leonard Schwartz discovered that by treating it with sulphuric acid colouring matters could be obtained from it. By this treatment the regenerated colouring matter is changed into purpurine, which predominates in these residues called garanceux, and which gives to the colours it produces this special shade of red which I shall soon describe, and which is little sought after.

Madder previously washed in boiling acidulated water is

also used in dyeing. Since 1828 this has been known under the name of garancine. By this transformation about 70 or 80 per cent. of colouring matter is gained; this is owing to the liberation of the pseudo-purpurine, which is immediately changed into purpurine, and which in dyeing produces shades equal in fastness to those which are produced by alizarine.

Such then are the deductions drawn from the study of the properties of pseudo-purpurine. If this latter is not directly useful in dyeing, it at any rate plays an important part by its easy transformation into purpurine.

The authors who have devoted their attention to the colouring matters of garancine have often confounded these two substances, and it is owing to this confusion (which can easily be imagined after what has just been said) that the erroneous notion of the part taken by purpurine in dyeing is to be attributed, which, according to the very competent authorities I have quoted, no longer forms part of madder reds when finished. This assertion can only be applied to pseudo-purpurine.

(3.) Purpurine and Hydrated Purpurine.—To obtain these two substances apart from alizarine, as a start I commenced with crude pseudo-purpurine exhausted with absolute alcohol. In causing this product to boil with distilled water or alcohol of 90° the transformation takes place. By washing it in water the purpuro-xanthine is obtained, and by the use of dilute alcohol the orange matter or hydrated purpurine of M. Schützenberger. The purpurine is made to re-crystallize from boiling 90 per cent. alcohol. The mother liquids always contain purpuro-xanthine, resulting from the partial destruction of the purpurine, but by washings in weak lukewarm alcohol this may be removed. We must recollect that by the sublimation of the pseudo-purpurine and hydrated purpurine, only purpurine is obtained.

Once sublimed it is easier to obain it in a crystallized state in alcohol.

Purpurine easily dyes mordants in distilled water. It enjoys this property in common with pseudo-purpurine. Alum mordants are dyed No. 4 violet red, pink colours (a weak alum

mordant), appear of a more violet shade than the red; they are a little brighter than those obtained by pseudo-purpurine under the same conditions. The violet is purer than from this latter substance, but not so good as that from alizarine. It is the No. 2 violet, three-tenths reduced. The shades which alum mordants take are not definite. The processes of soaping and clearing purify them without changing them, but boiling soap and water produces in them a remarkable change. They lose whatever violet shade they possessed. The red becomes true red (the o red of the chromatic tables), and assumes considerable brightness. The pink has a tendency to a clear orange-red. The violet on the contrary grows weaker and becomes duller.

This curious change, which I shall explain shortly, is also effected by the influence of boiling water alone, but the colours do not become so bright as with soap. Hydrated purpurine (the orange substance of M. Schützenberger) is difficult to obtain free from purpurine. It is formed at the same time as the latter by the action of boiling water on the pseudo-purpurine. I believe I had noticed its formation by the action of boiling acidulated water on a solution of purpurine and alum water or caustic soda, but I do not wish to be positive on this point. The properties of this body differ so little from those of the former that it is not worth while dwelling at length on them. The prolonged action of water or alcohol causes an alteration, and the result of this decomposition is still purpuro-xanthine.

As far as dyeing is concerned, hydrated purpurine behaves in the same manner as purpurine, with this difference, that the reds coming from the baths possess the pure shade which only appears on the cloth dyed in purpurine, after it has been boiled some time with water. Treating with soap and clearing only purify these colours without modifying them, so that mordants dyed in this orange matter, and soaped, produce the same shades as those dyed in purpurine and boiled in soap. It seems as if the aluminous lake of purpurine fixed the elements of water and changed into an aluminous combination of hydrated purpurine. The conclusion at least is the most

natural deduction from the various facts which I am about to detail.

Besides this difference of appearance which the mordanted cloth presents immediately after dyeing, the two colouring matters behave alike; and what I am going to say now applies just as well to one as to the other.

When to the distilled water which is used as the dye bath, increasing quantities of a solution of bicarbonte of calcium be added, it is clear that the results are not so greatly influenced as in the case of alizarine. Yet a maximum can be seen when there are equivalent quantities of salt of calcium and colouring matter. It may be remembered that under these conditions the alizarine also gives a maximum, even when pseudo-purpurine does not dye at all. Each colouring matter, then, of madder behaves in a different manner, purpurine saturating the mordants in distilled water, whereas alizarine does not saturate them at all. When the quantity of calcium is increased the dye bath becomes impoverished; and when there are three equivalents of salt to one of purpurine, the whole colouring matter is precipitated in the state of an insoluble lake. Carbonic acid acts very slightly on this lake, but it speedily decomposes that of alizarine.

In the cold, purpurine acts slowly on the calcareous carbonate dissolved in water. Heat accelerates this reaction, and the liquid assumes a pink colour. When left to settle, the calcic lake separates from it and it loses its colour. In this particular, then, purpurine behaves differently from alizarine, where the lake remains in suspension for several days, and colours the liquid a light violet. The purpurine colours support the operations of soaping and clearing as well as those of alizarine, but they do not so well withstand the direct action of the sun. The resistance which purpurine offers to soap and water has often caused it to be mistaken for alizarine, which, being obtained mixed with purpurine by those experimentalists who have worked upon the subject, giving in dyeing but slightly different shades, was mistaken for it.

(4.) Madder Colours.—Alizarine by itself yields beautiful violets with iron mordants. This fact is so universally admit-

ted that no further proof is requisite. But on the contrary it is not so generally well known that purpurine produces dull and reddish violets, and it remains for me to explain how, with madder and its commercial derivatives, which contain several colouring matters, beautiful violets can be obtained, that is to say, how the influence of purpurine is neutralized, prevented from fixing, or, if fixed, how its own lakes are destroyed.

The more free purpurine an extract of madder contains the less it is fitted for the production of purples; such as garancine, which in this respect is greatly inferior to flowers of madder, from which it comes; for the latter still contains in the state of an insoluble lake, pseudo-purpurine, which in the former is changed into free purpurine. In practice preference is therefore given to the flowers for dyeing purples. In the preparation of the flowers of madder intended for dyeing purples, care has been taken not to saturate the carbonate of calcium which is naturally contained in it; during the process of dyeing some is added to the baths. From the results which I obtained in commenting upon the action of this salt on purpurine, it will be seen that by that means the purpurine is precipitated in the state of a lake. This lake only participates very slightly in dyeing, the carbonic acid which is in solution in the bath, acting upon it in an incomplete manner; whereas the lake from the alizarine only forms slowly, the presence of carbonic acid impeding its precipitation. I have proved this fact by numerous experiments.

When in a dye bath containing the two colouring matters, carbonate of calcium is added in increasing quantity, a point is reached when the greater part of the purpurine is precipitated, although the alizarine remains free and performs the dyeing. So true is this, that with a mixture of small quantity of alizarine, and a large quantity of purpurine, such as garancine, a violet colour can be dyed and produced by previously determining that quantity of chalk which gives the best result. But a loss of total colouring matter occurs, which is the purpurine contained in the mixture (vide Schützenberger, *Traité des Mat. Colorantes, ii., p. 151).* In commerce there exists a

garancine known as commercial alizarine or pincoffine, which, with the addition of a little chalk or calcareous water, produces much finer violets than madder or the flowers of madder. This substance is obtained by submitting a good quality of garancine, well washed, to the action of steam superheated to about 400° F. M. Schützenberger holds that the heat destroys a brown resinous matter which tarnishes the purples. But as far as my experience goes it is the purpurine which is destroyed under these conditions, for I have been able by such treatment to obtain pure alizarine by taking extracts very rich in purpurine. This destruction also explains the reason why the madder loses by its transformation into pincoffine a portion of its colouring powers. The treatment which the purple undergoes after dyeing, while clearing the white parts not printed on, has the effect of removing in a great measure the iron and purpurine lake, which is greatly reduced by the effects of chlorine and boiling soap and water, while the lake of alizarine is not so much acted upon, but the purpurine is not totally extracted, and the violet always remains inferior to that produced by pure alizarine.

The madder red and pinks require the concurrence of several colouring matters; none of those we have just spoken of produces of itself these beautiful colours. Alizarine produces a dull purplish red. Pseudo-purpurine will not do for two reasons; firstly, because it is too easily precipitated by the salts of lime; secondly, because, if owing to a deficiency of chalk, it becomes soluble and dyes; the red produced will not resist the actions of soaping and clearing. Purpurine and hydrated purpurine produce reds of an orange shade. However, the red of madder is intermediate. It was then quite natural to try a synthesis of it by the mixture of alizarine and purpurine.

I performed my experiments with colouring matters which had been sublimed, and were as pure as it was possible for me to obtain them. Of each I made a titrated alcoholic solution, and with these solutions mixed in different proportions I made my dyeing experiments so as to obtain the maximum

result, that is to say in the presence of equivalent quantities of carbonate of calcium and of colouring matter.

I thus obtained a series of very slightly different shades (I had proceeded by addition of 5 per cent.), and I compared them with reds and pinks of good madder work. From the examination of the series it appeared that purpurine exerts a greater influence on the shade of the mixture than alizarine, which is speedily overpowered by its congener, that is to say, that slightly different amounts of purpurine gave nearly similar shades when this body was in excess, and 30 or 40 per cent. of alizarine scarcely modified the shade of the mixture, but the gradations at the other end of the scale differ in a greater degree. The beautiful *madder* red, which resembles the red of Adrianople and the beautiful pink colours from flowers of madder, can be produced by a mixture of 55 parts of purpurine and 45 parts of alizarine, that is to say by almost equivalent quantities.

In this method there is always a chance of error, which I am now about to indicate. In dyeing we never succeed in fixing on the cloth all the colouring matter which we place in the bath, only a small quantity remains there in the free state; another portion forms with the chalk in the bath and with the alum which is detached from the mordanted cloth, an insoluble combination, the quantity of which should not be overlooked, and which might contain the two colouring matters in proportions different from those which are fixed on the cloth without possibility of determination. I do not, therefore, insist upon these proportions of the alizarine and purpurine, being content to have shewn that two colouring matters are necessary for the formation of red and pink, and that these matters are alizarine and purpurine, which was in fact the aim of this memoir.

I have tried to analyze the lake of the beautiful madder red, and to determine the amount of fatty acids which the soapings have introduced with the colouring matter and the mineral portions; but I have no confidence in the calculations obtained in determining the vegetable matters, but the analysis of the ashes has given a very precise result, which confirms the

already well known observation of Mr. Henri Schlumberger. On a piece of cloth about 16 decimetres square and of a sufficiently covered ground, I found 0 gr. 033 of alumina and 0 gr. 0268 of lime. These figures agree with ratio of 4 of alumina to 3 of calcium, which by calculation require 0 gr. 033 alumina and 0 gr. 269 lime. The agreement is all that can be desired, and it is quite correct to conclude from this analysis that the lime forms a constituent part of the coloured lake, and that it enters into atomic combination. A further deduction might be drawn that the coloured lake itself is a definite combination, in which the fatty acid and the colouring matter, the chalk and alumina are in simple proportion. The fact that alizarine and purpurine require the addition of one atom of calcium to be thoroughly fixed on the alumina-mordanted cloth may be taken as a proof. The proportion between the alumina and the constituent portions of the coloured lake is influenced by the processes of brightening and the acid treatments. This operation only affects the quantity of calcium in a slight degree, this is evident from the analysis of M. Schlumberger. According to this eminent analyst, the ratio, before clearing, is as follows:—

> Alumina, 1·28. Lime, 0·23, and after the brightenings, Alumina, 0·21 to 0·25, and lime from 0·17 to 0·20.

In fine, to conclude my remarks on madder red and pink, it remains to explain the effect of ebullition in a closed boiler by which these colours obtain their greatest possible brightness. To understand this result, it must be remembered that dyeing fixes simultaneously three colouring matters, alizarine, purpurine, and hydrated purpurine. Of these three, purpurine undergoes by the action of boiling water a transformation which I have explained. Its alumina lake, which is dull purplish, becomes a very brilliant orange-red. It appears to change itself into a lake of hydrated purpurine, so that after this operation the coloured lake would not contain more than two colouring matters, alizarine and hydrated purpurine, which by mixture produce the pure shade, which is as remarkable for its brightness as for its great fastness.

To sum up—*(1.) Alizarine* extracted from madder cannot be separated from purpurine, which is mixed with it by the ordinary methods in use. I only obtained this result by destroying the latter by a prolonged heating with slightly alkaline water. It is much easier to purify the alizarine obtained from anthracene. In the pure state it produces with oxide of iron beautiful purples, but does not dye alumina red; the colour is more violet and duller than madder red. It requires the addition of one equivalent of chalk to saturate the mordants.

(2.) Pseudo-purpurine takes no part of itself in dyeing on account of the looseness of its colours, and of the great facility with which it forms insoluble combinations in the presence of salts of lime. It is the colouring matter of madder lake. It produces purpurine and hydrated purpurine with great facility, for which reason it should be considered as the generator of these two substances which are found in madder, which reduces the primitive colouring matters of this latter to two, alizarine and pseudo-purpurine.

(3.) Purpurine dyes mordants in distilled water. The presence of one equivalent of lime improves the results, but an excess is more injurious than with alizarine. It more easily forms insoluble calcareous lakes, its colours are changed by boiling in water, and become the same as those of hydrated purpurine, which with regard to salts of lime behaves in the same manner. The reds are more orange than madder reds, and are fast, the violets are duller.

(4.) Alizarine alone produces violet; but with a mixture of it and purpurine, the violet might be obtained by applying salts of lime to the latter, which is found for the most part eliminated in the state of an insoluble combination which is lost.

The *Madder Pink and Red* possess a shade intermediate to those obtained by alizarine and hydrated purpurine; with a mixture of these two bodies it can be reproduced, they seem to be formed by a definite combination. The soaping and brightening regulate the relative proportions. The final boiling, besides purifying the colours, changes the purpurine lake

into that of hydrated purpurine, and thus the colour obtains the highest possible brightness and fastness which can be given to it.*

4. *Upon India-rubber Coated Bowls for Machine Printing.*

THE following pages contain the substance of a report presented by MM. Reber, Benner, and Dépierre to the Industrial Society of Rouen, upon experiments made with bowls covered with india-rubber, manufactured by Letellier and Verstraet.†

The application of india-rubber had been previously tried, but under conditions which could not yield good results because the inventors directed their attention chiefly to the outside coating without considering the indispensable necessity of the adhesion of the coating to the bowl.

Long before caoutchouc had become generally employed in manufactures, numerous inventors had endeavoured to supersede the endless blanket in use, the first cost of which is very considerable, and the inconveniences of using it very great from the joinings, washings, partial shrinkings or fullings-up, drying, guiding, and soiling with colour at the edges.

It is not necessary to do more than refer to the principal attempts, the earliest of which dates from 1836, and was patented by M. Charles Dollfus, of Mulhouse, which refers to a clothing of the bowl to replace endless blankets, but does not mention india-rubber. About 1849 Huguenin and Ducomnun, of Mulhouse, took out a patent in which special mention is made of the application of vulcanized india-rubber upon the circumferences of cylinders of various machines,

*The word *avivage* has been translated as clearing and brightening; although not expressly stated in the paper, it is probable that a treatment with acids, or acid salts of tin is to be understood as included in the term *avivage*.—*Tr.*

† Bulletin of the Society, iv., p. 153.

but printing machine bowls are not specifically mentioned.* Towards 1853 or 1854 trials were made by M. Rondeaux with bowls made at Paris, but the india-rubber was not of the proper density; it yielded under pressure, an inconvenience very serious in printing with several colours.

In 1867 or 1868 M. Casassa, of Paris, made rubber-covered rollers for padding machines which had a perfect adhesion to the metal, but in England this had been accomplished some time previously and the reporter had used them in 1864 for squeezers.

There were three bowls experimented upon, two of which were for single-colour machines and one for a two-colour machine. The following table will show the principal dimensions and other particulars closely approximative:—

	Single-colour.		*Two-colour.*
Diameter of the metal part.....	7·48 in.	10·62 in.	11·53 in.
Circumference „	23·62 „	32·95 „	36·22 „
Curvature of the metal	0·08 „	——	0·10 „
Circumference of the coated bowl	25·19 „	36·85 „	37·79 „
Width of the coating	37·40 „	38·97 „	39·76 „
Curvature of the coated bowl ...	0·12 „	——	0·12 „
Weight of the bowl	551 lb.	573 lb.	507 lb.
Weight of the coating	27½ „	55 „	54 „

What is here called the curvature of the bowl is the perpendicular distance from what would be the surface of the bowl if it were a true cylinder, and the highest part of the actual surface; or, in other words, suppose an arc of a circle cutting the circumference of the bowl perpendicularly, draw two lines parallel to the axis of the bowl, one joining the two extremities of the arc, and the other tangent to the arc; a perpendicular from one line to the other is the curvature.

The india-rubber coating was in three layers, called the black, yellow, and red layers, the total thickness of which was about eight-tenths of an inch; its mean density was 1·45. The cost for the first bowl was 312 francs (£12. 10s.), for the second 620 francs (£24. 16s.), and for the third 611 francs

* Dalton's English patent for covering printing machine bowls with gutta-percha is dated 1st May, 1849.—*Ed.*

50 cents. (£24. 9s.) It may be noted that the first bowl was solid, the other two hollow.

It was found that two layers of india-rubber were sufficient, the layer next the metal is black, very hard, has a density of 1·6, and adheres to the metal; the outside layer is of a yellow-olive colour, density 1·3, and softer. The bowl is turned with a chisel, and before using it is polished with strong emery paper.

The external layer should be hard enough not to yield in a sensible manner under the pressure of the finger, but soft enough to be marked by the nail, the mark of which should disappear in a few seconds.

The curvature of the bowl should be regulated by the size of it, $\frac{12}{100}$ of an inch is a great deal too much, we obtained good results with one-half this amount. Too much curvature is easily detected by the edges of the piece being barely printed.

These coated bowls require nothing but a grey to print with, and at once dispense with lapping, short blankets, and long blankets. Less pressure is required than with blanket. Thus, for a blotch pattern printed with blanket we had upon the levers 264 lb., representing an actual pressure of 5,836 lb.; the same pattern with an india-rubber covered bowl gave very good results with 231 lb., representing actual pressure of 5,106 lb.

Another pattern with pins, requiring a heavy set, was printed by blanket with a weight of 462 lb., representing 10,214 lb. pressure, while with the india-rubber covered bowl a weight of 396 lb., or a pressure of 8,753 lb., was sufficient.

The several comparative trials we made justify us in stating that the ratio of the pressure required with the india-rubber to that with blanket is as seven to eight, and that of the india-rubber to long and short blanket as seven to ten. The printing is satisfactory: for more than a year that we have employed this bowl we have only had to congratulate ourselves on having tried it. We have printed all possible styles, and generally found it preferable to the blanket; cross-over patterns are those in which we have observed the

greatest difference. . . . It may be observed that as there is less crushing of the colour from the lower pressure the colours are better, because they are more upon the surface and penetrate less the stuff printed; this remark applies especially to garancine styles with blotch chocolates, which can be very well executed.

These results are for single, or at most two-colour patterns, and the reporters do not give any opinion as to many-coloured patterns, not having tried the experiments necessary.

In two-colour printing we made a very curious observation. If something happens in the course of working with blanket and lapping which compels the stoppage of the machine and the lifting of the bowl, it is found upon starting again that the pattern does not fit and the rollers have to be adjusted, so that several yards of print are daily spoiled; under the same circumstances we were astonished to find with the india-rubber covered bowls that there was no disturbance in the fitting of the rollers.

Advantages and Disadvantages of the System.—As every apparatus must have limits in its application, we proceed to shew those which affect these new bowls. In some works goods of different widths are printed, and the width of the lapping is regulated to suit them; as lapping cannot be used with the india-rubber covered bowls it is evident that the whole width will print, and in case of narrow goods and expensive colours the loss of colour would be considerable. It is advisable to have bowls covered with different widths of rubber to suit the widths of cloth. For padding, which can be done with little or no pressure, some lapping can be put over the rubber.

When the engraving is very deep the colour passes right through the back grey piece, and some of it on to the bowl; double greys cannot be used to obviate this defect on account of other inconveniences, it can only be met by applying a cleaning bar to the bowl to wipe off the colour, or using extra thick back greys. We only draw notice to this fact, for it is evident that the printer is interested in avoiding deep engravings except for a few special styles.

When the printing rollers are rather longer than the back grey is wide, colour will be deposited on the bowl, a wet rag easily cleans this off.

In our first experiments, during the summer months we believed that we observed a change in the rubber covering, and, in fact, after ten or twelve hours' work the covering was somewhat softer; we were not inconvenienced by this, for after a few hours' rest it had returned to its original state. This effect is attributed to the heat produced by friction, but it made no difference in the printing.

When printing with warm colours the same effect is observed, but it requires no attention; the use of heated rollers must be avoided, for they are liable to produce a local depression and elevation of the surface which will require the bowl to be turned to restore it to its proper form. Similar depressions of the surface may be occasioned by two or three folds of back grey passing under the bowl, and this has to be remedied by holding a thick bar of iron made red hot about eight inches from the bowl and turning the bowl by hand, when it recovers its form.

These being the defects, the advantages are that the printing is as good and sharp as with macintosh or woollen blanket. The same india-rubber can be used again and again to cover the bowl, and the use of blankets with all their cost and trouble is avoided.

Accidents to the Rubber Covering.—The effect of folds of back grey and the remedy have been referred to. Another accident is when a hard or metallic substance, as a nail, gets between the bowl and the grey. If there is a blanket it gets torn, in the india-rubber it makes a hole, and in both cases the engraving is injured. We restored the bowl by applying a solder of gutta-percha with a hot iron, or a mixture of gutta-percha and india-rubber was melted into the place and the excess removed after cooling by a fine grained file. One bowl which had been repaired in several places printed two thousand pieces afterwards. Unless the surface be carefully restored, the mark of the irregularity can be distinguished upon the printed piece.

After some time of working the surface of the rubber becomes as it were corroded with small shallow holes, which give a bad impression in certain styles ; in this case the bowl must be skimmed in the lathe with a file or chisel. It would appear that this is owing to some defect in the manufacture of certain bowls, for the later trials did not shew this appearance.

Although the degree of curvature of the bowl is entirely a special question of the kind of machine and rollers in use, the reporters recommend printers to try the rubber covering upon bowls of considerable curvature, as it appears that the rubber does not act so strongly in the middle of the bowl as at the ends. The repair of the bowls by turning is effected in the same way as with other rubber covered rollers ; for removing a considerable thickness a chisel is required ; the proper speed of the circumference in the lathe is about 1 in. per minute (? 1′), and the tool should travel about 2½ in. per minute (om,001 per second).*

With regard to the kind of printing machine, it is remarked that there is no particular difficulty in removing or replacing the bowl in French machines, most of which have not solid sides. In one of Koechlin's machines a bowl weighing 660 lbs. could be removed and another one placed in position in from fifteen to thirty minutes, which is less than would be required to put on a new blanket. But the English machines are not well adapted for changing bowls, the sides are cast in one piece, and it is necessary to take one side quite away to get the bowl out.

Some modifications are required in the machine to provide for driving the draw rollers for the grey and the white pieces which are usually driven from the blanket roller, these alterations are easily made.

The calculations of the relative cost of the rubber covered bowls and blankets shew greatly in favour of the former. For a blanket of the usual length employed in Normandy, say 44 yards, costing about £38, it is reckoned that about 550,000 yards of calico printed is a good result. One of the

* Upon this subject see Bull. de Mulh., xl., p. 193.

rubber covered bowls still in use had printed 512,000 yards of calico at a cost for the covering and carriage of about £13. 10s. This bowl was then sent to have another layer of rubber put on, which cost about £6. 10s., and up to the date of the report it had printed a further length of 213,000 yards, and there was no reason to suppose that it would not be able to print up to 500,000 yards, the cost per piece coming to about one-third of that reckoned for the blanket.

5. *Upon a Method of Transferring Designs to Copper.*

BY M. G. WITZ.*

WITHOUT entering into an examination of the methods in actual use in engraving establishments for the transfer of designs upon metallic surfaces, I think it useful to point out an excellent method, but little practised, which is founded upon a chemical reaction, and which was formerly suggested as a means of obtaining impressions upon metal. This method has been in use for some years at Barcelona, where it is said M. Martin Ziegler introduced it, and we owe the following details to the kindness of M. Bogureau, engraver at Deville.

The designs, sometimes very large ones, as those for furnitures, are thrown upon a vegetable paper, all the outlines being traced with a colour composed of red iodide of mercury, which may be mixed with a little white lead and sufficient gum water to make it useable. Metallic pens are corroded by this mixture, and pencils or crow quills are employed. It must not be forgotten that iodide of mercury is an active poison.

When the tracing is finished and quite dry, the paper is placed upon the metal, which has been previously well cleaned and freed from grease, it is covered with other paper and a weight so that a moderate pressure may be brought to bear

* Bull. de la Soc. Ind. de Rouen, iv., p. 22.

upon the tracing. The transfer is kept in its place by means of a little wax placed on the plain parts of the design. When working on a copper roller, a good plan is to cover it with a bandage of calendered calico, of the width of the hand ; two persons wrap the band of calico spirally round the roller with some tension, avoiding creases.

After the tracing has been in contact with the metal some hours, or a night at the most, the smallest details of the design will be found clearly reproduced on it, appearing at first as a dull drawing upon the bright metal, and as the action continues, they appear after some days' exposure to the air as grey lines more or less dark, but distinctly visible ; they resist in a complete manner friction with the finger, dry or humid, and remain unchanged all the time required by the engraver. The intensity of the marking varies according to the temperature and the length of time of contact, as experience will soon shew.

The transfer succeeds well upon rollers or plates of copper, bronze, brass, or other alloys ; on steel mills, etc. It is easy to obtain several impressions upon different metals from a single tracing.

If the paper tracing be kept in a dark place, it will be found to yield identical results even when several months old.

An analogous method which I experimented upon more than twenty years ago, consisted in adding alkaline sulphurets to the black colour which is commonly used for tracing, as for example, a small quantity of liver of sulphur. The marks fixed upon the copper appeared as black lines ; but the base of the preparation quickly changes in the air, the lines thicken, and for steel it was necessary to apply a coating of copper.

The preparation of the iodide of mercury is simple, and the expense is trifling. The proportions are as follow :—Add a solution of 40 grammes of bichloride of mercury in half a litre of water to a solution of 50 grammes of iodide of potassium in the same volume of water ; the precipitate (66 grammes) is washed with cold water by decantation, drained, and dried in the dark.

6. *Steam Blue from Indigo.*

In the Bulletin of the Industrial Society of Mulhouse for March, M. C. Zürcher communicates a note upon a method of obtaining a steam blue from indigo, and there is appended to it a report by M. Jeanmaire.

M. Zürcher says that a steam indigo colour should contain, besides the thickening, a reducing body and a substance neutral at ordinary temperatures but capable of becoming alkaline by heat. M. E. Schlumberger suggested cyanide of potassium, which possesses this property, but is objectionable on account of its cost and poisonous properties. The alkaline bicarbonates are free from these disadvantages; in the cold they are very feebly alkaline, but at about 160° or 180° F. they lose half their carbonic acid and are transformed into neutral carbonates, which have an alkaline reaction and are capable of dissolving white indigo.

A colour made with 1 gallon of gum water (neutralized if it is acid), 2½ lb. of stannous oxide in paste (protoxide of tin), an excess being avoided as it is injurious, 1 lb. of bicarbonate of soda, and 3 lb. of indigo ground with 20 per cent. of water, is not reduced in the cold, but with heat it is both reduced and dissolved. Printed upon cloth and steamed, it is only reduced when the steam in the box is in a state of great humidity. In regular steaming no reduction takes place, but in small trial apparatus or in the steam boxes of the chloring machine, where the steam is very moist, the reduction takes place, and the trials come out of the steam with the characteristic yellowish green colour.

Under existing conditions of steaming this colour is therefore not successful, but it would probably be useful with some special means of steaming with very moist steam.

M. Jeanmaire in his report says that the proportions of materials given by M. Zürcher yield good results, but that

the bicarbonates can be replaced by the carbonates of soda or potash, and preferably by the latter, which from its solubility can be employed in any required quantity, and by its hygroscopic nature serves to keep the fibre in a state suitable for the fixing of the reduced indigo. A thickening must be selected which is not coagulated by the mixture of metallic oxide and alkali. Such a colour prints well and keeps well, and the difficulty of the process is therefore not in the colour, as is the case with other alkaline blues, but entirely in the steaming.

The colour behaves in very different manners according to the method of steaming; the trials made have led the reporter to believe that the moistness of the steam is only a secondary consideration, and that it is the oxygen in the air contained in the steaming vessel which, mixing with the steam at 212°, oxidizes the reducing agent before it has had time to act upon the indigo. In fact, however moist the steaming may be, even with damp greys, only inferior results will be obtained unless the air is driven out at the commencement by a strong current of steam. If some of the blue printed on calico be placed in a vessel filled with some inert gas, as carbonic acid or coal gas, and introduced into the steaming box in such a way that it can be drawn out of the vessel into the steam after the air has been expelled, a good blue will be obtained. A similar trial in the ordinary way of steaming gives only a negative result; and, moreover, a trial which has not deoxidized in the regular steaming cannot be improved by any subsequent steaming. The alkaline carbonates appear to lose their carbonic acid in the presence of steam with extreme readiness and act like caustic alkalies; thus, a colour made with red prussiate and an alkaline carbonate printed upon a medium shade of dip-blue discharges very well when steamed for twenty minutes. In the case of the indigo mixture, an easily oxidizable stannite is formed.

7. *Critical and Historical Notes concerning the Production of Adrianople or Turkey Red, and the Theory of this Colour.**

BY THEODORE CHATEAU.

Corresponding Member of the Industrial Societies of Mulhouse and Amiens, etc. etc.

Swiss Process, 1846.—Persoz says that this process is not new, but a combination of various others which give satisfactory results. The white or oil baths are heated to a temperature of 82° to 86° F.; in addition to the usual ingredients they contain cow dung in fermentation. For 200 lb. of cotton there are employed—

Oil	13⅓ lb.
Solution of carbonate of potash, at 2½ B.	25 galls.
Cow dung, fermented and made into a thin paste with urine of the same animal	6¼ „

The cow dung is mixed with 25 gallons of water heated to about 100° F., the oil is added, and then the carbonate of potash sufficient to give the strength as above. The temperature of the liquid is brought to the desired degree and the cloth padded in the usual manner. The pieces are then placed for twelve or eighteen hours in a kind of wooden box in order to produce a sort of fermentation, which is developed to such an extent that it is not unusual to see myriads of maggots produced in a brief period of time; the pieces are then dried in the air and hung up for eight or ten hours in a stove heated to about 144° F.

The cloth is treated four successive times in a similar manner with fresh baths, using up also the remains of the old ones, so that after the four oilings the materials consumed for 200 lb. of cotton are—

Oil	53⅓ lb.
Carbonate of potash	100 galls.
Cow dung	25 „

* Abstracted and condensed from "Moniteur Scientifique," vi. (3), p. 500.

Continued from p. 282 Textile Colourist.

The drying and stoving are repeated after each oiling. To this succeeds four other oilings executed in the same manner, but made up of warm water holding in suspension the remainder of the four first baths and the old liquor obtained by steeping the oiled goods. After each oiling, the pieces are dried in the air and stoved, but at a rather lower temperature, say 140° F. for the fifth and sixth oiling, and 133° F. for the seventh and eighth, which terminate this part of the process.

The excess of oil is removed in the usual manner, and the liquor obtained preserved. The pieces are washed, squozen, and dried in a stove at 122° F.

The galling is done at twice. For the first time without alum, a liquor is made by boiling 7½ lb. galls and 6½ lb. Sicilian sumac with 20 gallons of water. This decoction is sieved and left twenty-four hours to settle; the clear liquor is decanted, heated up to 115° F., and the pieces padded in it, dried in the open air, and stoved at a heat of 122° F.

The second galling is done with the same quantity of galls and water, but without sumac, and with addition of 21 lb. of purified alum and 3½ lb. of solution of carbonate of potash at 40° Tw. After the pieces have been padded in this liquor, they are left wet for six hours, and then hung up in a closed stove heated to 80° F. to dry them; then exposed to the air for three days and stoved again at a temperature of 122° F. As the alum is only in part saturated, the pieces are passed afterwards in hot chalk and water, employing 2½ lb. of chalk for each 20 lb. of cloth, and the bath heated to 122° F.

In the dyeing, which is completed in one operation, 20 lb. of cloth require 20 to 30 lb. of madder, 2¾ lb. of sumac, and about 2 gallons of blood; the temperature in the dyeing is gradually raised to ebullition in two and-a-half hours. The pieces are washed and soaped twice in a closed pan. The first time they are boiled six hours with 5 lb. soap, 3 lb. carbonate of potash, and about 3 oz. crystals of tin; the second time with 5 lb. soap, 3 oz. of crystals of tin, and 2 oz. of nitric acid.* At the end of these operations they are spread on the

*Although not stated in the text, it is probable that the tin and nitric acid are made to act upon one another before adding to the soap or water.

grass for two or three days, and then passed into boiling bran water.

This process differs essentially from the preceding ones, in the fact that all the operations tend to provoke a fermentation among the different materials in mixture, and to cause a metamorphosis of the fatty matters. While fully aware of the necessity of employing a certain degree of heat the author of this method has perfectly understood the importance of facilitating the action of the air. This action takes place better when the cloth contains a certain quantity of moisture and is much retarded by quick drying; that is no doubt the reason why the hot stoving is preceded by open air drying, which is always slow and gradual.

The processes described in the preceding pages are those most generally followed. Many attempts have been made to simplify and hasten the series of operations, and the following notes will shew what is known or what has been tried in this direction.

Experiments of M. E. Schwartz.—We are indebted to this able chemist for some interesting experiments connected with the subject of Turkey red, which he made with a view of obtaining some information upon the oiling operations, and especially upon the two following questions:—

(1.) Is the presence of alkali indispensable in the oil baths?

(2.) Is it possible to shorten the operations of oiling, and instead of the slow action of air and heat to employ chemical agents capable of producing rapid action?

With respect to the first question, M. E. Schwartz acknowledges the necessity of using alkaline carbonates either of potash, soda, or ammonia, because having made emulsions of oil and water by means of yolk of egg and gum arabic, he found that cloth so treated and then mordanted in the usual way and dyed gave very poor colours.

With regard to the second question, he treated the usual quality of oil with various chemical agents. (1) With concentrated carbonate of potash at the temperatures at which the mixture acquired all the characters of the modified oil upon

the cloth; (2) with nitric acid heated until it ceased to give off red vapours; (3) with solution of chloride of lime at 11° Tw.; (4) with bicarbonate of potash. He found that the fatty matter modified by these various treatments when fixed upon calico, afterwards properly mordanted, dyed, and soaped, only furnished a colour of an inferior quality.

His experiments led him to the conclusion that the fatty matter must be modified or changed upon the surface of the cloth itself; an opinion to which M. Persoz is opposed.

M. Schwartz was, however, so convinced of the correctness of his view that he gave up trying to prepare the fatty mordant by itself, and endeavoured to produce it upon the cotton in a more rapid manner; he made a bath of 4 parts of oil, 1 part potash, and 16 parts water, and steeping half bleached calico in the mixture rolled it round a steam pipe and left it for two hours, the temperature being 230° F., then repeated the treatment, and afterwards washed, mordanted, and dyed the trial. The colour was good but the cloth was tender. By using bicarbonate of potash and bicarbonate of ammonia instead of commercial potash, and treating the cloth in the same manner he obtained good colours without any injury to the strength of the cloth.

These experiments were not made upon the large scale, and it is impossible to say whether such a method would have any advantage over the old style, but there is reason to think that it might be practically successful. Meanwhile, the suggestion may be ventured that if an alkaline carbonate is necessary for the production and fixing of the fatty principle upon cotton, perhaps the carbonic acid plays some part, and it may be a more important part than the alkaline base.*

Steiner's Process.—Some years before the date of Persoz's work (1846) Mr. Steiner carried out a process of his invention both in England and France, the products of which did, and do still, enjoy a great superiority in the three respects of economy, brilliancy of colour, and regularity of result.

It seems, says M. Schützenberger, that by Steiner's process,

* The experiments of M. Schwartz are to be found in the Bull. de la Soc. Ind. de Mulhouse, and in Persoz's well known work.

which is kept secret, the piece prepared with an alkaline carbonate is passed in oil, then between two similar pieces under pressure, and lastly that it is subjected to a sufficiently elevated temperature, and under proper conditions, so that the oxidation or alteration of the oil takes place quickly and at one operation.

Gastard's Process.—This process is described as follows by Persoz:—The pieces to be dyed having been left in warm water twenty-four hours, are washed and boiled four hours with a mixture of water and old oil mixtures, and left in the liquor all night, they are then washed and dried.

The oil bath for 106 to 109 lb. of cotton is made with 3½ lb. of oil, and 12 lb. of sheep or cow dung mixed with a sufficient amount of carbonate of potash at 5° Tw. to give a perfect emulsion. The pieces are padded and exposed to the air if the weather is favourable, otherwise, hung up. When they are nearly dried they are placed in a hot stove where the temperature is from 149° to 158° F, and then padded in nitric acid diluted to about 2° Tw., dried in the air. Heating is to be avoided or the cloth will be destroyed. These treatments are twice repeated, after the third acid treatment they are padded in the oil mixture, exposed to the air, and finally dried in the hot stove as at first, then passed in nitric acid again and dried in the air. For the two last oilings the sheep and cow dung may be left out.

After these operations the pieces are passed in a solution of carbonate of potash at 6° Tw. to remove the excess of oil, well squozen, and then dried in the air, left to soak in water two hours, washed, and dried.

The galling is done at twice, the first time in a perfectly clear decoction of 15 lb. of Sicilian sumac, and the second time in a decoction of gall-nuts. These liquids are applied hot and the cloth is dried after each immersion.

The pieces are alumed and dyed twice over. The first aluming is made with 12¼ lb. of alum, ¾ lb. of acetate of lead, and 2 gallons of carbonate of potash at 5° Tw. The cloth is passed in the clear solution nearly cold, and is left wet twelve or fifteen hours, then dried and steeped in water four hours and washed.

The first dyeing is done with 17 lb. madder, 1 gallon blood, and 2 to 3½ lb. sumac, raised to the boil in three hours. The second aluming is the same as the first, but after drying the pieces are dunged at 122° F. with cow dung mixed with chalk.

The second dyeing is the same as the first.

The brightening operations commence by boiling the goods in a mixture of water and old oil baths mixed well with some carbonate of potash. The boiling is continued for five hours, and the goods left in the boiler until the next day; they are then washed and laid out upon the grass for four or five days.

The final soaping is performed in a boiler of water, to which a decoction of 1 lb. of bran is first added. When the liquor boils 7½ lb. of Marseilles soap are added, and then, by small portions and with good stirring, ½ lb. of tin crystals dissolved in 2 quarts of water, acidulated with ¼ lb. of muriatic acid, and a small quantity of nitric acid if it is wished to produce a scarlet shade. The pieces previously wetted are introduced into the boiler and boiled for an hour, then left in until the next day.

Attention is drawn to the fact that the water used is calcareous, and therefore but little chalk used in the process. The quantity of oil is very low, being only 14 lb. of oil for 109 lb. of cloth, and it is said that the colours would bear favourable comparison with good work of Steiner's.

Mercer and Greenwood's Process.—The improvements claimed by these inventors refer in the first place to the preparation of the oil to be used, a subject which will be treated further on. The application of these prepared oils is described as follows:—2 quarts of the sulphated oxidized oil, and 2 quarts of oxidized oil are mixed with 12 gallons of pearl ash liquor of 2° Tw. The stuffs to be dyed are impregnated four different times with this oily mixture, and dried in the stove between each treatment. The goods are then twice treated with pearl ash liquor at 6° Tw. and dried between each treatment, the temperature being raised to 176° F. for three hours; the goods are afterwards passed into pearl ash liquor at 1° Tw. to remove

excess of oil, then washed and dried. In this state they are ready to receive the usual mordants.*

The second part of the improvements relate to "applying oil to goods or fabrics to be afterwards oxidized for the processes of dyeing and printing Turkey red." Take 1 pint of carbonate and caustic potash or soda in equal parts, and heat the same until the watery vapours cease to be evolved;† to this we add 2 gallons of olive oil, and heat the mixture to about 300° F., and keep the "same so heated until the oil has dissolved all the potash, the watery vapours and carbonic acid being first driven off." "The mixture is then allowed to cool below 200° F.; we then mix 2 gallons of water therewith. This preparation of oil is to be applied to goods or fabrics and oxidized in the ordinary manner, as is well understood, but we prefer the oxidizing process to be carried on according to either of the processes hereafter described."

The third part "relates to a mode of oxidizing goods or fabrics which have been oiled according to the means heretofore practised, or when prepared with oil according to the means described as the second part of our invention." "We hang or suspend the goods in a chamber which can be closed, and into this chamber we cause an oxidizing vapour to pervade, and for which purpose we take 1 gallon of solution of chloride of lime of 9° Tw. for every pint of oil in the goods, and to this solution we add 5 oz. of muriate of ammonia dissolved in a pint of boiling water; we place these matters in a suitable close vessel, with a suitable pipe into the chamber, and heat it to 150° F.; the vapours will flow into the chamber and oxidize the goods. Another mode of oxidizing the oil on goods is by atmospheric air and steam. For this purpose we prefer to employ perforated cylinders or rollers, such as those used by calico printers, and the goods (8 or 10 pieces

* The remainder of this process is transcribed from the abridgments of specifications, 1, p. 271.

† The abridgment here is obscure, the French version is clearer, and says take 1 pint of solution of carbonate of potash, or caustic potash, or soda, at 70° Tw., or better still, equal parts of carbonate and caustic.

thereof) are to be wound round such rollers or cylinders and then by a fan or other blowing apparatus we cause air heated to 160° or 200° F. to pass into the interior of such rollers or cylinders and through the goods thereon, and we keep up such flow of heated air for ten minutes, then apply steam to the interior of the rollers for ten minutes, then heated air and so on for two hours." The goods so oxidized are then to be treated with pearl ash liquor as before. This process may also be applied to oxidate colours, such as are called steam colours in cotton and silk printing.

The fourth part is for preparing a mordant consisting of 1 gallon of either of the oils above described, 2 gallons red liquor at 18° Tw., and 1 quart pearl ash liquor at 64° T., to which is afterwards added 1 quart of oil of turpentine. The goods being printed with this mordant are aged three days, then dunged in a mixture of dung, sumac, valonica, or quercitron bark in the usual way; they are then to be washed, dyed with quercitron bark, crofted for three days, dried at 100° F., and dyed with madder and bark, then cleaned after the manner of Turkey red but without alkali in the soap, and finally brightened in a mixture of soap and tin in the usual manner.

A fifth claim in the patent is "for the application of silica in the process of dyeing and printing. We take 1 gallon of silicate of potash made in the usual manner at 12° Tw., ½ pint of sulphuric acid at 68° Tw. mixed with 1½ pint of acetic acid at 8° or 9° Tw. The goods are prepared by running them through this liquor, drying them, and then passing them through a liquor composed of 3 or 4 oz. of muriate of ammonia to each gallon of water. When washed in water and dried the goods are ready for the mordant.

Bernard's Process (1867).—By using oil oxidized by means of chlorate of potash, M. Bernard, of Mulhouse, shortened the time required to produce Turkey red to forty-eight hours, the colours not differing in the slightest degree from the usual Turkey red. The oil prepared by the method indicated further on can be used for the direct impregnation of yarn or cloth, or can be employed to prepare alkaline oil baths. After

oiling, the goods are exposed for twelve hours to a temperature of 145° F., the excess of oil removed, mordanted, dyed, and brightened exactly as in the old processes.

Cordier's Process (1867).—At the universal exhibition of 1867, M. Cordier, of Bapaume, exhibited Turkey red colours which were remarkable for the beauty and intensity of the shade, and which were dyed by a rapid method kept secret. M. Cordier stated to the jury that the goods had been dyed in five days; and, in order to verify the statement, undertook to dye a parcel of goods stamped in a particular manner in that time, and accomplished it satisfactorily.

It was remarked that in M. Cordier's goods there was no appearance of oil, such as is found in ordinary Turkey reds, and further, that the red was easily acted upon by discharges, as was easy to see by the pieces exhibited.

Rance's Process (1867-68).—This process, said to be French, is translated from a German periodical. M. Chateau says that it is easy to see that the writer well understood the process, and therefore reproduces it in full.* The writer begins by describing the existing method as follows. The operations are commenced by boiling the yarn or cloth in a close boiler under a pressure of two or three atmospheres, with an alkaline ley at 3° Tw. for a space of seven or eight hours, draining, washing, extracting the water, and drying first in air and finally in a stove heated to 120° F.

The oiling mixture is prepared for 200 lb. of cotton with 15 lb. emulsive oil, 50 lb. of sheep or cow dung, and 20 or 30 gallons of hot carbonate of potash solution at about 4° Tw. Some dyers add glycerine to this mixture in order, as they say, to obtain more uniform results. The cloth is introduced into the mixture (well beaten up) and made to thoroughly imbibe it, then carefully pressed and packed in a vat which is kept heated up to 95° F. Heat begins to be generated, and at the end of twelve or eighteen hours, when it has well progressed, the yarn or cloth is taken out, dried in the air, and then exposed in a stove for several hours to a temperature of 140° to 160° F.

* See Le Technologiste, xix., p. 465; Deutsche Industriezeitung, 1868.

This treatment is repeated three or four times, and from 45 to 60 lb. of oil are consumed for the 200 lb. of cotton. After the oiling, the yarn or cloth is treated three or four times with weak alkaline washings, to which the remains of old oil baths are added, and between each treatment the goods are dried as before.

To remove excess of oil from the cotton the yarns or cloths are left for five or six hours in a boiler with water heated to 70° F.; they are drained, washed, expressed, and dried.

For the galling the quantity of galls taken varies according to the depth of shade required, from 12 to 20 lb. for 20 lb. of cotton;* sometimes divi-divi or sumac are used instead of galls. The galls are boiled in the necessary quantity of water and the solution strained through a cloth, and when sufficiently cooled the yarn or cloth is steeped, wrung out, dried in the sun, and finally in a stove heated to 140° F.

For the aluming, twice as much alum is taken as galls, and dissolved in 25 gallons of water heated to 122° F.; chalk or soda is carefully added to the alum to saturate the excess of acid; the clear part is decanted, and when it has become cold the cotton is steeped in it, wrung out, and piled up wet for twelve or fifteen hours, then dried at first in the air, and lastly in a stove heated to 122° F.

The mordant is fixed in a bath of chalk and water heated to 122° F., or else in a cold and very weak bath of potash or soda. The cotton is then ready for dyeing.

M. Rance has introduced improvements upon this method which bear upon the following points: (1) Substituting an artificially prepared oil for the natural oil. (2) A systematic method of removing the excess of oil. (3) Extraction of fatty matters from the oil baths. (4) Extraction of acetic acid from the aluming baths.

We shall describe afterwards in a section upon natural and artificial oils the method employed by M. Rance for specially preparing an oxidized oil from seed oil, or from a mixture of linseed, palm, and fish oil.

The stripping of the excess of oil is effected by the process

* So in the original, but it seems a misprint for 200 lb.

of displacement; the materials are treated by continually weaker and weaker fluids, and finally with pure water. The simplest apparatus for this purpose consists of three vats arranged round a crane; each vat is connected with a reservoir of water provided with a serpentine coil of pipe for steam and a discharge tap. Suppose the No. 1 vat contains the liquor from two washings, No. 2 the liquor from one washing, and No. 3 pure water. The yarn or cloth to be treated is contained in a cylinder pierced with holes and is lifted by means of the crane into the No. 1 vat, it remains there for an hour, is then lifted up and allowed to drain. The liquor in this vat, rich in oil, is now run out into the extracting vat and run up two-thirds full of pure water. The cloth or yarn in the cylinder is placed in the No. 2 vat, and after that in the No. 3 vat, and during this time a fresh lot of oiled cloth is placed in the No. 2 vat. At the end of an hour the cylinder of cloth or yarn is raised from No. 3 vat, and left to drain; the cloth or yarn is then taken out of the cylinder and the cylinder from the No. 2 vat is put in its place, and so on continuously.

The extraction of the oil from the spent liquors is one of the improvements, they contain considerable quantities of oil and fatty matter, and have been utilized to make up fresh oil baths, but they have proved more injurious than useful on account of the large quantity of foreign matters present with the others, and which are found to hinder the proper emulsion of the oil and make its fixation difficult. At the present day they are almost generally used up for the half bleaching of the grey calico, but for this purpose the oily matter present is of no use and is lost. To recover the alkali and fatty matter from the baths two different methods may be followed.

By the first method, the acetic acid vapours disengaged in the drying stoves are driven through the old baths, the fatty matter separates, can be removed and mixed with fresh oil for subsequent oilings, while the solution of acetate of soda which remains can be at once utilized to transform the alum into acetate of alumina.

By the second method, the baths of the oxidation process* are evaporated down to one-fourth of their bulk, and run into a lower reservoir which is heated by spent steam, and decomposed by a quantity of common salt sufficient to separate the fatty matters. After the heating has effected a complete decomposition, the ley is left to settle and then removed to a store vessel, from which it can be taken when required; it serves for the first part of the bleaching of the cotton for dyeing. If the soapy portions are meant to be employed in the brightening of the Turkey red, they must be made into perfect soaps by a proper treatment with caustic soda. The fatty matters could also be separated by sulphuric acid or other known means.

The mordanting is done with acetate of alumina. According to the depth of colour required, 24 to 40 lb. of alum, or an equivalent quantity of sulphate of alumina, free from iron, is dissolved at a temperature of 113° F. in 25 gallons of solution of acetate of soda prepared as mentioned, from old baths, and marking 4° to 6° Tw. After the mordanting the goods are left for one or two days, then dried at 140° F. in a current of air driven by a fan. When the air is saturated with acid vapours it is forced by the fan into or through the old oil baths, or else into a strong solution of soda or potash. This operation is repeated until the drying is complete, and finally the air is saturated with vapour of water to remove the greater portion of the acetic acid still remaining. The mordant is fixed or cleansed in a bath of dung and chalk, or silicate of soda, expressed by centrifugal machine, and is then ready for dyeing.

Comparing the cost of this improved process with the older one, M. Bance† calculates the total cost of dyeing 666 lb. of cotton in Turkey red in the old way was 876 francs, and in the new way 741 francs, shewing an advantage of 135 francs.

Russian Processes.—M. Achille Bulard has communicated some particulars upon Turkey red dyeing in Russia. Yarn dyeing is after the Elberfeld method, and calico dyeing similar

* This has not yet been described.

† The name is printed both Rance and Bance.

to the Swiss. The oil generally used is the emulsive oil from Messina and Calabria. Some dyers, as M. Baranoff, employ animal fats. Blood is generally used in dyeing.

The madder used is the *marina*, a rich quality grown in the Caucasus. Garancine made from this product is also used. Artificial alizarine and purpurine are also largely used.

Modern Processes.—The account of these is transcribed from Schützenberger's *Traité des Matières Colorantes (1867).*

The pieces, when bleached in the usual manner, are padded in an emulsion of oil and carbonated alkali. The oil employed called "tournante" is characterised by the ease with which it forms with caustic alkalies and carbonated alkalies a perfect and permanent emulsion.

It appears useful to add a certain amount of sheep or cow dung to the oil bath. This addition is made as it is said to animalise the cotton, and give it properties similar to those of animal fibres; it is probably useful on account of the elements of the excremential products assisting and favouring the change of the fatty matters. The padded cloth is dried in the warm stove, and then exposed upon the grass. If the weather is favourable it may be dried at once in the sun. Under these conditions of temperature, by the action of air, light, moisture, and the alkaline carbonates, that mysterious change takes place in the fatty matter, the nature of which evades our researches. Generally the oiling process is several times repeated; when the cloth is sufficiently oiled, and the excess of oil removed by alkali, the cotton passed into sumac attracts from the latter a sufficient quantity of its colouring principle to acquire a full yellow shade when treated with acetate of alumina.

The goods are treated with alkali in order to remove the oil which has not undergone the change, and also that changed oil which does not adhere to the fibre. The liquor obtained by this treatment, and called old oil liquor, serves better than fresh for treating cloth, probably because it contains a greater or less quantity of oil, more or less changed.

The mordanting follows. The precipitation of the alumina is in this case favoured by the attraction exercised by the or-

ganic matter. The goods may be padded in acetate of alumina, dried, fixed in a warm ageing room, and dunged in the usual manner; or they can be first treated with an astringent matter, as gall-nuts or sumac, then passed in alum, dried, and passed in chalk and water to saturate the alum, and assist the precipitation of the alumina, which, without this operation, would be incomplete. Sometimes the galls are mixed with the alum.

The dyeing is done with madder or flowers of madder. With madder there is frequently added chalk, ox blood, glue, or sumac. The dyeing is sometimes done at one operation, and other times at two operations with a mordanting between. The brightening is performed in a close boiler under pressure, and repeated two or three times. The first boiling is with soap and carbonate of potash, the others with soap and salt of tin, or soap, carbonate of potash, and salt of tin.

[*To be continued.*]

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8. *Abridgments of Complete Specifications of Patents Recently Published.*

A.D. 1875, June 12.—No. 2161.

NEWTON, HENRY EDWARD. *(A Communication from Pierre Nos a'Argence).* "Improvements in ornamenting or producing patterns or designs of various kinds on fabrics, and in the apparatus to be used for such purpose." This patent refers to pile fabrics, and the pattern is produced by drawing out the pile from the back by various contrivances described. It has not direct connection with printing or dyeing.

A.D. 1875, July 31.—No. 2713.

AUCHINVOLE, JOHN. "Improvements in recovering surplus Indigo from Textile Materials or Fabrics." *(A Communication from Camille Bouhon).* This invention refers principally to

wool dyeing, and the novelty appears to be in the way by which the indigo diffused in the wash water is collected on the surface as thus described: "The dyed goods with the blue "colour developed upon them are washed in water, in which "soda crystals are dissolved, and the water is by preference "well drained from them, or it is expressed by passing the "goods through rollers on leaving the washing tank. To the "wash water there is then added a further quantity of soda "crystals, and after these are dissolved a quantity of hydro-"chloric or other suitable acid is thoroughly mixed in. The "carbonic acid gas disengaged from the soda by the acid "carries up to the surface most of the indigo contained in the "wash water, and this indigo may be skimmed off and be "drained by sieves or filters. A further quantity of indigo is "recoverable on allowing the skimmed water to rest, when the "indigo still in suspension gradually subsides to the bottom "of the tank, and may be removed after drawing off the super-"natant clear water." For 100 lb. of wool 6 oz. of soda crystals are dissolved in the wash water, and after the wool is washed and withdrawn, 7 lb. more are added and dissolved in the water, and afterwards about 28 lb. of commercial hydrochloric acid.

A.D. 1875, August 10.—No. 2812.

SMITH, THOMAS JAMES. "Improvements in Bleaching Silk and other Fibres." *(A Communication from Cyprien Marie Tessié du Motay).* This invention is chiefly applicable to silk of a cheap sort, that from the wild silkworm, and to Tussah or Tussore silks, "and to other silks which have not been "capable of being bleached by the ordinary processes, and "generally to all silks and wool which soap and sulphuric acid "bleach insufficiently." The bleaching agent is binoxide or peroxide of barium, which is added to water and the silk heated up with it; the barium compound is insoluble in water, but yields nascent oxygen to the organic matter without the intervention of any acid. When the action is finished the substances bleached are washed and steeped in acidulated water, and then washed in pure water and dried. Tussah

silks require 50 to 100 per cent. of their weight of the binoxide of barium; "other silks and wools are bleached by a very much less proportion of binoxide, according to their nature." If the binoxide fails to bleach the silk in a complete manner recourse is had to "the employment of one or "several cold baths, containing in solution, either permanganic "acid, or permanganate of magnesia or lime, or a mixture of "these latter permanganates with alkaline permanganates, "aqua regia, or a solution of oxygenated water in hydrochloric "acid."

A.D. 1875, August 12.—No. 2845.

MARSDEN, RICHARD, and others. "Improvements in Machinery or Apparatus for Dyeing, Washing, and Scouring Fabrics." The drawing shews a dyeing vessel, the section of which is the quarter of a circle, and the improvement is an arrangement for keeping the piece or fabric straight or open; difficulty has been found in doing this heretofore, and uneven colours have resulted. "We propose to remedy this defect by "having a trellis work partition placed in the cistern, between "which partition and the inside of the cistern the fabric "passes. This trellis work is moveable, and can be raised out "of the cistern and taken away when desired by placing the "partition on that side of the cistern which is furthest from "the steam pipe, the guards usually employed for protecting "the fabric from the steam are dispensed with." Another addition is that of grooved guide rollers which are formed right-handed and left-handed, meeting in the middle of the roller; and the patentees also claim some improvements in the general construction of the body of the dyeing cistern.

A.D. 1875, August 14.—No. 2866.

BAERLEIN MAXIMILIAN. "Improvements in the method of Mordanting, Dyeing, and Sizing Yarns." This invention is for combining dyeing or mordanting with sizing in one continuous process, and is intended to do away with certain inconveniences said to attach to previous arrangements. The apparatus consists of two boxes, a hot air drying machine and

the ordinary headstock, the boxes being the same as those described in the same inventor's patent No. 4014, December 5th, 1873. No washing box is employed, and a great point seems to be that instead of using sulphate of iron in the dyeing which required washing off, the patentee has substituted acetate of iron which does not require washing off. The preparation of yarns in this way is limited to either dyeing them black or impregnating them with tannic acid or sumach, so that they will dye easily when woven with silk or other animal fibre.

A.D. 1875, August 18.—No. 2918.

CLARK, ALEXANDER MELVILLE. "An Improvement in Bleaching Vegetable Fibrous Substances." *(A Communication from Charles Bordat.)* This is for an improved mixture made as follows: "I dissolve in a sufficient quantity of water 1 part of soap having a base of soda, potash, or in some cases of ammonia. 2nd, I grind together 1 part of soda crystals with 1 part of chloride of lime," the two are carefully mixed together and form a paste. To apply this paste in bleaching, 1 part of it is dissolved in 8 or 10 parts of river water, and the "substances to be bleached are steeped therein twenty-four to forty-eight, or sixty hours, according to the material under treatment, and the degree of bleaching desired."

A.D. 1875, August 21.—No. 2943.

JONES, EDWARD JAMES. "Improvements in Apparatus for Ageing or Steaming Woven or other Web Fabrics or Yarns." In this invention the goods instead of passing directly through an ageing box, for example, are made to fall into a vertical cage of open work inside the box or room, extending from the top to the bottom of the machine, and are there allowed to accumulate as long as may be thought necessary, and then drawn off from the bottom of the cage, the result being that the goods are exposed to the atmosphere of the room for a much longer time than if they passed right through in a state of tension. The plan is applicable to both steaming and ageing. The construction of the cage is such that the goods fall

easily in folds, and can be drawn from the bottom by a roller and continue their passage through the machine after being arrested for a certain length of time, and without interruption or break in the process. The drawings must be seen to fully understand the nature of the change proposed to be made so as to adapt existing ageing rooms to this patented invention.

A.D. 1875, August, 25.—No. 2976.

FIELD FREDERICK. "Improvements in the Treatment of the Solution of Aniline Colours for producing Pigments therefrom." (*Provisional Protection only*). The treatment consists in precipitating the colouring matter from solutions by the addition of artificially prepared silicates, of which those preferred are the silicates of magnesia, lime, strontia, or baryta. The precipitate is filtered and dried to be used as a pigment.

A.D. 1875, August 27.—No. 3015.

BARLOW HENRY BERNOUILLI. (*A Communication from Eugene Torletin*). "Improvements in the Manufacture of Size known as Parementine." "In preparing the composition "I take 100 parts of gelatinous glue dissolved in the smallest "possible quantity of water; and when the solution is effected, "I add 70 parts of dextrine, 20 parts of sulphate of magnesia, "20 parts of glycerine, and 20 parts of sulphate of zinc. "These ingredients must be well mixed until they form a "paste, which is then run into moulds and allowed to cool." The above composition is used for sizing yarns of wool, linen, and cotton, and "for dressing and preparing woollen fabrics, "or fabrics of mixed wool and cotton;" also in preparing cotton fabrics the inventor directs a quantity, say one fifth, of this parementine to be added to the ordinary size in use.

A.D. 1875, September 1.—No. 3064.

SIEBER CHARLES HENRY. (*Partly a Communication from Louis Gonin*). "Certain Improvements in Dyeing." This patent is for making and applying oleic acid compounds for dyeing. The oleates mentioned are those of tin and alumina, and a mixture of these two. "These mordants or oleates are

"used as mordants for printing and dyeing yarns and fabrics "of cotton, linen, wool, silk, and mixed fabrics; and the fibres "also of the above-mentioned fabrics in the state before spin- "ning with any colouring or dye stuff, whether of organic or "mineral origin." It would seem from the somewhat obscure and verbose language of the specification, that the oleic acid is made by acting upon fats with acids, and separating it from solution by common salt. Then the resulting oil is treated with alkali, "sufficient to saponify these oils or fats, and to "dissolve the hydrates of oxides of tin, in whatever state the "oxides of tin may be, I prefer to use the hydrate of tin, but "use also the dry oxides of tin, or metallic tin, in a state of great division." Other methods of obtaining the so-called oleate of tin are given, but in every case alkali is used, so that the tin is present apparently in alkaline solution. The oleate of alumina is obtained by analogous methods. "In some "cases I form an oleate of tin, or an oleate of alumina, or of "both, directly on the fibre, yarn, or fabric, by treating them "with an emulsion or solution of oleic acid, to which I add, "according to the colour required, chlorate of potash or chlo- "rate of ammonia, or I use a solution of soap." The method of alternate treatment with soluble oleates and salts of tin and alumina is described. The treatment of fibres with emulsion of oleic acid is also given, and all these are claimed as the improvements of the patentee.

A.D. 1875, December 29.—No. 4524.

LAKE ROBERT. "Improvements in Pentagraph Engraving Machines." *(A Communication from John Hope).* This patent claims improvements and simplification, the nature of which can only be understood by referring to the drawings, and the description of which does not admit of intellgible abridgment.

9. British and Foreign Patents, from the Commissioners of Patents Journal, April 21st to May 23rd, 1876, inclusive.

Colouring Matters.

1642. JULIUS BRÖNNER and HERMANN GUTZKOW, both of Frankfort-on-the-Maine, in the kingdom of Prussia, for an invention of "An improved method of obtaining anthracen out of asphaltos, that is to say, pitch produced from coal tar, and of preparing two colouring matters from the anthracen."—Dated 28th May, 1869.—The stamp duty of £100 has been paid for this patent.

4138. ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, for an invention of "Improved processes for the manufacture of artificial purpurine and other coloring matters, together with the applications of such products."—A communication to him from abroad by William Jules Samuel Grawitz, of Paris, France.—Dated 29th November, 1875.—This patent has passed the great seal.

1229. JOHN HENRY JOHNSON, of 47, Lincoln's Inn Fields, in the county of Middlesex, Gentleman, for an invention of "Improvements in obtaining colouring matters suitable for dyeing and printing."—A communication to him from abroad by Heinrich Caro, of Mannheim, in the empire of Germany, Chemist to the Badische Anilin and Soda Fabrik, of Mannheim aforesaid (Grand Duchy of Baden).—Dated 22nd March, 1876.—This patent has passed the great seal.

1851. RICHARD SIMPSON, ARTHUR BROOKE, and THOMAS ROYLE, all of Greenford Green Alizarine Works, Harrow, in the county of Middlesex, for an invention of "Improvements in the preparation of alizarine and other analogous colouring matters made from anthracine."—Dated 2nd May, 1876.—This patent has received provisional protection.

109,172. WILLM and GIRARD, for "Preparing blue colouring substances derived from mixed tertiary monamines."—Dated 15th November, 1875.—Certificate af addition to French patent.

109,423. GRAWITZ, for "Manufacture of colours of anthracene and alizarine."—Dated 27th October, 1875.—Certificate of addition to French patent.

109,423. GRAWITZ, for "Obtaining colours of anthracene and alizarine."—Dated 29th November, 1875.—Certificate of addition to French patent.

39,219. THE CHEMICAL WORKS COMPANY, for an imported invention of "A new colouring substance extracted from vegetable tar."—Dated 29th March, 1876.—(French patent, 3rd March, 1876.)—Belgian patent.

Singeing.

4009. AUGUSTE HYACINTHE BLANCHE, of Boulevard Saint-Denis, 1, at Paris, Manufacturer, for an invention of "Improved machinery or apparatus for singeing woven fabrics."—Dated 18th November, 1875.—This patent has passed the great seal.

1422. EDWARD KEIGHLEY, of Bradford, in the county of York, Dye Works Manager, for the invention of "Improved means or apparatus for singeing woven fabrics and other fibrous substances."—This patent has received provisional protection.

105,186. BRECHON, for "Improvements in machines for singeing tissues."—Dated 4th October, 1875.

Bleaching.

1672. JOHN FREDERICK WILLIAM HODGES, of Belfast, Ireland, Chemical Assistant, for an invention of "Improved process for bleaching jute and other textile fibres, and for preparing the same for the reception of colours, and for the manufacture of paper."—Dated 8th May, 1873.—The stamp duty of £50 has been paid for this patent.

3954 THOMAS FLETCHER, of Newton, Hyde, in the county of Chester, for an invention of "Improvements in apparatus employed for bleaching cotton or other fibrous substances or fabrics."—Dated 13th November, 1875.—This patent has passed the great seal.

109,960. TESSIE DU MOTAY, for "Bleaching vegetable fibres and tissues."—Dated 16th October, 1875.—French patent.

Printing and Dyeing.

1557. ALEXANDER MELVILLE CLARK, of 53, Chancery Lane, in the county of Middlesex, Patent Agent, for an invention of "Improvements in the preparation and employment of indigo-

blue dye."—A communication to him from abroad by Jerome Marble, of Worcester, county of Worcester, and state of Massachusetts, United States of America.—Dated 29th April, 1873.—This patent has become void.

4134.—JAMES HUMMERSTON, of Leeds, in the county of York, for an invention of "A new (or improved) machine for printing on paper, floor cloths, and woollen or other woven or felted fabrics."—Dated 29th November, 1875.—This patent has passed the great seal.

1654. WILLIAM MORGAN-BROWN, of the firm of Brandon and Morgan-Brown, Engineers and Patent Agents, of 38, Southampton Buildings, London, and 13, Rue Gaillon, Paris, for the Invention of "Improvements in the manufacture of ornamental textile fabrics."—A communication to him from abroad by Samuel Barlow, of Lawrence, Massachusetts, United States of America, Colour Master.—This patent has received provisional protection.

2048. JOE FROST, of Huddersfield in the county of York, Chemist, and JOHN WALMSLEY, of Mirfield, in the same county, Printer, for an invention of "Improved means or methods of obtaining two or more colours on piled fabrics or on material intended for such fabrics with a view to imitate the skins of animals or produce designs thereon, such means being also applicable to produce different effects on natural skins or furs."—Dated 15th May, 1876.

2. DESCAT BROTHERS and J. SELOSSE, of Flers, France, for "An indigo vat of soluble stannites or protoxide of tin."—6 years.—Dated 27th September, 1875.—Italian Patent.

29. G. C. GIBBS, of Brentford, for "Improvements in apparatus for dyeing felt, silk, and other woven or porous stuffs."—1 year.—(Secret.)—Dated 11th December, 1875.—Austrian patent.

Yarn and Thread Treatments.

1733. JOHN HENRY JOHNSON, of 47, Lincoln's Inn Fields, in the county of Middlesex, Gentleman, for an invention of "Improvements in or connected with apparatus for sizing and dressing yarn or thread."—A communication to him from abroad by Eugène Dollander, of Paris, in the republic of France, Manufacturer.—Dated 24th April, 1876.—This patent has received provisional protection.

173,392. C. CORRON, of St. Etienne, France, for "Dyeing apparatus."—Application filed 19th January, 1876.—American patent.

Brief.—"The frame which holds the skeins is worked vertically by crank-shaft and pinion gearing into a rack connected with cords over pulleys. The frame rides on wheels resting on the sill of the tank, and is reciprocated horizontally by a lever at the end of the tank. (Improvement on Patent No. 130,280)."

Claim.—"In combination with the vat D, having one or more compartments, the frame C, with their rolls B and wheels *n*, pulleys $p.p^1$, with their cords, and the reciprocating lever, *f*, in the manner and for the purposes set forth."

109,953. IMBS, for "A machine for shearing or scraping thread."—Dated 14th October, 1875.—French patent.

43. C. CORRON, of Saint-Etienne, for "An apparatus for dressing silk and other textile matter in skeins."—6 years.—Dated 28th October, 1875.—Italian patent.

110,062. VINDRY, Nephew, and Co., and LOMBARD-GERIN, for "A machine for washing and beating textile substances in skeins."—Dated 30th October, 1875.—French patent.

Wool and Silk Treatments.

1704. CHARLES HENRY FIRTH, Knight, of Heckmondwike, in the county of York, Member of the firm of Edwin Firth and Sons, of the same place, Manufacturers, for an invention of "Improved means of finishing silks, plush, and velvets, and for producing lustre on the surface thereof."—Dated 10th May, 1873.—This patent has become void.

3844. HENRY WALTON WHITEHEAD, of Holbeck, in the parish of Leeds, in the county of York, a partner in the firm of Taylor, Wordsworth, and Co., of the same place, Machine and Tool Makers, and FREDERICK HENRY WRIGHT, of Halifax, in the same county, Wool Comber, for an invention of "Improvements in means or apparatus used in washing or scouring wool and other fibres."—Dated 4th November, 1875.—This patent has passed the great seal.

3876. JOHN THOMAS WAY, of 9, Russel Road, Kensington, in the county of Middlesex, for an invention of "Improvements in the manufacture of woollen and silken fabrics, and of soap and detergents for use in these manufactures, and for other purposes."—Dated 8th November, 1875.—This patent has passed the great seal.

945. GEORGE RYDILL, of Southampton Buildings, London, for an invention of "Improvements in preparing woollen, cotton, silk, and other such like fabrics, for extracting vegetable fibres therefrom, and for cleaning the same."—Dated 4th March, 1876.—This patent has passed the great seal.

1646. JAMES MILLEN DICK, of Buffalo, in the county of Erie, in the state of New York, one of the United States of America, for the invention of "Improved method and apparatus for removing moisture from wool and similar substances."—This patent has received provisional protection.

2016. HENRY EDWARD NEWTON, of the Office for Patents, 66, Chancery Lane, in the county of Middlesex, Civil Engineer, for an invention of "An improved process and apparatus for removing pieces of straw, wood, and other vegetable substances from fabrics made of wool, silk, hair, or other animal fibres."—A communication to him from abroad by Francois Delamare the younger, of Paris, in the republic of France.—Dated 13th May, 1876.

2018. ALBERT HOPFF, Merchant, of Hamburg, for an invention of "Improvements in apparatus for removing burrs out of wool."—A communication to him from Carl Ulbrich, a person resident at Chemnitz, in the kingdom of Saxony."—Dated 13th May, 1876.

28. D. MICHEL, of Paris, for "Carbonizing vegetable matter contained in wool or woollen rags."—6 years.—Dated 16th October, 1875.—Italian patent.

76. UGONE, Brothers, of Turin, for "An apparatus for carbonizing vegetable fibres in wool, cloth, and other materials."—5 years.—Dated 16th November, 1875.—Italian patent.

57. L. FOSSATI, of Masciago, Milanese, for "An improved machine for glazing silk."—3 years.—Dated 13th November, 1875.—Italian patent.

117. P. CANTU, of Varese, for "A machine for dressing silk stuff."—3 years.—Dated 22nd December, 1875.—Italian patent.

39,178. E. LECLERCQ, for an imported invention of "A new chemical mechanical system of cleansing and disacidifying wool and other textile substances containing vegetable substances."—Dated 24th March, 1876.—(French patent, 21st March, 1876.) Belgian patent.

105,743. BACHELU and PRENAT, for "A machine for washing silk."

—Dated 27th October, 1875.—Certificate of addition to French patent.

109,921. MICHEL, for "Carbonizing vegetable substances contained in wool or woollen rags."—Dated 12th October, 1875.—French patent.

109,961. TESSIE DU MOTAY, for "Bleaching wool and silk."—Dated 16th October, 1875.—French patent.

Finishing Processes.

1230. CLINTON EDGCUMBE BROOMAN, of the firm of Robertson, Brooman, and Company, of 166, Fleet Street, in the city of London, Patent Agents, for an invention of "Improvements in dressing or finishing fabrics."—A communication to him from abroad by Joseph Ernest Thiemonge, of Lesses, near Thillot, France.—Dated 21st April, 1869.—This patent has become void.

1410. WILLIAM HENDERSON, of the firm of Walker, Henderson, and Company, of Glasgow, in the county of Lanark, North Britain, Engineers, for an invention of "Improvements in apparatus for finishing woven fabrics."—Dated 8th May, 1869.—The stamp duty of £100 has been paid upon this patent.

1603. JAMES BOOTH, of Ovenden, near Halifax, in the county of York, Manufacturer, and JAMES BRIGGS GARDAM, of Halifax aforesaid, Finisher, for an invention of "Improvements in means for tipping or finishing fabrics made in imitation of seal skins, and other similar fabrics."—Dated 3rd May, 1873.—This patent has become void.

1631. EDWARD GRIFFITH BREWER, of 89, Chancery Lane, in the county of Middlesex, Patent Agent, for an invention of "Improvements in machinery or apparatus for drying, applicable to the dressing or stiffening of fabrics such as tulle and lace."—A communication to him from abroad by Eugène Pasquier, of Reims, France.—Dated 6th May, 1873.—This patent has become void.

1659. JAMES STEWART, of the firm of A. and S. Henry and Coy., of Glasgow, Lanark, North Britain, for an invention of "Improvements in damping and starching textile fabrics, and in the machinery employed therefor.—Dated 8th May, 1873.—The stamp duty of £50 has been paid upon this patent.